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Abstract Compared to the higher fungi (Dikarya), taxonomic and evolutionary studies on the basal clades of fungi are fewer in number. Thus, the generic boundaries and higher ranks in the basal clades of fungi are poorly known. Recent DNA based taxonomic studies have provided reliable and accurate information. It is therefore necessary to compile all available information since basal clades genera lack updated checklists or outlines. Recently, Tedersoo et al. (MycKeys 13:1–20, 2016) accepted *Aphelidiomycota* and *Rozellomycota* in Fungal clade. Thus, we regard both these phyla as members in Kingdom Fungi. We accept 16 phyla in basal clades viz. *Aphelidiomycota*, *Basidiobolomycota*, *Blastocladiomycota*, *Calcarisporiellomycota*, *Caulochytriomycota*, *Chytridiomycota*, *Entomophthoromycota*, *Glomeromycota*, *Kickxellomycota*, *Monoblepharomycota*, *Mortierellomycota*, *Mucoromycota*, *Neocallimastigomycota*, *Olpidiomycota*, *Rozellomycota* and *Zoopagomycota*. Thus, 607 genera in 153 families, 43 orders and 18 classes are provided with details of classification, synonyms, life modes, distribution, recent literature and genomic data. Moreover, *Catenariaceae* Couch is proposed to be conserved, *Cladochytriales* Mozl.-Standr. is emended and the family *Nephridiophagaceae* is introduced.

Keywords (separated by '-') Invalid genera - *Nephridiophagaceae* fam. nov. - Outline - Phylogeny - Validation

Footnote Information



1 **Notes for genera: basal clades of Fungi (including *Aphelidiomycota*,**
2 ***Basidiobolomycota*, *Blastocladiomycota*, *Calcarisporiellomycota*,**
3 ***Caulochytriomycota*, *Chytridiomycota*, *Entomophthoromycota*,**
4 ***Glomeromycota*, *Kickxellomycota*, *Monoblepharomycota*,**
5 ***Mortierellomycota*, *Mucoromycota*, *Neocallimastigomycota*,**
6 ***Olpidiomycota*, *Rozellomycota* and *Zoopagomycota*)**

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15 **Abstract**

16 **AQ1** Compared to the higher fungi (Dikarya), taxonomic and evolutionary studies on the basal clades of fungi are fewer in
17 number. Thus, the generic boundaries and higher ranks in the basal clades of fungi are poorly known. Recent DNA based
18 taxonomic studies have provided reliable and accurate information. It is therefore necessary to compile all available
19 information since basal clades genera lack updated checklists or outlines. Recently, Tedersoo et al. (MycKeys 13:1–20,
20 2016) accepted *Aphelidiomycota* and *Rozellomycota* in Fungal clade. Thus, we regard both these phyla as members in
21 Kingdom Fungi. We accept 16 phyla in basal clades viz. *Aphelidiomycota*, *Basidiobolomycota*, *Blastocladiomycota*,
22 *Calcarisporiellomycota*, *Caulochytriomycota*, *Chytridiomycota*, *Entomophthoromycota*, *Glomeromycota*, *Kickxellomy-*
23 *cota*, *Monoblepharomycota*, *Mortierellomycota*, *Mucoromycota*, *Neocallimastigomycota*, *Olpidiomycota*, *Rozellomycota*
24 **AQ7** and *Zoopagomycota*. Thus, 607 genera in 153 families, 43 orders and 18 classes are provided with details of classification,
25 synonyms, life modes, distribution, recent literature and genomic data. Moreover, *Catenariaceae* Couch is proposed to be
26 conserved, *Cladochytriales* Mozl.-Standr. is emended and the family *Nephridiophagaceae* is introduced.
27

28 **Keywords** Invalid genera · *Nephridiophagaceae* fam. nov. · Outline · Phylogeny · Validation

29
30 **Introduction**

31 Classification and understanding the evolution of fungi has
32 become one of the recent hot topics for research in
33 mycology (Hyde et al. 2017a). DNA based systematic and
34 evolutionary studies have become fundamental among
35 mycologists and taxonomists as these provide a strong

foundation for understanding the kingdom Fungi. There 36
have been numerous taxonomic studies on the Ascomycota 37
(e.g. Hyde et al. 2013, 2017b; Ariyawansa et al. 2015; Li 38
et al. 2016; Wijayawardene et al. 2016, 2018), Basid- 39
iomycota (E.g. Justo and Hibbett 2011; Justo et al. 2011; 40
Millanes et al. 2011; He and Dai 2012; Ortiz-Santana et al. 41
2013) (i.e. Dikarya) and in the basal clades of fungi (e.g. 42
Spatofora et al. 2016; Seto et al. 2017; Radek et al. 2017), 43
which are important sources for dictionaries, outlines, 44
checklists, various databases and the basic study of the 45
fungi (Kirk et al. 2008, 2013; Lumbsch and Huhndorf 46

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2010; Hyde et al. 2011, 2013; Humber 2012, 2016; Benny et al. 2014, 2016b; Wijayawardene et al. 2012, 2014, 2017a, b, 2018; Lücking et al. 2017; Index Fungorum 2018). However, understanding of the earliest diverging events of Fungi are poorly understood as compared to the higher fungi i.e. Dikarya (Spatafora et al. 2016). Furthermore, the classification of basal clades of fungi is also debatable as mycologists do not have a broad agreement (e.g. Humber 2016 vs. Spatafora et al. 2016 on *Entomophthoromycota* and *Glomeromycota*). Moreover, elevating lower ranks to higher ranks and demoting the higher ranks to lower ranks (Spatafora et al. 2016; Tedersoo et al. 2016) also causes disagreements.

60 Distribution, life modes, applications

61 The basal lineages of fungi comprise the aquatic taxa (e.g. *Blastocladiomycota*, *Chytridiomycota*, *Neocallimastigomycetes*), and the terrestrial taxa (e.g. *Entomophthoromycota*, *Glomeromycota*) (Benny et al. 2016a, b). Most of the taxa are ubiquitous and show different life modes, viz. some causing diseases in agricultural crops (e.g. Choanephora rot caused by *Choanephora cucurbitarum*; *Gilbertella persicaria* as the cause of soft rot in *Syzygium cumini* and fruit rot in papaya *vide* Pinho et al. 2014; Cruz-Lachica et al. 2016); pathogens of humans and other mammals (e.g. mucormycosis caused by *Apophysomyces* spp. *vide* Kennedy et al. 2016; mucormycosis caused by *Rhizopus arrhizus*), mycoparasites (e.g. *Syncephalis* *vide* Lazarus et al. 2017), amoebae endoparasites (e.g. *Amoebophilus* *vide* Mrva 2011). Moreover, some taxa have been used in biotechnological biodegradation, biosorption, bioremediation and biotransformations (Benny et al. 2016a, b).

78 Classification

79 The classification of basal clades genera is conflicting in different publications. The collective term, Zygomycota Moreau was treated as a phylum in eumycotan fungi (e.g. Kendrick 2000; Kirk et al. 2008), but this rank has not been supported as a monophyletic clade in recent analyses and thus eumycotan taxa have been separated into different phyla (Spatafora et al. 2016). However, the establishment of new phyla has not been broadly accepted, thus synonymizing or erecting phyla/ sub phyla have been frequent since James et al. (2006) (e.g. Hibbett et al. 2007) introduced *Neocallimastigomycota* to accommodate *Neocallimastigomycetes*, but Spatafora et al. (2016) treated this as a class in *Chytridiomycota*. Seto et al. (2017), however, recognized *Neocallimastigomycota* as a distinct phylum in their phylogenetic analyses. Table 1 summarizes the

overview of phyla in basal clades based on major publications since 2000.

Recently, Tedersoo et al. (2016) proposed a new classification which accepted *Rozellomycota* (including *Microsporidia*) and *Aphelidiomycota* as phyla in Kingdom Fungi. Furthermore, Tedersoo et al. (2016) introduced *Calcarisporiellomycota*, *Kickxellomycota* and *Mortierellomycota* as new phyla. In this study, we follow classification in Tedersoo et al. (2016).

Overview

We accept 16 phyla (*viz.* *Aphelidiomycota*, *Basidiobolomycota*, *Blastocladiomycota*, *Calcarisporiellomycota*, *Caulochytriomycota*, *Chytridiomycota*, *Entomophthoromycota*, *Glomeromycota*, *Kickxellomycota*, *Monoblepharomycota*, *Mortierellomycota*, *Mucoromycota*, *Neocallimastigomycota*, *Olpidiomycota*, *Rozellomycota* and *Zoopagomycota*) as early divergence groups in fungi (Fig. 1). Below, we provide the outline of all phyla and short entries for each genus in notes section. Moreover, we propose to conserve the family *Catenariaceae* Couch (which is based on *Catenaria* Sorokin; nom. illegit., Art. 53.1 *vide* Index Fungorum 2018), emend *Cladochytriales* Mozl.-Standr. and introduce *Nephridiophagaceae* R. Radek et al.

Materials and Methods

Data collection

Collecting data on existing names (including genera and higher ranks) was based on Kirk et al. (2008, 2013), Species Fungorum (2018) and Catalogue of Life (<http://www.catalogueoflife.org/>). The works by Humber (2012), Benny et al. (2016a, b), Spatafora et al. (2016), Cali et al. (2017), Desirò et al. (2017) and Tedersoo et al. (2016) were also used for further clarification. Data are provided in accordance to information available in publications and publicly-accessible databases such as NCBI. Wijayawardene et al. (2017a) was followed as the template for entries. The citation of the articles given in each entry was decided by the author who provided the entry and is not standardized. Based on recent publications and Species Fungorum (2018), synonyms of generic names (if fewer than 10) are also provided.

Taxonomy

Catenariaceae Couch *nom. cons. prop.*

Nom. illegit., see Art. 18.3 (Melbourne)

Table 1 Phyla currently recognized in different studies

Phylum	Basidiobolomycota	Blastocladiomycota	Caulochytriomycota	Chytridiomycota	Entomophthoromycota	Glomeromycota
Introduced by	Doweld (2011)	James et al. (2006)	Doweld (2014g)	Doweld (2001)	Humber (2012)	Schüßler et al. (2001)
Demoted by					Spatafora et al. (2016)	Spatafora et al. (2016)
Current rank	Phylum	Phylum	Phylum	Phylum	Sub phylum Entomophthoromycotina	Sub phylum Glomeromycotina
In this study	Phylum	Phylum	Phylum	Phylum	Phylum	Phylum
Phylum	Monoblepharomycota	Mucoromycota	Neocallimastigomycota	Olpidiomycota	Zoopagomycota	
Introduced by	Doweld (2001)	Doweld (2001)	Hibbett et al. (2007)	Doweld (2013c)	Spatafora et al. (2016)	
Demoted by			Spatafora et al. (2016)/Seto et al. (2017)			
Current rank	Phylum	Phylum	Class Neozygitomycetes/or as the phylum	Phylum	Phylum	
In this study	Phylum	Phylum	Phylum	Phylum	Phylum	

Type: *Catenaria* Sorokin, Revue mycol., Toulouse 11(no. 43): 139 (1889) *nom. cons. prop. nom. illegit.* Art. 53.1

Cladochytriales Mozl.-Standr. **emend.**
 Index Fungorum (2018) mentioned that the type was not indicated in Mozley-Standridge et al. (2009) thus below we state the type.
 Type: *Cladochytrium* Nowak., Cohn Beitr. Biol. Pfl. 2: 92. 1876".
 See Mozley-Standridge et al. (2009) for a Latin and English description.

In here, we introduce new family *Nephridiophagaceae*

Nephridiophagales Doweld
 Life style obligate biotrophic/parasitic in arthropods; uni- to multinucleate stages; endogenous spore formation; no thallic organization.

Order type: *Nephridiophagaceae* R. Radek, Letcher, Wijayaw., P.M. Kirk & K.D. Hyde

Nephridiophagaceae R. Radek, Letcher, Wijayaw., P.M. Kirk & K.D. Hyde **fam. nov.**

Merogonial plasmodia; sporogenic plasmodia with endogenous spore formation and residual somatic nuclei; cryptomitosis; bi- or tetranuclear sporoblasts; mature spores mostly uninucleate, flattened-oval form. Sporoblasts generally delimited in the sporogenic cytoplasm by ER cisternae and spore wall material deposited between the two resulting membranes. Extra- and intracellular in Malpighian tubules of insects. Transmission by oral infection

Family type: *Nephridiophaga* Ivanić 1937

Notes: Doweld (2014f) introduced *Nephridiophagales* Doweld based on the morphology of insect parasitic genus *Nephridiophaga* Ivanić. However, Doweld (2014f) did not typify the order with a family (i.e. ordinal type). Radek et al. (2017) showed that three *Nephridiophaga* species viz. *N. blattellae* (H. Crawley) P. Woolever, *N. maderae* R. Radek et al. and *N. blaberi* Fabel et al. grouped as a distinct clade in their phylogenetic analyses. Hence, we introduce new family, *Nephridiophagaceae* as the ordinal type of *Nephridiophagales* (Fig. 2).

Outline for basal clades

APHELIDIOMYCOTA Tedersoo, Koljalg, Bahram, Doring, Schigel, T. May, Sanchez-Ramirez, M. Ryberg & Abarenkov

Aphelidiomycetes Tedersoo, Koljalg, Bahram, Doring, Schigel, T. May, Sanchez-Ramirez, M. Ryberg & Abarenkov

Aphelidiales Tedersoo, Koljalg, Bahram, Doring, Schigel, T. May, Sanchez-Ramirez, M. Ryberg & Abarenkov

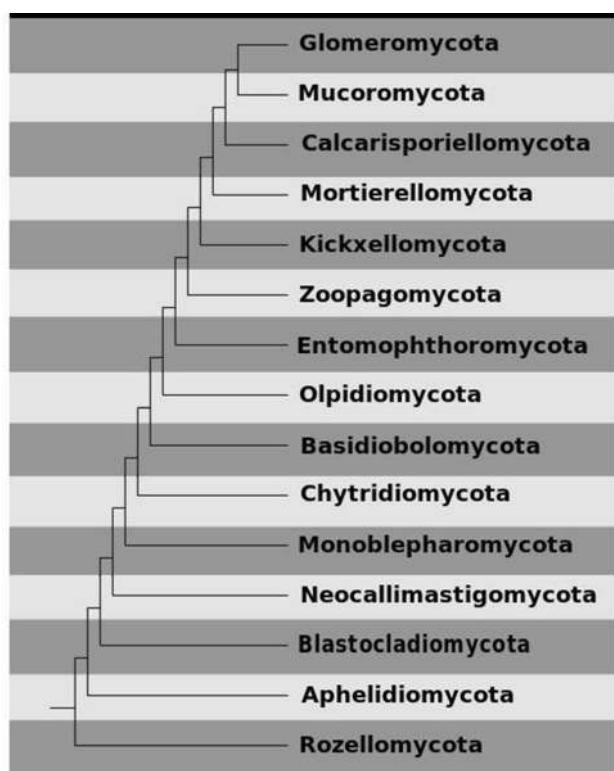


Fig. 1 Cladogram showing relationships between basal clades following taxonomy proposed by Tedersoo et al. (2016)

185	<i>Aphelidiaceae</i> Tedersoo, Koljalg, Bahram, Doring, Schigel, T. May, Sanchez-Ramirez, M. Ryberg & Abarenkov
186	<i>Amoebophilidium</i> Scherff.
187	<i>Aphelidium</i> Zopf
188	<i>Paraphelidium</i> Karpov, Moreira, Lopez-Garcia
189	<i>Pseudaphelidium</i> Schweikert & Schnepf
190	
191	BASIDIOBOLOMYCOTA Doweld
192	<i>Basidiobolomycetes</i> Humber
193	<i>Basidiobolales</i> Caval.-Sm.
194	<i>Basidiobolaceae</i> Claussen
195	<i>Basidiobolus</i> Eidam
196	<i>Schizangiella</i> J. Dwyer, B. Burwell, Humber, C. Mcleod,
197	M. Fleetwood & T. Johnson bis
198	BLASTOCLADIOMYCOTA T.Y. James
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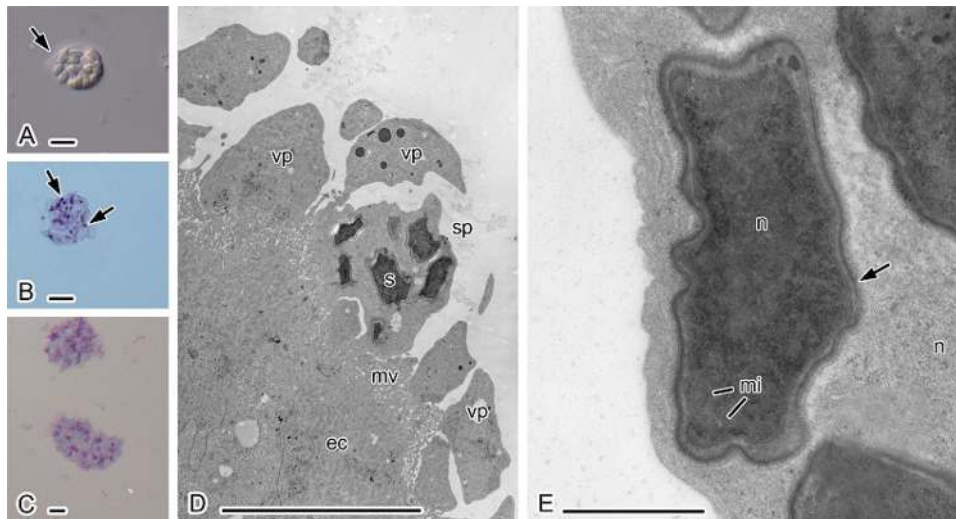


Fig. 2 A, B: *Nephridiophaga archimandrita*, C–E: *N. lucihormetica*. Bars A–D = 10 μ m, E = 1 μ m. A Sporogenic plasmodium with mature spores. Arrow = plasma membrane of plasmodium. Differential interference contrast (DIC). B Giemsa stained microscopic smear; sporogenic plasmodium. Arrows point to residual nuclei between the spores. Bright field. C Giemsa stained vegetative plasmodia with

many nuclei. DIC. D Ultrathin section of infected Malpighian tubule. Vegetative plasmodia (vp) and sporogenic plasmodia (sp) with internal spores (sp) attach to the microvilli (mv) of the epithelial cells (ec). E Part of a sporogenic plasmodium with mature spores. Spore with spore wall (arrow), nucleus (n) and mitochondria (mi). A further residual nucleus (n) is in the cytoplasm of the plasmodium

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991	<i>Culicosporella</i> Weiser	<i>Orthothelohania</i> Codreanu & Codreanu-Balcescu	1034
992	<i>Dimeiospora</i> Simakova, Pankova & Issi	<i>Paradoxium</i> G.D. Stentiford, S.H. Ross, R. Kerr, D. Bass &	1035
993	<i>Edhazardia</i> Becnel, V. Sprague & Fukuda	K.S. Bateman	1036
994	<i>Hyalinocysta</i> Hazard & Oldacre	<i>Pegmatheca</i> Hazard & Oldacre	1037
995	<i>Intrapredatorus</i> Chen, Kuo & Wu 1998	<i>Resiomeria</i> Larsson	1038
996	<i>Novothelohania</i> Andreadis, Simakova, Vossbrinck, Shep-	<i>Sphaerospora</i> J.J. Garcia	1039
997	ard & Yurchenko	<i>Thelohania</i> Henneguy	1040
998	<i>Parastempellia</i> Khodzhaeva	<i>Toxoglugea</i> Léger & Hesse	1041
999	<i>Parathelohania</i> Codreanu		
1000	<i>Trichoctosporea</i> Larsson	Microsporidea families <i>incertae sedis</i> ,	1042
1001	<i>Tricornia</i> Pell & Canning	Areosporiidae G.D. Stentiford, S. Bateman, Feist, S.	1043
1002	Burenelliidae Jouvenaz & Hazard	Oyarzún, J.C. Uribe, M. Palacios & D.M. Stone	1044
1003	<i>Burenella</i> Jouvenaz & Hazard	<i>Areospora</i> G.D. Stentiford, S. Bateman, Feist, S. Oyarzún,	1045
		J.C. Uribe, M. Palacios & D.M. Stone	1046
		Berwaldiidae Simakova, Tokarev, Issi	1047
		<i>Berwaldia</i> Larsson	1048

- 1049 *Fibrillanosema* Slothouber Galbreath, Smith, Terry, Becnel, & Dunn 1091
- 1051 **Cougourdellidae** Poisson 1092
- 1052 *Cougourdella* E. Hesse 1093
- 1053 **Facilisporidae** Jones, Prosperi-Porta & Kim 1094
- 1054 *Facilispora* Jones, Prosperi-Porta & Kim 1095
- 1055 **Heterovesiculidae** Lange, Macvean, Henry & Streett 1096
- 1056 *Heterovesicula* Lange, Macvean, Henry & Streett 1097
- 1057 **Myosporidae** Stentiford, Bateman, Small, Moss, Shields, Reece & Tuck 1098
- 1058 *Myospora* Stentiford, Bateman, Small, Moss, Shields, Reece & Tuck 1099
- 1059 *Myospora* Stentiford, Bateman, Small, Moss, Shields, Reece & Tuck 1100
- 1060 *Myospora* Stentiford, Bateman, Small, Moss, Shields, Reece & Tuck 1101
- 1061 **Neonosemoidiidae** Faye, Toguebaye & Bouix 1102
- 1062 *Neonosemoides* Faye & Toguebaye 1103
- 1063 **Ordosporidae** Larsson, Ebert & Vávra 1104
- 1064 *Ordospora* Larsson, Ebert & Vávra 1105
- 1065 **Pleistosporidiidae** Codreanu-Balcescu & Codreanu 1106
- 1066 *Pleistosporidium* Codreanu-Balcescu & Codreanu 1107
- 1067 **Neopereziidae**. Voronin 1108
- 1068 *Bacillidium* Janda 1109
- 1069 *Bryonosema* Canning, Refardt, Vossbrinck, Okamura & Curry 1110
- 1070 *Bryonosema* Canning, Refardt, Vossbrinck, Okamura & Curry 1111
- 1071 *Neoperezia* Issi & Voronin 1112
- 1072 *Pseudonosema* Canning, Refardt, Vossbrinck, Okamura & Curry 1113
- 1073 *Pseudonosema* Canning, Refardt, Vossbrinck, Okamura & Curry 1114
- 1074 *Schroedera* D.J. Morris & A. Adams 1115
- 1075 *Trichonosema* Canning, Refardt, Vossbrinck, Okamura & Curry 1116
- 1076 *Trichonosema* Canning, Refardt, Vossbrinck, Okamura & Curry 1117
- 1077 **Telomyxidae** Léger & Hesse 1118
- 1078 *Telomyxa* Léger & Hesse 1119
- 1079 **Toxoglugeidae** Larsson 1120
- 1080 *Toxospora* Voronin 1121
- 1081 **Tubulinosematidae** Franzen, Fischer, Schröder, Schölmerich & Schneuwly 1122
- 1082 *Tubulinosematidae* Franzen, Fischer, Schröder, Schölmerich & Schneuwly 1123
- 1083 *Anncaliia* Issi, Krylova & Nikolaeva 1124
- 1084 *Kneallhazia* Sokolova & Fuxa 1125
- 1085 *Tubulinosema* Franzen, Fischer, Schröder, Schölmerich & Schneuwly 1126
- 1086 *Tubulinosema* Franzen, Fischer, Schröder, Schölmerich & Schneuwly 1127
- 1087 **Microsporidea** genera *incertae sedis* 1128
- 1088 *Alfvenia* Larsson 1129
- 1089 *Anisofilariata* Tokarev, Voronin, Seliverstova, Dolgikh, Pavlova, Ignatieva & Issi 1130
- 1090 *Anisofilariata* Tokarev, Voronin, Seliverstova, Dolgikh, Pavlova, Ignatieva & Issi 1131
- Auraspora* Weiser & K. Purrini 1132
- Baculea* Loubès & Akbarieh 1133
- Campanulospora* Issi, Radishcheva & Dolzhenko 1134
- Caulleryetta* Dogiel 1135
- Chytridioides* Tregouboff 1136
- Ciliatosporidium* Foissner & Foissner 1137
- Crispospora* Tokarev, Voronin, Seliverstova, Pavlova & Issi 1138
- Cryptosporina* Hazard & Oldacre 1139
- Cystosporogenes* Canning, Barker, Nicholas & Page 1140
- Endoreticulatus* Brooks, Becnel & Kennedy 1141
- Enterocytophora* Rode, Landes, Lievens, Flaven, Segard, Jabbour-Zahab, Michalakakis, Agnew, Vivarés & Lenormand 1142
- Evlachovaia* Voronin 1143
- Geusia* Rühl & Korn 1144
- Globulispora* Vávra, Hylis, Viala, Nebesarova 1145
- Glugoides* (Chatton) Larsson, Ebert, Vávra & Voronin 1146
- Gurleyides* Voronin 1147
- Hamiltosporidium* Haag, Larsson, Refardt, and Ebert 1148
- Hazardia* Weiser 1149
- Hirsutosporos* Batson 1150
- Holobispora* Voronin 1151
- Issia* Weiser 1152
- Janacekia* Larsson 1153
- Kinorhynchospora* Adrianov & Rybakov 1154
- Liebermannia* Sokolova, Lange & Fuxa 1155
- Mariona* Stempell 1156
- Merocinta* Pell & Canning 1157
- Microsporidium* Balbiani 1158
- Multilamina* Becnel, Scheffrahn, Vossbrinck & Bahder 1159
- Myxocystis* Mrazek 1160
- Nematocinator* Sapir, Dillman, Connon, Grupe, Ingels, Mundo-Ocampo, Levin, Bladwin, Orphan & Sternberg 1161
- Nematocida* Troemel, Félix, Whiteman, Barrière & Ausubel 1162
- Nosemoides* Vinckier 1163
- Orthosomella* Canning, Wigley & Barker 1164
- Sheriffia* Larsson 1165
- Spiroglugea* Léger & Hesse 1166
- Sporanauta* Ardila-Garcia & Fast 1167
- Stempellia* Léger & Hesse 1168
- Systemostrema* Hazard & Oldacre 1169
- Takaokaspora* Andreadis, Takaoka, Otsuka & Vossbrinck 1170
- Trichotuzetia* Vávra, Larsson & Baker 1171
- Triwangia* Wang, Nai, Chih Wang, Solter, Hsu, Wang & Lo 1172
- Vittaforma* Silveira & Canning 1173
- Wittmannia* Czaker 1174
- Rudimicrosporea** Sprague 1175
- Metchnikovellida** Vivier 1176
- Amphiacanthidae** Larsson 1177
- Amphiacantha* Caullery & Mesnil 1178
- Amphiamblys* Caullery & Mesnil 1179

1142	<i>Metchnikovellidae</i> Caullery & Mesnil	NOTES FOR GENERA	1188
1143	<i>Desportesia</i> Issi & Voronin	In this section we provide an introduction for each phylum	1189
1144	<i>Metchnikovella</i> Caullery & Mesnil	and entries for each genus with taxonomic placements,	1190
1145	<i>Microsporidiopsis</i> Schereschewsky	habitat, recent references etc.	1191
1146	<i>Rozellomycota</i> genera <i>incertae sedis</i>	<i>Aphelidiomycota</i> Tedersoo et al.	1192
1147	<i>Mitosporidium</i> Haag, James, Pombert, Larsson, Schaer,	Tedersoo et al. (2016) introduced <i>Aphelidiomycota</i>	1193
1148	Refardt & Ebert	which comprises one class, one order and one family.	1194
1149	<i>Paramicrosporidium</i> Corsaro, Walochnik, Venditti, Stein-	Currently, we accept four genera belonging in	1195
1150	mann, Müller & Michel	<i>Aphelidiomycota</i> .	1196
1151	ZOOPAGOMYCOTA Gryganskyi, M.E. Sm., Spatafora &	Notes for genera	1197
1152	Stajich	<i>Amoebophilium</i> Scherff. 1925, <i>Aphelidiaceae</i> , <i>Aphelidiales</i> ,	1198
1153	<i>Zoopagomycetes</i> Doweld	<i>Aphelidiomycetes</i> , <i>Aphelidiomycota</i> , five species,	1199
1154	<i>Zoopagales</i> Bessey ex R.K. Benj.	type: <i>A. achnanthidis</i> Scherff., parasites, aquatic, cos-	1200
1155	<i>Cochlonemataceae</i> Dudd.	mopolitan, see Letcher et al. (2015b; new species), Karpov	1201
1156	<i>Amoebophilus</i> P.A. Dang.	et al. (2016; phylogeny), sequences are available.	1202
1157	<i>Aplectosoma</i> Drechsler	<i>Aphelidium</i> Zopf 1885, <i>Aphelidiaceae</i> , <i>Aphelidiales</i> ,	1203
1158	<i>Bdellospora</i> Drechsler	<i>Aphelidiomycetes</i> , <i>Aphelidiomycota</i> , seven species, type: <i>A.</i>	1204
1159	<i>Cochlonema</i> Drechsler	<i>deformans</i> Zopf, parasites of algae, aquatic, worldwide, see	1205
1160	<i>Endocochlus</i> Drechsler	Karpov et al. (2016; phylogeny), Letcher et al. (2017; new	1206
1161	<i>Euryancale</i> Drechsler	species), sequences are available.	1207
1162	<i>Helicocephalidaceae</i> Boedijn	<i>Paraphelidium</i> Karpov, Moreira, Lopez-Garcia 2017b,	1208
1163	<i>Brachymyces</i> G.L. Barron	<i>Aphelidiaceae</i> , <i>Aphelidiales</i> , <i>Aphelidiomycetes</i> , <i>Aphelid-</i>	1209
1164	<i>Helicocephalum</i> Thaxt.	<i>iomycota</i> , two species, type: <i>P. tribonemae</i> Karpov, Mor-	1210
1165	<i>Rhopalomyces</i> Corda	eira, Lopez-Garcia, parasites of <i>Tribonema gayanum</i> ,	1211
1166	<i>Verrucocephalum</i> Degawa	aquatic, Russia, see Karpov et al. (2017b, c; taxonomy,	1212
1167	<i>Piptocephalidaceae</i> J. Schröt.	phylogeny), sequences are available.	1213
1168	<i>Kuzuhaea</i> R.K. Benj.	<i>Pseudaphelidium</i> Schweikert & Schnepf 1996, <i>Aphelidi-</i>	1214
1169	<i>Piptocephalis</i> de Bary	<i>aceae</i> , <i>Aphelidiales</i> , <i>Aphelidiomycetes</i> , <i>Aphelidiomycota</i> ,	1215
1170	<i>Syncephalis</i> Tiegh. & G. Le Monn.	one species, type: <i>P. drebesii</i> Schweikert & Schnepf, par-	1216
1171	<i>Sigmoideomycetaceae</i> Benny, R.K. Benj. & P.M. Kirk	asite, marine, Germany, see Schweikert and Schnepf (1996,	1217
1172	<i>Reticulocephalis</i> Benny, R.K. Benj. & P.M. Kirk	1997; description, light microscopy, electron microscopy),	1218
1173	<i>Sigmoideomyces</i> Thaxt.	sequences are unavailable.	1219
1174	<i>Sphondylocephalum</i> Stalpers	<i>Basidiobolomycota</i> Doweld	1220
1175	<i>Thamnocephalis</i> Blakeslee	Doweld (2011) introduced <i>Basidiobolomycota</i> based on	1221
1176	<i>Zoopagaceae</i> Drechsler	<i>Basidiobolus</i> Eidam. Taxonomic placement of <i>Basidiobo-</i>	1222
1177	<i>Acaulopage</i> Drechsler	<i>lus</i> (including higher taxonomic ranks i.e. <i>Basidiobolaceae</i> , AQ3	1223
1178	<i>Cystopage</i> Drechsler	<i>Basidiobolales</i> , <i>Basidiobolomycetes</i>) was doubtful since	1224
1179	<i>Lecophagus</i> M.W. Dick	different publications accommodated it in different place-	1225
1180	<i>Stylopage</i> Drechsler	ments in Kingdom Fungi. Nagahama et al. (1995) and	1226
1181	<i>Tentaculophagus</i> Doweld	James et al. (2000) showed that <i>Basidiobolus</i> grouped with	1227
1182	<i>Zoopage</i> Drechsler	<i>Chytridiomycetes</i> based on 18S rDNA sequence analyses.	1228
1183	<i>Zoophagus</i> Sommerst.	However, James et al. (2006), for the first time, accepted	1229
1184	<i>Zoopagales</i> genera <i>incertae sedis</i>	<i>Basidiobolus</i> belongs in <i>Entomophthoromycota</i> . The	1230
1185	<i>Massartia</i> De Wild.	placement in James et al. (2006) was followed by Humber	1231
1186	<i>Zoopagomycotina</i> genus <i>incertae sedis</i>	(2012) and Gryganskyi et al. (2013a, b). Nevertheless,	1232
1187	<i>Basidiolum</i> Cienk.	Hibbett et al. (2007) provided contrary conclusion with all	1233
		above placements on <i>Basidiobolus</i> , and placed it in	1234
		uncertain placement in Kingdom Fungi. Nevertheless,	1235

1236 Tedersoo et al. (2016) accepted *Basidiobolomycota* (fide
1237 Doweld 2011) as a distinct phylum in their newly proposed
1238 classification of fungi. Our phylogenetic analyses also
1239 agree with this placement thus in here, we conclude *Basidiobolomycota*
1240 as a distinct phylum which comprises
1241 *Basidiobolus* and *Schizangiella* J. Dwyer et al. (Fig. 1).

1242 Notes for genera

1243 ***Basidiobolus*** Eidam 1886, *Basidiobolaceae*, *Basidiobolales*,
1244 *Basidiobolomycetes*, *Entomophthoromycota*, four
1245 species, type: *B. ranarum* Eidam, on dung, human patho-
1246 gen, worldwide, see Rabie et al. (2011; Basidiobolomy-
1247 cosis), Sharma et al. (2011; human pathogen), Humber
1248 (2012; classification), Kumar Verma et al. (2012; subcu-
1249 taneous zygomycosis), Kwon-Chung (2012; human
1250 pathogen), Gryganskyi et al. (2013a; notes), Kirk et al.
1251 (2013; genus accepted), Al-Maani et al. (2014; gastroin-
1252 testinal basidiobolomycosis), Mendoza et al. (2015; human
1253 pathogen), Almoosa et al. (2017; pediatric gastrointestinal
1254 basidiobolomycosis), cultures and sequences are available,
1255 genomes available: *B. meristosporus* CDC-B9252 and CBS
1256 931.73 (Chibucos et al. 2016) available at NCBI genomes,
1257 *B. heterosporus* CDC-B8920 (Chibucos et al. 2016)
1258 available at NCBI genomes.

1259 ***Schizangiella*** J. Dwyer, B. Burwell, Humber, C. Mcleod,
1260 M. Fleetwood & T. Johnson bis 2006, *Basidiobolaceae*,
1261 *Basidiobolales*, *Basidiobolomycetes*, *Entomophthoromy-*
1262 *cota*, one species, type: *S. serpentis* J. Dwyer, B. Burwell,
1263 Humber, C. Mcleod, M. Fleetwood & T. Johnson bis, snake
1264 pathogen, cosmopolitan, see Gryganskyi et al. (2013a;
1265 notes, phylogeny), Hoffmann et al. (2013; notes), Humber
1266 (2016; classification), cultures and sequences are available.

1267 *Blastocladiomycota* T.Y. James

1268 James et al. (2006) elevated the order *Blastocladales*,
1269 which was traditionally treated as in *Chytridiomycota*, to a
1270 phylum *Blastocladiomycota*. The members of *Blastocla-*
1271 *diomycota* show different life modes such as saprobic,
1272 invertebrate parasites (e.g. *Callimastix* Weissenb., *Coelo-*
1273 *omyces* Keilin), and fungal and algal parasites (Hoffman
1274 et al. 2008; James et al. 2011). In evolution perspective,
1275 *Blastocladales* differs from the chytrids which have
1276 zygotic meiosis while most *Blastocladales* have a life
1277 cycle with sporic meiosis (James et al. 2006). Subsequent
1278 studies by Hibbett et al. (2007), Porter et al. (2011), James
1279 et al. (2012, 2014), Jones et al. (2016), Seto et al. (2017)
1280 and Krings et al. (2016) also recognized *Blastocladiomy-*
1281 *cota* as a distinct phylum of fungi.

1282 In this study, we accept one class, three orders, eight
1283 families and 14 genera in *Blastocladiomycota*.

Notes for genera

Allomyces E.J. Butler 1911 (= *Septocladia* Coker & F.A.
Grant 1922), *Blastocladiaceae*, *Blastocladales*, *Blasto-*
cladiomycetes, *Blastocladiomycota*, c. ten species, type: *A.*
arbusculus E.J. Butler, from soil, cosmopolitan, see Porter
et al. (2011; phylogeny), James and Berbee (2012; phy-
logeny), Kirk et al. (2013; genus accepted), cultures and
sequences are available.

Blastocladia Reinsch 1877, *Blastocladiaceae*, *Blastocladi-*
ales, *Blastocladiomycetes*, *Blastocladiomycota*, c. 20 species,
type: *B. pringsheimii* Reinsch, saprobes, aquatic, Argentina,
see Porter et al. (2011; DNA, phylogeny), Kirk et al. (2013;
genus accepted), cultures and sequences are available.

Blastocladopsis Sparrow 1950, *Blastocladiaceae*, *Blasto-*
cladales, *Blastocladiomycetes*, *Blastocladiomycota*, two
species, type: *B. parva* Whiffen ex Sparrow, saprobes,
aquatic, cosmopolitan, see Kirk et al. (2013; genus
accepted), cultures and sequences are unavailable.

Callimastix Weissenb. 1912, *Callimastigaceae*, *Calli-*
mastigales, *Blastocladiomycetes*, *Blastocladiomycota*, one
species, type: *C. cyclopis* Weissenb., on crustaceans, ter-
restrial, cosmopolitan, see Kirk et al. (2013; genus accep-
ted), cultures and sequences are unavailable.

Catenomyces A.M. Hanson 1944, *Catenomycetaceae*,
Catenomycetales, *Blastocladiomycetes*, *Blastocladiomy-*
cota, two species, type: *C. persicinus* A.M. Hanson, sap-
robes, North America, see Freeman et al. (Freeman et al.
2009; phylogeny), Kirk et al. (2013; genus accepted),
Hillman et al. (2017; microbes in gastrointestinal tract),
cultures and sequences are available.

Catenophlyctis Karling 1965 (= *Perirhiza* Karling 1946),
Catenariaceae, *Blastocladales*, *Blastocladiomycetes*,
Blastocladiomycota, two species, type: *C. variabilis* (Kar-
ling) Karling, saprobes, worldwide, see Kirk et al. (2013;
genus accepted), cultures and sequences are available.

Coelomomyces Keilin 1921, *Coelomomycetaceae*, *Calli-*
mastigales, *Blastocladiomycetes*, *Blastocladiomycota*, c.
75 species, type: *C. stegomyiae* Keilin, insect pathogens,
worldwide, see Seye et al. (2009; pathogens of *Aedes*
albopictus), Kirk et al. (2013; genus accepted), sequences
are available.

Coelomycidium Debais. 1919 (= *Zografia* Bogoyavl.
1922), *Coelomomycetaceae*, *Callimastigales*, *Blastocla-*
diomycetes, *Blastocladiomycota*, one species, type: *C.*
simulii Debais., insect pathogens, worldwide, see Porter
et al. (2011; phylogeny), Kirk et al. (2013; genus accepted),
cultures and sequences are available.

Endoblastidium Codreanu 1931, *Blastocladales* genera
incertae sedis, *Blastocladiomycetes*, *Blastocladiomycota*,
one species, type: *E. caulleryi* Codreanu, saprobes, cos-
mopolitan, see Kirk et al. (2013; genus accepted), cultures
and sequences are available for unidentified species.

1336 *Microallomyces* R. Emers. & J.A. Robertson 1974, *Blasto-*
1337 *tocladiomycetes* genera *incertae sedis*, *Blastocladiomycota*,
1338 two species, type: *M. dendroideus* R. Emers. & J.A.
1339 Robertson, saprobes, aquatic, Costa Rica, see Kirk et al.
1340 (2013; genus accepted), cultures and sequences are
1341 unavailable.

1342 *Nematoceromyces* Doweld 2013, *Catenariaceae*, *Blasto-*
1343 *cladiales*, *Blastocladiomycetes*, *Blastocladiomycota*, three
1344 species, type: *N. spinosus* (W. Martin) Doweld, parasitic in
1345 eggs of insects, cosmopolitan, see Doweld et al. (2014k;
1346 genus accepted), cultures and sequences are unavailable.

1347 *Paraphysoderma* Boussiba, Zarka & T.Y. James 2011,
1348 *Paraphysodermataceae*, *Blastocladales*, *Blastocla-*
1349 *diomycetes*, *Blastocladiomycota*, three species, type: *P.*
1350 *sedebokerense* Boussiba, Zarka & T.Y. James, parasitic on
1351 *Haematococcus pluvialis*, Israel, see James et al. (2011;
1352 taxonomy), Letcher et al. (2016; ultrastructure studies),
1353 Strittmatter et al. (2016; flagellated dispersion stage), cul-
1354 tures and sequences are available.

1355 *Physoderma* Wallr. 1833 (= *Oedomyces* Sacc. ex Trab.
1356 1894; = *Physopella* G. Poirault 1905; = *Urophlyctis* J.
1357 Schröt. (1886) [1889]), *Physodermataceae*, *Physoder-*
1358 *matales*, *Physodermatomyces*, *Blastocladiomycota*, c. 60
1359 species, type: *P. maculare* Wallr., saprobes, worldwide, see
1360 Kirk et al. (2013; genus accepted), cultures and sequences
1361 are available.

1362 *Sorochytrium* Dewel 1985, *Sorochytriaceae*, *Blastocla-*
1363 *diales*, *Blastocladiomycetes*, *Blastocladiomycota*, one spe-
1364 cies, type: *S. milnesiophthora* Dewel, saprobes, USA, see
1365 Kirk et al. (2013; genus accepted), cultures and sequences
1366 are unavailable.

1367 *Caulochytriomycota* Doweld

1368 Doweld (2014g) introduced *Caulochytriomycota* based
1369 on *Caulochytrium* Voos & L.S. Olive. *Caulochytrium*
1370 *gloeosporii* Voos & L.S. Olive, the type species of *Cau-*
1371 *lochytrium* was isolated from dead leguminous pods and
1372 treated as in *Chytridiales* (Voos and Olive 1968). The
1373 genus lacks DNA sequences in GenBank (accession date
1374 29.06.2018) thus the erection was based only on mor-
1375 phology and habitat. Currently the phylum comprises one
1376 class, one order, one family and one genus.

1377 Note for genus

1378 *Caulochytrium* Voos & L.S. Olive 1968, *Caulochytri-*
1379 *aceae*, *Caulochytriales*, *Caulochytriomycetes*,
1380 *Caulochytriomycota*, two species, type: *C. gloeosporii*
1381 Voos & L.S. Olive, saprobes, USA, see Kirk et al. (2013;
1382 genus accepted), cultures and sequences are unavailable.

Chytridiomycota Doweld

Doweld (2001) introduced *Chytridiomycota* based on
Chytridium A. Braun (1851). Hibbett et al. (2007) also
introduced *Chytridiomycota* M.J. Powell based on the same
genus thus this name is treated as an isonym of *Chytrid-*
iomycota Doweld. (Index Fungorum 2018). Taxa in
Chytridiomycota (Figs. 3 and 4) show a broad range of
distribution and mostly occur as aquatic (fresh water or
marine) saprobes and parasites, although taxa in some
orders (e.g. *Spizellomycetales* and *Rhizophlyctidales*) are
nearly exclusively terrestrial saprobes of refractive
substrates.

Hibbett et al. (2007) accepted two classes i.e. *Chytrid-*
iomycetes Caval.-Sm. (including three orders) and *Mono-*
blepharidomycetes J.H. Schaffn. (including one order).
Subsequent studies by Letcher et al. (2008a, b, c), Mozley-
Standridge et al. (2009), Simmons et al. (2009), Longcore
and Simmons (2012), Karpov et al. (2014) added several
orders to *Chytridiomycetes*. We accept two classes, 13
orders, 57 families and 151 genera in *Chytridiomycota*.

Notes for genera

Achlyella Lagerh. 1890, *Chytridiomycota* genera *incertae*
sedis, one species, type: *A. flahaultii* Lagerh., on pollen
grains, aquatic, Europe, see Kirk et al. (2013; genus
accepted), cultures and sequences are unavailable.

Achlyogeton Schenk 1859, *Chytridiomycota* genera *incer-*
tae sedis, one species, type: *A. entophytum* Schenk, para-
sitic, aquatic, cosmopolitan, see Kirk et al. (2013; genus
accepted), cultures and sequences are unavailable.

Algochytrrops Doweld 2014i, *Lobulomycetales* genera *in-*
certae sedis, *Lobulomycetes*, *Chytridiomycota*, one species,
type: *A. polysiphoniae* (Cohn) Doweld, epibiotic, marine,
cosmopolitan, see Simmons et al. (2009; as *Chytridium*
polysiphoniae, phylogeny), Doweld (2014i; taxonomy),
cultures and sequences are unavailable.

Allochytridium D.J.S. Barr & Désauln. 1987 (= *Al-*
lochytridium Salkin 1970), *Cladochytriales* genera *incertae*
sedis, *Cladochytriomycetes*, *Chytridiomycota*, one species,
type: *A. luteum* D.J.S. Barr & Désauln., from sandy soil,
Canada, see Mozley-Standridg et al. (2009; phylogeny),
Kirk et al. (2013; genus accepted), cultures and sequences
are available.

Alogomyces D.R. Simmons & Letcher 2012, *Alogomyc-*
etaceae, *Lobulomycetales*, *Lobulomycetes*, *Chytridiomy-*
cota, one species, type: *A. tanneri* D.R. Simmons &
Letcher, from horse manure, USA, see Simmons et al.
(2012; taxonomy), Doweld (2014b; introduced *Alogomyc-*
etaceae), cultures and sequences are available.

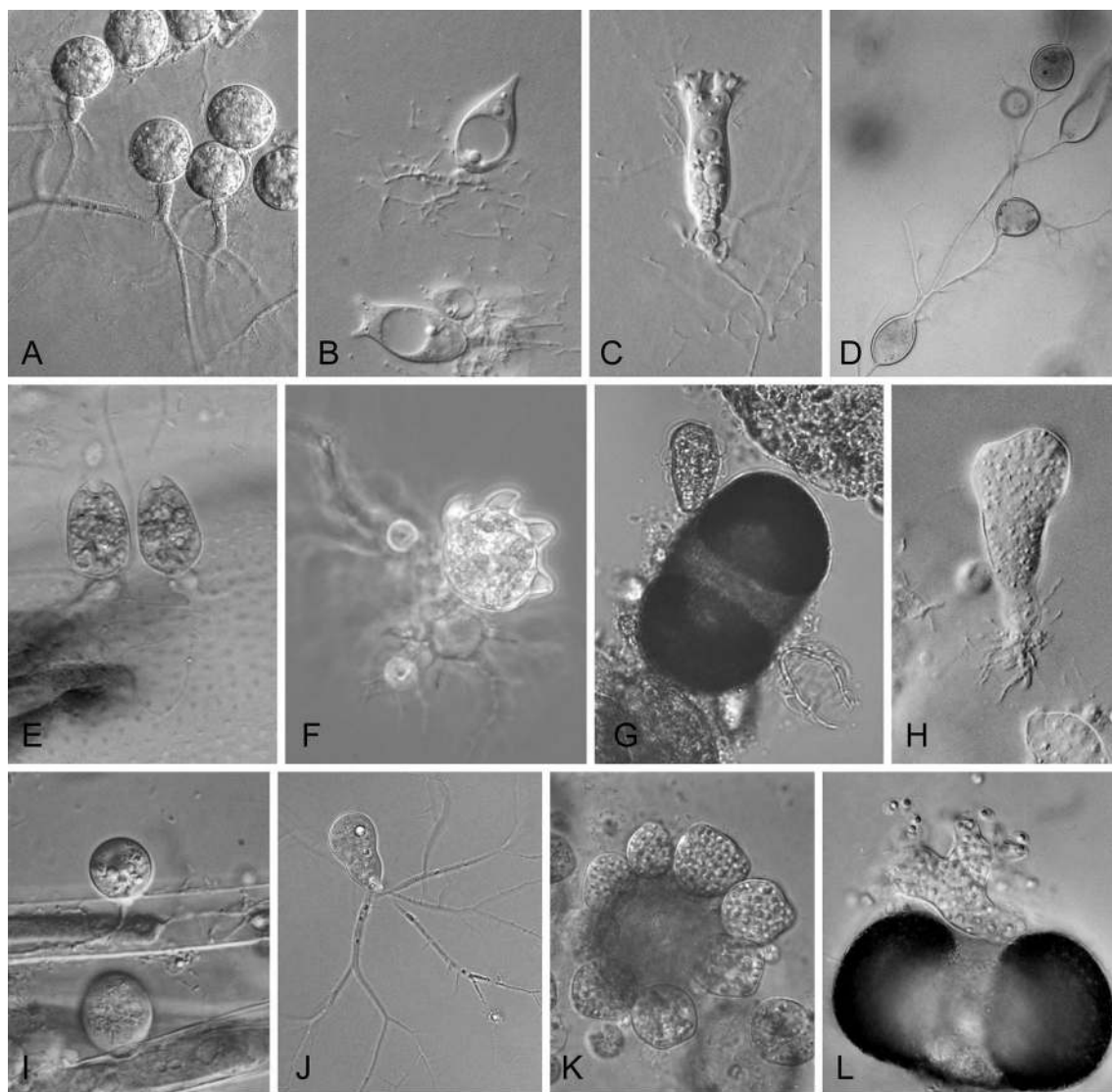


Fig. 3 A–D Chytriomycetaceae, Chytridiales. A *Chytriomycetes hyalinus*. B *Obelidium mucronatum*. C *Podochytrium dentatum*. D *Physocladia obscura*. E, F Chytridiaceae, Chytridiales. E *Phlyctochytrium planicorne*. F *Phlyctochytrium bullatum*. G, H Lobulomycetaceae.

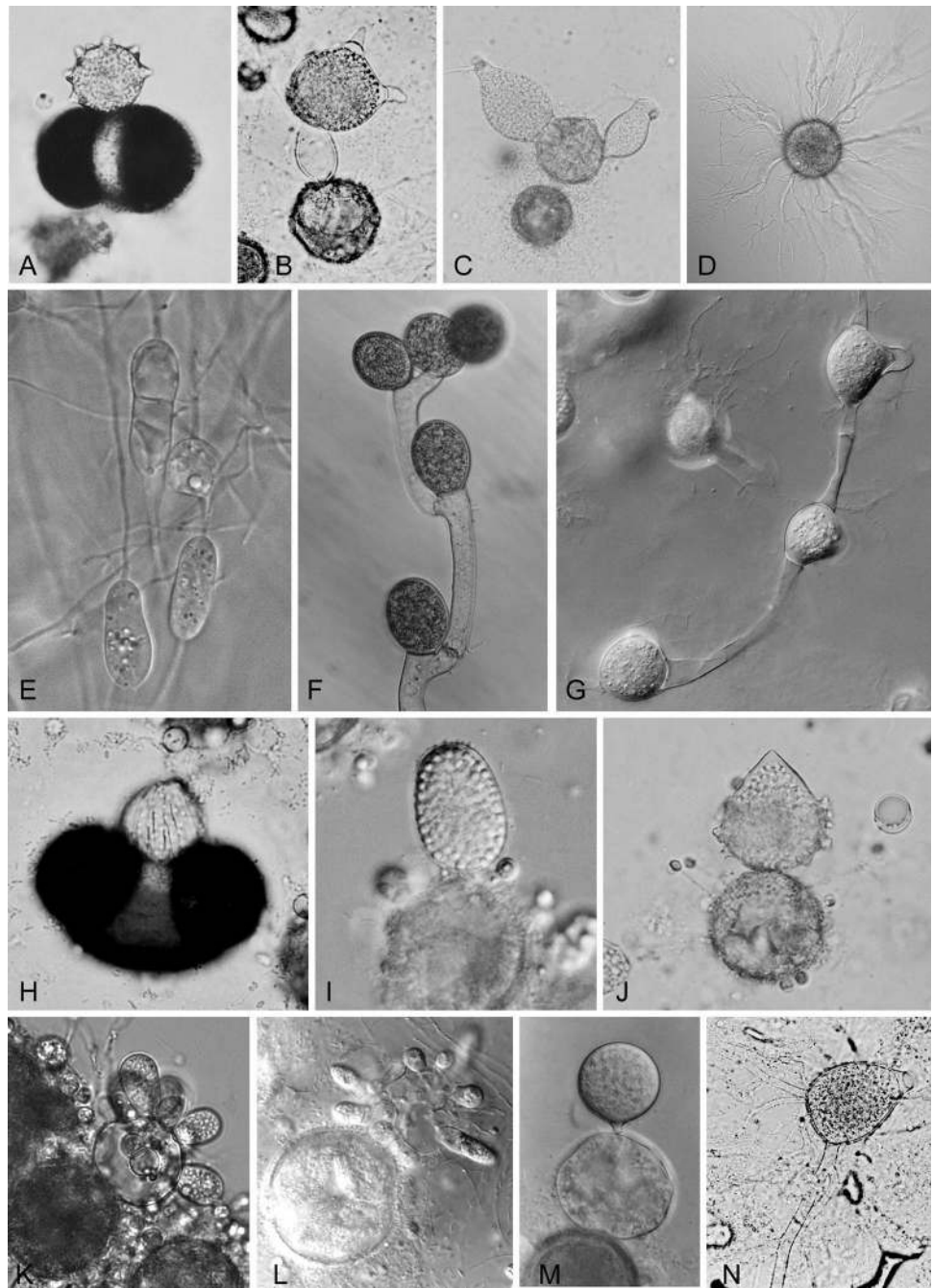
G *Lobulomyces poculatus*. H *Lobulomyces angularis*. I–L Rhizophydiales. I *Rhizophydium globosum*. J *Operculomyces laminatus*. K *Terramyces subangulosus*. L *Coralloidiomyces digitatus*

1431 ***Alphamyces*** Letcher 2008, *Alphamycetaceae*, *Rhizophydiales*, *Rhizophydiomycetes*, *Chytridiomycota*, one species, type: *A. chaetifer* (Sparrow) Letcher, on pollen, Argentina, see Letcher et al. (2008c, 2012a, b; taxonomy), Akinwole et al. (2014; fatty acids), cultures and sequences are available.
 1437 ***Amoebochytrium*** Zopf 1884, *Amoebochytriaceae*, *Chytridiomycetes* families *incertae sedis*, *Chytridiomycota*, one species, type: *A. rhizidioides* Zopf, from soil, cosmopolitan, see Kirk et al. (2013; genus accepted), Doweld (2014c; introduced *Amoebochytriaceae*), cultures and sequences are unavailable.
 1443 ***Angulomyces*** Letcher 2008, *Angulomycetaceae*, *Rhizophydiales*, *Rhizophydiomycetes*, *Chytridiomycota*, one

species, type: *A. argentinensis* Letcher, from submersed mud, cosmopolitan, see Letcher et al. (2008b; taxonomy), Davis et al. (2013; from Alabama), cultures and sequences are available, ITS of the type culture NR_119644.
Aphanistis Sorokín 1883, *Chytridiomycetes* genera *incertae sedis*, *Chytridiomycota*, two species, type: needs typification, Asia, see Kirk et al. (2013; genus accepted), cultures and sequences are unavailable.
Aquamyces Letcher 2008, *Aquamycetaceae*, *Rhizophydiales*, *Rhizophydiomycetes*, *Chytridiomycota*, one species, type: *A. chlorogonii* (Serbinow) Letcher, South America, see Letcher et al. (2008c; taxonomy, phylogeny), cultures and sequences are available, ITS of the type culture EF585643.

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Fig. 4 **A, B** *Spizellomyces*-*etaceae*, *Spizellomycetales*.
A *Spizellomyces punctatus*.
B *Phlyctochytrium reinboldiae*.
C *Powellomycetaceae*, *Spizellomycetales*.
Powellomyces variabilis.
D *Rhizophlyctidales*.
Rhizophlyctis rosea.
E *Cladochytriales*.
Cladochytrium replicatum.
F, G *Blastocladiomycota*.
F *Allomyces anomalus*.
G *Catenaria anguillulae*.
H–N *incertae sedis*.
H *Blyttomyces helicus*.
I *Polyphlyctis cystofera*.
J *Phlyctochytrium mucronatum*.
K *Chytridium rhizophydii*.
L *Septosperma rhizophydii*.
M *Rhizophyidium obpyriformis*.
N *Rhizophlyctis ingoldii*



1459 *Arizonaphlyctis* Letcher 2008, *Arizonaphlyctidaceae*, *Rhizophlyctidales*, *Rhizophlyctidomycetes*, *Chytridiomycota*,
 1460 one species, type: *A. lemmonensis* Letcher, USA, see
 1461 Letcher et al. (2008a; taxonomy, phylogeny), cultures and
 1462 sequences are available, ITS of the type culture EU379214.
 1463 *Arkaya* Longcore & D.R. Simmons 2012, *Arkayaceae*,
 1464 *Polychytriales*, *Polychytriomycetes*, *Chytridiomycota*, two
 1465 species, type: *A. lepida* Longcore & D.R. Simmons, USA,
 1466 see Longcore and Simmons (2012; taxonomy, phylogeny),
 1467 cultures and sequences are available.
 1468

Asterophlyctis H.E. Petersen 1903, *Asterophlyctaceae*,
 1469 *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*, two
 1470 species, type species. *A. sarcoptoides* H.E. Petersen, see
 1471 Vélez et al. (2011, taxonomy, phylogeny), Doweld (2014e;
 1472 introduced *Asterophlyctaceae*), cultures and sequences
 1473 available.
 1474

Avachytrium Vélez & Letcher 2013, *Chytriomycetaceae*,
 1475 *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*, two
 1476 species, type: *A. platense* Vélez & Letcher, USA, see Vélez
 1477 et al. (2013; taxonomy, phylogeny), Letcher et al. (2014;
 1478

- 1479 DNA), cultures and sequences are available, ITS of the
1480 type culture NR_111808.
- 1481 **Barromyces** M.J. Powell & Letcher 2018, *Spizellomyc-*
1482 *etaceae*, *Spizellomycetales*, *Spizellomycetes*, *Chytridiomy-*
1483 *cota*, one species, type: *B. tenuis* (D.J.S. Barr) M.J. Powell
1484 & Letcher, from soil, USA, see Powell et al. (2018; tax-
1485 onomy), ITS of type culture FJ827713.
- 1486 **Batrachochytrium** Longcore, Pessier & D.K. Nichols
1487 1999, *Batrachochytriaceae*, *Rhizophydiales*, *Rhizophy-*
1488 *diomycetes*, *Chytridiomycota*, two species, type: *B. den-*
1489 *drobatidis* Longcore, Pessier & D.K. Nichols, from skin of
1490 amphibians, USA, The Netherlands, see Fisher et al. (2009;
1491 amphibian chytridiomycosis), Van Rooij et al. (2012;
1492 amphibian pathogens), Blooi et al. (2013; real time PCR),
1493 Doweld (2013b; *Batrachochytriaceae*), Martel et al. (2013;
1494 new species, phylogeny), Dillon et al. (2017; pathogens),
1495 cultures and sequences are available.
- 1496 **Bertramia** Mesnil & Caullery 1897, *Chytridiomycetes*
1497 *genera incertae sedis*, *Chytridiomycota*, six species, type:
1498 *B. capitellae* Mesnil & Caullery, in annelids, Europe, see
1499 Kirk et al. (2013; genus accepted), cultures and sequences
1500 are unavailable.
- 1501 **Betamyces** Letcher 2011, *Alphamycetaceae*, *Rhizophydi-*
1502 *ales*, *Rhizophydiomycetes*, *Chytridiomycota*, one species,
1503 type: *A. americaemerdionalis* Letcher, Vélez, Schultz &
1504 M.J. Powell, on pollen, Argentina, see Letcher et al. (2011;
1505 taxonomy), cultures and sequences are available, ITS of the
1506 type culture EF585664.
- 1507 **Blyttomyces** A.F. Bartsch 1939, *Chytridiomycetes* *genera*
1508 *incertae sedis*, *Chytridiomycota*, eleven species, type: *B.*
1509 *spinulosus* (A. Blytt) A.F. Bartsch, saprobes, aquatic,
1510 worldwide, see Blackwell et al. (2011; reported from
1511 Alabama and Argentina, notes), Kirk et al. (2013; genus
1512 accepted), cultures and sequences are unavailable.
- 1513 **Boothomyces** Letcher 2006, *Terramycetaceae*, *Rhizophy-*
1514 *diales*, *Rhizophydiomycetes*, *Chytridiomycota*, one species,
1515 type: *B. macroporosum* (Karling) Letcher, from soil, ter-
1516 restrial, New Zealand, see Davis et al. (2013; DNA,
1517 reported from Alabama), cultures and sequences are
1518 available, ITS of the type culture NR_119591.
- 1519 **Borealophlyctis** Letcher 2008, *Borealophlyctidaceae*,
1520 *Rhizophlyctidales*, *Rhizophlyctidomycetes*, *Chytridiomy-*
1521 *cota*, two species, type: *B. paxensis* Letcher, from soil, on
1522 pollen, terrestrial, USA, see Letcher et al. (Letcher et al.
1523 2008c; taxonomy), Davis et al. (2016a, b; new species),
1524 cultures and sequences are available, ITS of the type cul-
1525 ture NR_111314.
- 1526 **Brevicalcar** Letcher & M.J. Powell 2018, *Spizellomyc-*
1527 *etaceae*, *Spizellomycetales*, *Spizellomycetes*, *Chytridiomy-*
1528 *cota*, one species, type: *B. kilaueaense* Letcher and M.J.
1529 Powell, from soil, on pollen, terrestrial, Hawaii, see
1530 Letcher and Powell (2018; taxonomy), cultures and
1531 sequences are available.
- Bulbosomyces** Letcher & Longcore 2018, *Spizellomyc-*
1532 *etaceae*, *Spizellomycetales*, *Spizellomycetes*, *Chytridiomy-*
1533 *cota*, one species, type: *B. maxikinetosomus* Letcher &
1534 Longcore, from soil, on pollen, terrestrial, USA, see
1535 Letcher and Powell (2018; taxonomy), cultures and
1536 sequences are available.
- 1537 **Canteria** Karling 1971, *Chytridiomycetes* *genera incertae*
1538 *sedis*, *Chytridiomycota*, one species, type: *C. apophysata*
1539 (Canter) Karling, Europe, see Kirk et al. (2013; genus
1540 accepted), cultures and sequences are unavailable.
- 1541 **Carpenterophlyctis** Doweld 2013 (= *Carpenterella* Tehon
1542 & H.A. Harris 1941, *Synchytriaceae*, *Synchytriales*,
1543 *Synchytriomycetes*, *Chytridiomycota*, two species, type: *C.*
1544 *cannae* (Mundk. & Tirum.) Doweld, see Doweld (2013a;
1545 nomenclature), cultures and sequences are unavailable.
- 1546 **Catenochytridium** Berdan 1939, *Catenochytridiaceae*,
1547 *Cladochytriales*, *Cladochytriomycetes*, *Chytridiomycota*, c.
1548 eight species, type: *C. carolinianum* Berdan, saprobes,
1549 cosmopolitan, see Kirk et al. (2013; genus accepted), cul-
1550 tures and sequences are available for unidentified species.
- 1551 **Chytridium** A. Braun 1851, *Chytridiaceae*, *Chytridiales*,
1552 *Chytridiomycetes*, *Chytridiomycota*, c. 50 species, type: *C.*
1553 *olla* A. Braun, worldwide, see Kirk et al. (2013; genus
1554 accepted), cultures and sequences are available.
- 1555 **Chytriomycetes** Karling 1945, *Chytriomycetaceae*,
1556 *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*, c. 30
1557 species, type: *C. hyalinus* Karling, worldwide, see Kirk
1558 et al. (2013; genus accepted), cultures and sequences are
1559 available.
- 1560 **Cladochytrium** Nowak. 1877 (= *Pyroctonum* Prunet 1897),
1561 *Cladochytriaceae*, *Cladochytriales*, *Cladochytriomycetes*,
1562 *Chytridiomycota*, c. 15 species, type: *C. tenue* Nowak.,
1563 Europe, see Mozley-Standridge et al. (2009; DNA), Kirk
1564 et al. (2013; genus accepted), cultures and sequences are
1565 available.
- 1566 **Clydaea** D.R. Simmons 2009, *Lobulomycetaceae*, *Lobul-*
1567 *omycetales*, *Lobulomycetes*, *Chytridiomycota*, one species,
1568 type: *C. vesicula* D.R. Simmons, USA, see Simmons et al.
1569 (2009; taxonomy), cultures and sequences are available,
1570 ITS of the type culture NR_121339.
- 1571 **Coenomyces** K.N. Deckenb. 1901 (= *Deckenbachia* Jacz.
1572 19311), *Chytridiomycota* *genera incertae sedis*, one spe-
1573 cies, type: *C. consuens* K.N. Deckenb., saprobes, cos-
1574 mopolitan, see Kirk et al. (2013; genus accepted), cultures
1575 and sequences are available.
- 1576 **Coleospora** Gibbs 1959, *Nephridiophagaceae*, *Nephridio-*
1577 *phagales*, *Chytridiomycetes*, *Chytridiomycota*, one species,
1578 type: *C. binucleata* Gibbs, insect parasites, cultures and
1579 sequences are unavailable.
- 1580 **Coralloidiomyces** Letcher 2008, *Coralloidiomycetaceae*,
1581 *Rhizophydiales*, *Rhizophydiomycetes*, *Chytridiomycota*,
1582 one species, type: *C. digitatus* Letcher, saprobes, South
1583 America, see Letcher et al. (2008b; genus accepted),
1584

- 1585 Doweld (2014d; introduced *Coralloidiomycetaceae*),
1586 Powell et al. (2015; phylogeny), cultures and sequences are
1587 available.
- 1588 **Cyclopsomyces** K. Seto & Degawa 2015, *Lobulomyc-*
1589 *etaceae*, *Lobulomycetales*, *Lobulomycetes*, *Chytridiomy-*
1590 *cota*, one species, type: *C. plurioperculatus* K. Seto &
1591 Degawa, saprobes, Asia, see Seto et al. (2015; taxonomy,
1592 phylogeny), cultures and sequences are available.
- 1593 **Cylindrochytridium** Karling 1941, *Cladochytriales* genera
1594 *incertae sedis*, *Cladochytriomycetes*, *Chytridiomycota*, two
1595 species, type: *C. johnstonii* Karling, saprobes, cosmopoli-
1596 tan, see Kirk et al. (2008) accepted the genus but Kirk et al.
1597 (2013) did not list the genus, Steiger et al. (2012; phy-
1598 logeny, accepted as in *Cladochytriales*).
- 1599 **Dangeardia** Schröd. 1898, *Chytridiomycetes* genera *in-*
1600 *certae sedis*, *Chytridiomycota*, six species, type: *D.*
1601 *mamillata* Schröd., saprobes, cosmopolitan, see Kirk et al.
1602 (2013; genus accepted), cultures and sequences are
1603 unavailable.
- 1604 **Dangeardiana** Valkanov ex A. Batko 1970 (= *Dangear-*
1605 *diana* Valkanov 1964), *Chytridiomycetes* genera *incertae*
1606 *sedis*, *Chytridiomycota*, two species, type: *D. eudorinae*
1607 Valkanov ex A. Batko, saprobes, Europe, see Kirk et al.
1608 (2013; genus accepted), cultures and sequences are
1609 unavailable.
- 1610 **Delfinachytrium** Vélez & Letcher 2013, *Chytridiales*
1611 genera *incertae sedis*, *Chytridiomycetes*, *Chytridiomycota*,
1612 one species, type: *D. mesopotamicum* Vélez & Letcher,
1613 from marsh of semipermanent stream, Argentina, see Vélez
1614 et al. (2013; genus accepted), cultures and sequences are
1615 available.
- 1616 **Dendrochytridium** Letcher, Longcore & M.J. Powell 2014,
1617 *Chytridiaceae*, *Chytridiales*, *Chytridiomycetes*, *Chytrid-*
1618 *iomycota*, one species, type: *D. crassum* Letcher, Longcore
1619 & M.J. Powell, saprobes, Argentina, see Letcher et al.
1620 (2014; taxonomy, phylogeny), cultures and sequences are
1621 available.
- 1622 **Dictyomorpha** Mullins 1961, *Chytridiomycetes* genera *in-*
1623 *certae sedis*, *Chytridiomycota*, two species, type: *D. dioica*
1624 Couch ex Mullins, insect pathogens, USA, see Kirk et al.
1625 (2013; genus accepted), Blackwell et al. (2017; taxonomy),
1626 cultures and sequences are unavailable.
- 1627 **Dinomyces** Karpov & Guillou 2014, *Dinomycetaceae*,
1628 *Rhizophydiales*, *Rhizophydiomycetes*, *Chytridiomycota*,
1629 one species, type: *D. arenysensis* Karpov & Guillou, from
1630 *Alexandrium*, Europe, see Lepelletier et al. (2014; taxon-
1631 omy), Gleason et al. (2015; parasitic on harmful algal
1632 blooms), Jephcott et al. (2016; impact on harmful algal
1633 blooms), cultures and sequences are available.
- 1634 **Diplophlyctis** J. Schröt. 1892 (= *Asterophlyctis* H.E.
1635 Petersen 1903), *Endochytriaceae*, *Cladochytriales*,
1636 *Cladochytriomycetes*, *Chytridiomycota*, twelve species,
1637 type: *D. intestina* (Schenk) J. Schröt., saprobes,
cosmopolitan, see Mozley-Standridge et al. (2009; DNA),
Kirk et al. (2013; genus accepted), cultures and sequences
are available for unidentified species.
- Endochytrium** Sparrow 1933, *Endochytriaceae*,
Cladochytriales, *Cladochytriomycetes*, *Chytridiomycota*,
seven species, type: *E. oophilum* Sparrow, parasitic on
eggs, cosmopolitan, see Kirk et al. (2013; genus accepted),
cultures and sequences are available for unidentified
species.
- Endodesmidium** Canter 1949, *Synchytriaceae*, *Synchytri-*
ales, *Synchytriomycetes*, *Chytridiomycota*, one species,
type: *E. formosum* Canter, parasitic on desmids, cos-
mopolitan, see Kirk et al. (2013; genus accepted), cultures
and sequences are available for unidentified species.
- Entophlyctis** A. Fisch. 1892, *Chytriomycetaceae*,
Chytridiales, *Chytridiomycetes*, *Chytridiomycota*, c. 30
species, type: *E. cienkowskiana* (Zopf) A. Fisch, parasites,
in soil, cosmopolitan, see Kirk et al. (2013; genus accep-
ted), Wang et al. (2017b; in soil), cultures and sequences
are available.
- Fayochytriomycetes** W.J. Davis, Letcher, Longcore & M.J.
Powell 2015a, b, *Chytriomycetaceae*, *Chytridiales*,
Chytridiomycetes, *Chytridiomycota*, one species, type: *F.*
spinosus (Fay) W.J. Davis, Letcher, Longcore & M.J.
Powell, saprobes, see Davis et al. (2015a, b; taxonomy),
cultures and sequences are available.
- Fimicolochytrium** D.R. Simmons & Longcore 2012,
Powellomycetaceae, *Spizellomycetales*, *Spizellomycetes*,
Chytridiomycota, one species, type: *F. jonesii* D.R. Sim-
mons & Longcore, on manure, USA, see Simmons and
Longcore (2012; taxonomy), cultures and sequences are
available.
- Gaertneriomycetes** D.J.S. Barr 1980, *Spizellomycetaceae*,
Spizellomycetales, *Spizellomycetes*, *Chytridiomycota*, two
species, type: *G. semiglobifer* Uebelm. ex D.J.S. Barr, from
soil, cosmopolitan, see Kirk et al. (2013; genus accepted),
Powell et al. (2018; new species), cultures and sequences
are available.
- Gallinipes** Letcher & M.J. Powell 2018, *Spizellomyc-*
etaceae, *Spizellomycetales*, *Spizellomycetes*, *Chytridiomy-*
cota, three species, type: *G. danensis* Letcher and M.J.
Powell, from soil, on pollen, terrestrial, USA, see Letcher
and Powell (2018; taxonomy), cultures and sequences are
available.
- Gammamyces** Letcher 2012, *Alphamycetaceae*, *Rhizophy-*
diales, *Rhizophydiomycetes*, *Chytridiomycota*, one species,
type: *G. ourimbahensis* Letcher, saprobes, Australia, see
Letcher et al. (2012a, b; genus accepted), cultures and
sequences are available.
- Gamolpidium** Vlădescu 1892, *Chytridiomycetes* genera
incertae sedis, *Chytridiomycota*, two species, type: *G.*
nitidum Vlădescu, on algae, Europe, see Kirk et al. (2013;
genus accepted), cultures and sequences are unavailable.

- 1691 **Geranomyces** D.R. Simmons 2011, *Powellomycetaceae*,
1692 *Spizellomycetales*, *Spizellomyces*, *Chytridiomycota*, four
1693 species, type: *G. variabilis* (Longcore, D.J.S. Barr &
1694 Désauln.) D.R. Simmons, from soil, on manure, USA, see
1695 Simmons (2011; taxonomy, phylogeny), Simmons and
1696 Longcore (2012; new species), cultures and sequences are
1697 available.
- 1698 **Globomyces** Letcher 2008, *Globomycetaceae*, *Rhizophy-*
1699 *diales*, *Rhizophydiomycetes*, *Chytridiomycota*, one species,
1700 type: *G. pollinis-pini* (A. Braun) Letcher, saprobes, cos-
1701 mopolitan, see Letcher et al. (2008c; taxonomy, phy-
1702 logeny), Davis et al. (2013; in Alabama), cultures and
1703 sequences are available.
- 1704 **Gorgonomyces** Letcher 2008, *Gorgonomycetaceae*, *Rhi-*
1705 *zophydiales*, *Rhizophydiomycetes*, *Chytridiomycota*, one
1706 species, type: *G. haynaldii* (Schaarschm.) Letcher, sap-
1707 robes, cosmopolitan, see Letcher et al. (2008c; taxonomy,
1708 phylogeny), Davis et al. (2013; in Alabama), Powell et al.
1709 (2015; phylogeny), cultures and sequences are available.
- 1710 **Gromochytrium** Karpov & Aleoshin 2014, *Gromochytri-*
1711 *aceae*, *Gromochytriales*, *Mesochytriomycetes*, *Chytrid-*
1712 *iomycota*, one species, type: *G. mamkaevae* Karpov &
1713 Aleoshin, parasites, Russia, see Karpov et al. (2014; tax-
1714 onomy, phylogeny), cultures and sequences are available,
1715 ITS of the type species NR_132054.1.
- 1716 **Halomyces** Letcher & M.J. Powell 2015, *Halomycetaceae*,
1717 *Rhizophydiales*, *Rhizophydiomycetes*, *Chytridiomycota*,
1718 one species, type: *H. littoreus* (Amon) Letcher & M.J.
1719 Powell, saprobes, marine, cosmopolitan, see Letcher et al.
1720 (2015a; taxonomy, phylogeny), cultures and sequences are
1721 available.
- 1722 **Homolaphlyctis** Longcore, Letcher & T.Y. James 2011,
1723 *Rhizophydiales* genera *incertae sedis*, *Rhizophydiomycetes*,
1724 *Chytridiomycota*, one species, type: *H. polyrhiza* Longcore,
1725 Letcher & T.Y. James, saprobes, from acidic lake, USA,
1726 see Longcore et al. (2011; taxonomy), cultures and
1727 sequences are available.
- 1728 **Ichthyochytrium** Plehn 1920, *Chytridiomycetes* genera
1729 *incertae sedis*, *Chytridiomycota*, one species, type: *I. vul-*
1730 *gare* Plehn, saprobes, Europe, see Kirk et al. (2013; genus
1731 accepted), cultures and sequences are unavailable.
- 1732 **Irineochytrium** Letcher, Longcore & M.J. Powell 2014,
1733 *Chytridiaceae*, *Chytridiales*, *Chytridiomycetes*, *Chytrid-*
1734 *iomycota*, one species, type: *I. annulatum* (Dogma)
1735 Letcher, Longcore & M.J. Powell, saprobes, see Letcher
1736 (2014; nomenclature correction), cultures and sequences
1737 are available.
- 1738 **Johnkarlingia** Pavgi & S.L. Singh 1979, *Synchytriaceae*,
1739 *Synchytriales*, *Synchytriomycetes*, *Chytridiomycota*, one
1740 species, type: *J. brassicae* S.L. Singh & Pavgi, saprobes,
1741 India, see Kirk et al. (2013; genus accepted), cultures and
1742 sequences are unavailable.
- Kappamyces** Letcher & M.J. Powell 2005, *Kappamyc-*
etaceae, *Rhizophydiales*, *Rhizophydiomycetes*, *Chytrid-*
iomycota, one species, type: *K. laurelensis* Letcher & M.J.
Powell, saprobes, from aquaculture of moss-covered soil,
Eurasia, see Monchy et al. (2011; phylogeny), Davis et al.
(2013; in Alabama), cultures and sequences are available.
- Karlingomyces** Sparrow 1960, *Polychytriaceae*, *Polychy-*
triales, *Polychytriomycetes*, *Chytridiomycota*, c. six spe-
cies, type: *K. asterocystis* (Karling) Sparrow, saprobes, see
Marano et al. (2011; diversity of zoosporic fungi in Las
Cañas stream, Argentina), Longcore and Simmons (2012;
DNA), Kirk et al. (2013; genus accepted), cultures and
sequences are available.
- Kochiomyces** D.J.S. Barr 1980, *Spizellomycetaceae*,
Spizellomycetales, *Spizellomyces*, *Chytridiomycota*, one
species, type: *K. dichotomus* (Umphlett) D.J.S. Barr, sap-
robes, USA, see Wakefield et al. (2010; phylogeny), Kirk
et al. (2013; genus accepted), Letcher and Powell (2017;
phylogeny), cultures and sequences are available.
- Lacustromyces** Longcore 1993, *Polychytriaceae*, *Poly-*
chytriales, *Polychytriomycetes*, *Chytridiomycota*, one spe-
cies, type: *L. hiemalis* Longcore, from soil, USA, see
Karpov et al. (2010; relationship with *Mesochytrium*), Kirk
et al. (2013; genus accepted), cultures and sequences are
available.
- Loborhiza** A.M. Hanson 1944, *Chytridiomycetes* genera
incertae sedis, *Chytridiomycota*, one species, type: *L.*
metzneri A.M. Hanson, saprobes, see Kirk et al. (2013;
genus accepted), cultures and sequences are unavailable.
- Lobulomyces** D.R. Simmons 2009, *Lobulomycetaceae*,
Lobulomycetales, *Lobulomycetes*, *Chytridiomycota*, two
species, type: *L. angularis* (Longcore) D.R. Simmons,
saprobes, see Simmons et al. (2009, 2012; taxonomy,
phylogeny), cultures and sequences are available.
- Macrochytrium** Minden 1902, *Chytridiomycetes* genera
incertae sedis, *Chytridiomycota*, one species, type: *M.*
botrydioides Minden, saprobes, see Kirk et al. (2013; genus
accepted), Krings et al. (2016; fossil fungi), cultures and
sequences are unavailable.
- Maunachytrium** D.R. Simmons 2009, *Lobulomycetaceae*,
Lobulomycetales, *Lobulomycetes*, *Chytridiomycota*, one
species, type: *M. keaense* D.R. Simmons, from soil,
Hawaii, see Simmons et al. (2009, 2012; taxonomy, phy-
logeny), cultures and sequences are available.
- Megachytrium** Sparrow 1931, *Chytridiomycetes* genera
incertae sedis, *Chytridiomycota*, one species, type: *M.*
westonii Sparrow, saprobes, North America, see Kirk et al.
(2013; genus accepted), cultures and sequences are
unavailable.
- Mesochytrium** B.V. Gromov, Mamkaeva & Pljusich 2000,
Mesochytriaceae, *Mesochytriales*, *Mesochytriomycetes*,
Chytridiomycota, one species, type: *M. penetrans* B.V.
Gromov, Mamkaeva & Pljusich, from green algae, Asia, see

- 1796 Karpov et al. (2010, 2014; phylogeny), cultures and
1797 sequences are available.
- 1798 **Micromyces** P.A. Dang. 1889 (= *Micromycopsis* Scherff.
1799 1926), *Synchytriales* genera *incertae sedis*, *Synchytri-*
1800 *omycetes*, *Chytridiomycota*, c. 13 species, type: *M.*
1801 *zygonii* P.A. Dang., on algae, Europe, see Kirk et al.
1802 (2013; genus accepted), cultures and sequences are
1803 unavailable.
- 1804 **Mitochytridium** P.A. Dang. 1911, *Chytridiomycetes* genera
1805 *incertae sedis*, *Chytridiomycota*, two species, type: *M.*
1806 *ramosum* P.A. Dang., cosmopolitan, see Kirk et al. (2013;
1807 genus accepted), cultures and sequences are unavailable.
- 1808 **Mucophilus** Plehn 1920, *Chytridiomycetes* genera *incertae*
1809 *sedis*, *Chytridiomycota*, one species, type: *M. cyprini*
1810 Plehn, in fishes, Europe, see Kirk et al. (2013; genus
1811 accepted), cultures and sequences are unavailable.
- 1812 **Myiophagus** Thaxt. ex Sparrow 1939, *Chytridiales* genera
1813 *incertae sedis*, *Chytridiomycetes*, *Chytridiomycota*, one
1814 species, type: *M. ucrainicus* (Wize) Sparrow, in fishes,
1815 Europe, USA, Colombia, see Kirk et al. (2013; genus
1816 accepted), cultures and sequences are unavailable.
- 1817 **Neokarlingia** Longcore & D.R. Simmons 2012, *Polychy-*
1818 *triaceae*, *Polychytriales*, *Polychytriomycetes*, *Chytrid-*
1819 *iomycota*, one species, type: *N. chitinophila* (Karling)
1820 Longcore & D.R. Simmons, USA, see Longcore and
1821 Simmons (2012; taxonomy), cultures and sequences are
1822 available
- 1823 **Nephridiophaga** Ivanić 1937, *Nephridiophagaceae*,
1824 *Nephridiophagales*, *Chytridiomycetes*, *Chytridiomycota*,
1825 13 species, type: *N. apis* Ivanić, insect parasites, world-
1826 wide, see Radek et al. (2011, 2017; new species), cultures
1827 of infected hosts and sequences are available
- 1828 **Nephrochytrium** Karling 1938, *Cladochytriales* genera
1829 *incertae sedis*, *Cladochytriomycetes*, *Chytridiomycota*,
1830 three species, type: *N. appendiculatum* Karling, cos-
1831 mopolitan, see Mozley-Standridge et al. (2009; DNA),
1832 Kirk et al. (2013; genus accepted), cultures and sequences
1833 are available
- 1834 **Nowakowskia** Borzí 1885, *Chytridiomycetes* genera *in-*
1835 *certae sedis*, *Chytridiomycota*, one species, type: *N. hor-*
1836 *mothecae* Borzí, saprobes, Europe, see Kirk et al. (2013;
1837 genus accepted), cultures and sequences are unavailable
- 1838 **Nowakowskiella** J. Schröt. 1893, *Nowakowskiellaceae*,
1839 *Cladochytriales*, *Cladochytriomycetes*, *Chytridiomycota*, c.
1840 15 species, type: *N. elegans* (Nowak.) J. Schröt., saprobes,
1841 Europe, see Kirk et al. (2013; genus accepted), cultures and
1842 sequences are available
- 1843 **Obelidium** Nowak. 1877, *Chytriomycetaceae*, *Chytridi-*
1844 *ales*, *Chytridiomycetes*, *Chytridiomycota*, three species,
1845 type: *O. mucronatum* Nowak., on mosquito larva, Europe,
1846 see Blackwell et al. (2012; review), Kirk et al. (2013; genus
1847 accepted), cultures and sequences are available
- Odontochytrium** Vélez & Letcher 2013, *Chytriomyc-*
etaceae, *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*,
one species, type: *O. milleri* Vélez & Letcher, saprobes,
South America, see Vélez et al. (2013; taxonomy), Letcher
et al. (2014; phylogeny), cultures and sequences are
available, ITS of the type: NG_042745.
- Olpidiaster** Pascher 1917, *Chytridiomycetes* genera *in-*
certae sedis, *Chytridiomycota*, three species, type: *O. brassi-*
cae (Woronin) Doweld, parasitic, cosmopolitan, see
Doweld et al. (2014; taxonomy), cultures and sequences
are unavailable.
- Operculomyces** M.J. Powell, Letcher & Longcore 2011,
Operculomycetaceae, *Rhizophydiales*, *Rhizophy-*
diomycetes, *Chytridiomycota*, one species, type: *O. lami-*
natus M.J. Powell, Letcher & Longcore, from soil, USA,
see Powell et al. (2011; taxonomy), cultures and sequences
are available, ITS of the type: NR_119590.
- Oryctospora** Purrini & Weiser 1990, *Nephridiophagaceae*,
Nephridiophagales, *Chytridiomycetes*, *Chytridiomycota*,
one species, type: *O. alata* Purrini and Weiser, insect
parasites, cultures and sequences are unavailable.
- Paludomyces** Letcher & M.J. Powell 2015, *Halomyc-*
etaceae, *Rhizophydiales*, *Rhizophydiomycetes*, *Chytrid-*
iomycota, one species, type: *P. mangrovei* (Ulken) Letcher
& M.J. Powell, marine, see Letcher et al. (2015a; taxon-
omy), cultures and sequences are available, ITS of the type:
NR_138404.
- Paranomyces** Letcher & M.J. Powell 2015, *Halomyc-*
etaceae, *Rhizophydiales*, *Rhizophydiomycetes*, *Chytrid-*
iomycota, one species, type: *P. uniporus* Letcher & M.J.
Powell, marine, South America, see Letcher et al. (2015a;
taxonomy), cultures and sequences are available, ITS of the
type: KP723828.
- Pateromyces** Letcher 2008, *Pateramycetaceae*, *Rhizophy-*
diales, *Rhizophydiomycetes*, *Chytridiomycota*, one species,
type: *P. corrientinensis* Letcher, South America, see
Letcher et al. (2008c; taxonomy), Powell et al. (2015;
phylogeny), cultures and sequences are available, ITS of
the type: NR_111261.
- Peltomyces** Léger 1909, *Nephridiophagaceae*, *Nephridi-*
ophagales, *Chytridiomycetes*, *Chytridiomycota*, one species,
type: *P. hyalinus* Léger, insect parasites, cultures and
sequences are unavailable.
- Pendulichytrium** K. Seto & Degawa 2017, *Chytriomyc-*
etaceae, *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*,
one species, type: *P. sphaericum* K. Seto & Degawa,
saprobes, Japan, see Seto and Degawa (2017; taxonomy),
cultures and sequences are available, ITS of the type:
LC223124.
- Perolpidium** Doweld 2014, *Chytridiomycetes* genera *in-*
certae sedis, *Chytridiomycota*, one species, type: *P. sac-*
catum (Sorokīn) Doweld, saprobes, see Doweld (2014m;
taxonomy), cultures and sequences are unavailable.

- 1901 **Phlyctochytrium** J. Schröt. 1892, *Phlyctochytriaceae*
 1902 *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*, c. 35
 1903 species, type: *P. hydrodictyi* (A. Braun) J. Schröt., sap-
 1904 robes, see Letcher et al. (2012a, b; DNA), Kirk et al. (2013;
 1905 genus accepted), cultures and sequences are available.
- 1906 **Phlyctorhiza** A.M. Hanson 1946, *Phlyctorhizaceae*,
 1907 *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*, one
 1908 species, type: *P. endogena* A.M. Hanson, saprobes, on
 1909 insect remains, USA, see Kirk et al. (2013; genus accep-
 1910 ted), cultures and sequences are available.
- 1911 **Physocladia** Sparrow 1932, *Chytriomycetaceae*, *Chytridi-*
 1912 *ales*, *Chytridiomycetes*, *Chytridiomycota*, one species,
 1913 type: *P. obscura* (Sparrow) Sparrow, saprobes, on insect
 1914 remains, USA, see Picard et al. (2009; phylogeny), Kirk
 1915 et al. (2013; genus accepted), cultures and sequences are
 1916 available.
- 1917 **Physorhizophidium** Scherff. 1926, *Chytridiomycetes* genera
 1918 *incertae sedis*, *Chytridiomycota*, one species, type: *P.*
 1919 *pachydermum* Scherff., on diatoms, USA, see Kirk et al.
 1920 (2013; genus accepted), cultures and sequences are
 1921 unavailable.
- 1922 **Plasmophagus** De Wild. 1895, *Chytridiomycetes* genera
 1923 *incertae sedis*, *Chytridiomycota*, one species, type: *P.*
 1924 *oedogoniorum* De Wild., in algae, Europe, see Kirk et al.
 1925 (2013; genus accepted), cultures and sequences are
 1926 unavailable.
- 1927 **Podochytrium** Pfitzer 1870, *Chytriomycetaceae*, *Chytridi-*
 1928 *ales*, *Chytridiomycetes*, *Chytridiomycota*, seven species,
 1929 type: *P. clavatum* Pfitzer, worldwide, see Kirk et al. (2013;
 1930 genus accepted), Blooi et al. (2013; growing media), cul-
 1931 tures and sequences are available.
- 1932 **Polychytrium** Ajello 1942, *Polychytriaceae*, *Polychytri-*
 1933 *ales*, *Polychytriomycetes*, *Chytridiomycota*, one species,
 1934 type: *P. aggregatum* Ajello, saprobes, USA, see Kirk et al.
 1935 (2013; genus accepted), cultures and sequences are avail-
 1936 able, ITS from reference material NR_119549 (*vide* James
 1937 et al. 2006).
- 1938 **Polyphagus** Nowak. 1877, *Polyphagaceae*, *Polyphagales*,
 1939 *Chytridiomycetes*, *Chytridiomycota*, ten species, type: *P.*
 1940 *euglenae* (Bail) Nowak., saprobes, worldwide, see Kirk
 1941 et al. (2013; genus accepted), Doweld (2014n; new spec-
 1942 ies), cultures and sequences are unavailable.
- 1943 **Polyphlyctis** Karling 1968, *Chytridiaceae*, *Chytridiales*,
 1944 *Chytridiomycetes*, *Chytridiomycota*, two species, type: *P.*
 1945 *unispina* (R.A. Paterson) Karling, saprobes, cosmopolitan,
 1946 see Vélez et al. (2011; DNA), Kirk et al. (2013; genus
 1947 accepted), cultures and sequences are available.
- 1948 **Powellomyces** Longcore, D.J.S. Barr & Désauln. 1995,
 1949 *Powellomycetaceae*, *Spizellomycetales*, *Spizellomycetes*,
 1950 *Chytridiomycota*, one species, type: *P. hirtus* Longcore,
 1951 D.J.S. Barr & Désauln., saprobes, Canada, see Simmons
 1952 (2011; DNA, phylogeny, proposed *Powellomycetaceae*),
 Kirk et al. (2013; genus accepted), cultures and sequences
 are available.
- Protrudomyces** Letcher 2008, *Protrudomycetaceae*, *Rhi-*
zophydiales, *Rhizophyidiomycetes*, *Chytridiomycota*, one
 species, type: *P. lateralis* (A. Braun) Letcher, saprobes,
 South America, see Letcher et al. (2008c; taxonomy),
 cultures and sequences are available, ITS of the type
 NR_119650.
- Pseudopileum** Canter 1963, *Chytridiomycetes* genera *in-*
certae sedis, *Chytridiomycota*, one species, type: *P. unum*
 Canter, saprobes, British Isles, see Kirk et al. (2013; genus
 accepted), cultures and sequences are unavailable.
- Pseudorhizidium** M.J. Powell, Letcher & Longcore 2013,
Pseudorhizidiaceae, *Chytridiales*, *Chytridiomycetes*,
Chytridiomycota, one species, type: *P. endosporangiatum*
 (Karling) M.J. Powell, Letcher & Longcore, saprobes,
 USA, see Powell et al. (2013; genus accepted), cultures and
 sequences are available, ITS of the type NR_111221.
- Rhizidiocystis** Sideris 1929, *Chytridiomycetes* genera *in-*
certae sedis, *Chytridiomycota*, one species, type: *R. ana-*
nasi Sideris, saprobes, Hawaii, see Kirk et al. (2013; genus
 accepted), cultures and sequences are unavailable.
- Rhizidium** A. Braun 1856, *Chytriomycetaceae*, *Chytridi-*
ales, *Chytridiomycetes*, *Chytridiomycota*, c. 20 species,
 type: *R. mycophilum* A. Braun, saprobes, cosmopolitan, see
 Picard et al. (2009; new species, DNA), Kirk et al. (2013;
 genus accepted), Doweld (2014h; sub-order *Rhizidiineae*),
 cultures and sequences are available.
- Rhizoclosmatium** H.E. Petersen 1903, *Chytriomycetaceae*,
Chytridiales, *Chytridiomycetes*, *Chytridiomycota*, species,
 type: *R. globosum* H.E. Petersen, saprobes, worldwide, see
 Kirk et al. (2013; genus accepted), Akinwole et al. (2014;
 fatty acids), cultures and sequences are available.
- Rhizophlyctis** A. Fisch. 1892, *Rhizophlyctidaceae*, *Rhi-*
zophlyctidiales, *Rhizophlyctidomycetes*, *Chytridiomycota*, c.
 ten species, type: *R. rosea* (de Bary & Woronin) A. Fisch.,
 saprobes, worldwide, see Marano et al. (2011; diversity),
 Kirk et al. (2013; genus accepted), cultures and sequences
 are available.
- Rhizophydium** Schenk ex Rabenh. 1868, *Rhizophydiales*,
Rhizophydiales, *Rhizophyidiomycetes*, *Chytridiomycota*, c.
 110 species, type: *R. globosum* (A. Braun) Rabenh., sap-
 robes, parasites, worldwide, see Lilje and Lilje (2008;
 colony physiology), Gerphagnon et al. (2013; occurrence),
 Kirk et al. (2013; genus accepted), Zhang et al. (2015;
 occurrence and molecular detection), Maier and Peterson
 (2016, specific qPCR detection & identification), Scholz
 et al. (2016; pathogen), Seto et al. (2017; phylogeny),
 Frenken et al. (2017; ecology), cultures and sequences are
 available.
- Rhizosiphon** Scherff. 1926, *Chytridiomycetes* genera *in-*
certae sedis, *Chytridiomycota*, three species, type: *R.*
crassum Scherff., parasitic, worldwide, see Kirk et al.

- 2006 (2013; genus accepted), Doweld (2014o; new species),
2007 cultures and sequences are unavailable.
- 2008 **Rhopalophlyctis** Karling 1945, *Chytridiomycetes* genera
2009 *incertae sedis*, *Chytridiomycota*, one species, type: *R.*
2010 *sarcoptoides* Karling, parasitic, America, see Kirk et al.
2011 (2013; genus accepted), cultures and sequences are
2012 unavailable.
- 2013 **Riethophlyctis** Doweld 2014, *Chytridiomycetes* genera *in-*
2014 *certae sedis*, *Chytridiomycota*, one species, type: *R. vau-*
2015 *cheriae* Doweld, Europe, see Doweld (2014p; taxonomy),
2016 cultures and sequences are unavailable.
- 2017 **Saccomyces** Serbinow 1907, *Chytridiomycetes* genera *in-*
2018 *certae sedis*, *Chytridiomycota*, two species, type: *S. dan-*
2019 *geardii* Serbinow, Europe, see Kirk et al. (2013; genus
2020 accepted), cultures and sequences are unavailable.
- 2021 **Saccopodium** Sorokĭn 1877, *Saccopodiaceae*, *Saccopodi-*
2022 *ales*, *Chytridiomycetes*, *Chytridiomycota*, one species,
2023 type: *S. gracile* Sorokĭn, Asia, see Kirk et al. (2013; genus
2024 accepted), cultures and sequences are unavailable.
- 2025 **Sagittospora** Lubinsky 1955, *Chytridiomycetes* genera *in-*
2026 *certae sedis*, *Chytridiomycota*, one species, type: *S.*
2027 *cameronii* Lubinsky, on *Eudiplodinium*, Asia, see Kirk
2028 et al. (2013; genus accepted), cultures and sequences are
2029 unavailable.
- 2030 **Scherffeliomyces** Sparrow 1934, *Scherffeliomycetaceae*,
2031 *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*, one
2032 species, type: *S. parasitans* (Sparrow) Sparrow, cos-
2033 mopolitan, see Kirk et al. (2013; genus accepted), cultures
2034 and sequences are unavailable.
- 2035 **Scherffeliomycopsis** Geitler 1962, *Chytridiomycetes* gen-
2036 *era incertae sedis*, *Chytridiomycota*, one species, type: *S.*
2037 *coleochaetes* Geitler, on algae, Europe, see Kirk et al.
2038 (2013; genus accepted), cultures and sequences are
2039 unavailable.
- 2040 **Schizolpidium** Doweld 2014, *Chytridiomycetes* genera *in-*
2041 *certae sedis*, *Chytridiomycota*, one species, type: *S. majus*
2042 (Ivimey Cook & W.B. Collins) Doweld, on cucumber, see
2043 Doweld et al. (2014q; taxonomy), cultures and sequences
2044 are unavailable.
- 2045 **Septochytrium** Berdan 1939, *Septochytriaceae*, *Cladochy-*
2046 *triales*, *Cladochytriomycetes*, *Chytridiomycota*, five spe-
2047 cies, type: *S. variabile* Berdan, on grass, USA, see Kirk
2048 et al. (2013; genus accepted), cultures and sequences are
2049 available.
- 2050 **Septolpidium** Sparrow 1933, *Chytridiomycetes* genera *in-*
2051 *certae sedis*, *Chytridiomycota*, one species, type: *S. lineare*
2052 Sparrow, in diatoms, Europe, see Kirk et al. (2013; genus
2053 accepted), cultures and sequences are available.
- 2054 **Septosperma** Whiffen ex R.L. Seym. 1971, *Chytrid-*
2055 *iomycetes* genera *incertae sedis*, *Chytridiomycota*, four
2056 species, type: *S. anomalum* (Couch) Whiffen ex R.L.
2057 Seym., on chytrids, Europe, see Kirk et al. (2013; genus
2058 accepted), cultures and sequences are unavailable.
- Siphonaria** H.E. Petersen 1903, *Chytriomycetaceae*, 2059
Chytridiales, *Chytridiomycetes*, *Chytridiomycota*, three 2060
species, type: *S. variabilis* H.E. Petersen, on chytrids, 2061
Europe, see Kirk et al. (2013; genus accepted), cultures and 2062
sequences are unavailable. 2063
- Solutoparies** Whiffen ex W.H. Blackw. & M.J. Powell 2064
1998, *Chytridiomycetes* genera *incertae sedis*, *Chytrid-* 2065
iomycota, four species, type: *S. pythii* Whiffen ex W.H. 2066
Blackw. & M.J. Powell, on chytrids, Europe, see Kirk et al. 2067
(2013; genus accepted), cultures and sequences are 2068
unavailable. 2069
- Sonoraphlyctis** Letcher 2008, *Sonoraphlyctidaceae*, *Rhi-* 2070
zophlyctidiales, *Rhizophlyctidomycetes*, *Chytridiomycota*, 2071
one species, type: *S. ranzonii* Letcher, saprobes, USA, see 2072
Letcher et al. (2008a; taxonomy), cultures and sequences 2073
are available, ITS of the type NG_042454. 2074
- Sorokinocystis** Doweld 2014, *Chytridiomycetes* genera 2075
incertae sedis, *Chytridiomycota*, one species, type: *S.* 2076
mirabilis (Sorokĭn) Doweld, saprobes, see Doweld et al. 2077
(2014r; taxonomy), cultures and sequences are unavailable. 2078
- Sparrowia** Willoughby 1963, *Sparrowiaceae*, *Chytrid-* 2079
iomycetes families *incertae sedis*, *Chytridiomycota*, four 2080
species, type: *S. parasitica* Willoughby, on fungi, Europe, 2081
see Kirk et al. (2013; genus accepted), cultures and 2082
sequences are unavailable. 2083
- Spizellomyces** D.J.S. Barr 1980, *Spizellomycetaceae*, 2084
Spizellomycetales, *Spizellomycetes*, *Chytridiomycota*, eight 2085
species, type: *S. punctatus* (W.J. Koch) D.J.S. Barr, sap- 2086
robes, worldwide, see Freeman et al. (2009; occurrence), 2087
Kirk et al. (2013; genus accepted), Russ et al. (2016; 2088
genome sequence), Ahrendt et al. (2017; biotechnology), 2089
Hérivieux et al. (2017; biotechnology), cultures and 2090
sequences are available, ITS of the type: NR_111189. 2091
- Sporophlyctidium** Sparrow 1933, *Chytridiomycetes* genera 2092
incertae sedis, *Chytridiomycota*, two species, type: *S.* 2093
africanum Sparrow, on algae, Morocco, see Kirk et al. 2094
(2013; genus accepted), cultures and sequences are 2095
unavailable. 2096
- Sporophlyctis** Serbinow 1900, *Chytridiomycetes* genera 2097
incertae sedis, *Chytridiomycota*, one species, type: *S. ros-* 2098
trata Serbinow, on algae, Asia, see Kirk et al. (2013; genus 2099
accepted), cultures and sequences are unavailable. 2100
- Staurastromyces** S. Van den Wyngaert, K. Seto & K. 2101
Rojas-Jimenez 2017, *Staurastromycetaceae*, *Rhizophydi-* 2102
ales, *Rhizophydiomycetes*, *Chytridiomycota*, one species, 2103
type: *S. oculus* S. Van den Wyngaert, K. Seto & K. Rojas- 2104
Jimenez, Germany, see Van den Wyngaert et al. (2017: 2105
taxonomy, phylogeny), sequences available, ITS of the 2106
type culture KY350146. 2107
- Synchytrium** de Bary & Woronin 1863 [1865], *Synchy-* 2108
triaceae, *Synchytriales*, *Synchytriomycetes*, *Chytridiomy-* 2109
cota, c. 100 species, type: *S. taraxaci* de Bary & Woronin, 2110
saprobes, Europe, see Ballvora et al. (2011; pathogenicity), 2111

- 2112 Yun et al. (2011; new report from Korea), Kirk et al. (2013; 2164
 2113 genus accepted), Smith et al. (2014; taxonomy and 2165
 2114 molecular detection), Obidiegwu et al. (2015; pathogenicity), 2166
 2115 Longcore et al. (2016; new species), cultures and 2167
 2116 sequences are available. 2168
- 2117 **Terramyces** Letcher 2006, *Terramycetaceae*, *Rhizophydiales*, 2169
 2118 *Chytridiomycetes*, *Rhizophyidiomycetes*, one species, 2170
 2119 type: *T. subangulosus* (A. Braun) Letcher, on diatoms, 2171
 2120 Europe, see Letcher et al. (2008b; phylogeny), Gleason 2172
 2121 et al. (2011; physiology), cultures and sequences are 2173
 2122 available, ITS of the type: NR_119592. 2174
- 2123 **Tetrachytrium** Sorokīn 1874, *Tetrachytriaceae*, *Chytridiomycetes* 2175
 2124 families incertae sedis, *Chytridiomycota*, one 2176
 2125 species, type: *T. triceps* Sorokīn, saprobes, Asia, see Kirk 2177
 2126 et al. (2013; genus accepted), cultures and sequences are 2178
 2127 unavailable. 2179
- 2128 **Thalassochytrium** Nyvall, M. Pedersén & Longcore 1999, 2180
 2129 *Thalassochytriaceae*, *Chytridiomycetes* families incertae 2181
 2130 sedis, *Chytridiomycota*, one species, type: *T. gracilariopsisidis* 2182
 2131 Nyvall, M. Pedersén & Longcore, saprobes, China, 2183
 2132 see Kirk et al. (2013; genus accepted), cultures and 2184
 2133 sequences are available. 2185
- 2134 **Thoreauomyces** D.R. Simmons & Longcore 2012, *Powellomycetaceae*, 2186
 2135 *Spizellomycetales*, *Spizellomycetes*, 2187
 2136 *Chytridiomycota*, one species, type: *T. humboldtii* D.R. 2188
 2137 Simmons & Longcore, in soil, USA, see Simmons and 2189
 2138 Longcore (2012; taxonomy), cultures and sequences are 2190
 2139 available. 2191
- 2140 **Trematophlyctis** Pat. 1918, *Chytridiomycetes* genera incertae 2192
 2141 sedis, *Chytridiomycota*, one species, type: *T. leptodesmiae* Pat., 2193
 2142 saprobes, Madagascar, see Simmons and 2194
 2143 Longcore (2012; taxonomy), cultures and sequences are 2195
 2144 unavailable. 2196
- 2145 **Tripartalcar** D.J.S. Barr 1980, *Spizellomycetaceae*, 2197
 2146 *Spizellomycetales*, *Spizellomycetes*, *Chytridiomycota*, one 2198
 2147 species, type: *T. arcticum* (D.J.S. Barr) D.J.S. Barr, cultures 2199
 2148 and sequences are available. 2200
- 2149 **Truittella** Karling 1949, *Chytridiomycetes* genera incertae 2201
 2150 sedis, *Chytridiomycota*, one species, type: *T. setifera* Karling, 2202
 2151 saprobes, USA, see Kirk et al. (2013; genus accepted), 2203
 2152 cultures and sequences are unavailable. 2204
- 2153 **Uebelmesseromyces** M.J. Powell & Letcher 2015, *Uebelmesseromycetaceae*, 2205
 2154 *Rhizophlyctidiales*, *Rhizophyidiomycetes*, *Chytridiomycota*, one 2206
 2155 species, type: *U. harderi* M.J. Powell & Letcher, saprobes, USA, see Kirk et al. 2207
 2156 (2013; genus accepted), cultures and sequences are 2208
 2157 unavailable. 2209
- 2158 **Ulkenomyces** Letcher & M.J. Powell 2015, *Halomycetaceae*, 2210
 2159 *Rhizophydiales*, *Rhizophyidiomycetes*, *Chytridiomycota*, one 2211
 2160 species, type: *U. aestuarii* (Ulken) Letcher 2212
 2161 & M.J. Powell, saprobes, USA, see Letcher et al. (2015a; 2213
 2162 taxonomy), cultures and sequences are available. 2214
- Urceomyces** Letcher 2008, *Globomycetaceae*, *Rhizophydiales*, *Rhizophyidiomycetes*, *Chytridiomycota*, one species, type: *U. sphaerocarpus* (Zopf) Letcher, saprobes, America, see Letcher et al. (2008c; taxonomy), cultures and sequences are available.
- Volvorax** Doweld 2013, *Chytridiomycetes* genera incertae sedis, *Chytridiomycota*, one species, type: *V. ingoldii* Doweld, saprobes, UK, see Doweld et al. (2013a, b, c, d; taxonomy), cultures and sequences are unavailable.
- Zygochytrium** Sorokīn 1874, *Chytridiomycetes* genera incertae sedis, *Chytridiomycota*, one species, type: *Z. aurantiacum* Sorokīn, saprobes, Asia, see Kirk et al. (2013; genus accepted), cultures and sequences are unavailable.
- Zygothlyctis** Doweld 2014, *Chytridiomycetes* genera incertae sedis, *Chytridiomycota*, one species, type: *Z. planktonica* Doweld, saprobes, Europe, see Doweld (2014s; taxonomy), cultures and sequences are unavailable.
- Zygorhizidium** Löwenthal 1904, *Zygorhizidiaceae*, *Chytridiales*, *Chytridiomycetes*, *Chytridiomycota*, c. ten species, type: *Z. willei* Löwentha, saprobes, cosmopolitan, see Gsell et al. (2013; pathogenicity), Kirk et al. (2013; genus accepted), Seto et al. (2017; DNA, phylogeny), cultures and sequences are available.
- Calcarisporiellomycota** Tedersoo, Koljalg, Bahram, Doring, Schigel, T. May, Sanchez-Ramirez, M. Ryberg & Abarenkov
 Hirose et al. (2012) showed that *Calcarisporiella* de Hoog has phylogenetic affinity within Mucoromycotina but distinct to *Endogonales*, *Mortierellales* and *Mucorales*. Tedersoo et al. (2016) confirmed the findings in Hirose et al. (2012) and established a new phylum, *Calcarisporiellomycota* to accommodate *Calcarisporiella* and *Echinochlamydosporium*.
 We accept one class, one order, one family and two genera in *Calcarisporiellomycota*.

Notes for genera

- Calcarisporiella** de Hoog 1974, *Calcarisporiellaceae*, *Calcarisporiellales*, *Calcarisporiellomycetes*, *Calcarisporiellomycota*, one species, type: *C. thermophilum* H.C. Evans, hyphomycetous, isolate obtained from coal spoil tip soil, Europe, see Seifert et al. (2011; morphology), Hirose et al. (2012; DNA), Morgenstern et al. (2012; phylogeny), Kirk et al. (2013; genus accepted), Benny et al. (2016b; classification), cultures and sequences are available.
- Echinochlamydosporium** X.Z. Jiang, H.Y. Yu, M.C. Xiang, X.Y. Liu & Xing Z. Liu 2011, *Calcarisporiellaceae*, *Calcarisporiellales*, *Calcarisporiellomycetes*, *Calcarisporiellomycota*, one species, type: *E. variabile* X.Z. Jiang, H.Y. Yu, M.C. Xiang, X.Y. Liu & Xing Z. Liu, from nematodes, Liaoning (China), see Jiang et al. (2011;

2215 taxonomy), Benny et al. (2016b; classification), cultures
2216 and sequences are unavailable.

2217 *Entomophthoromycota* Humber

2218 Introduction

2219 Humber (2012) introduced the phylum *Entomoph-*
2220 *thoromycota* to accommodate subphylum Entomoph-
2221 *thoromycotina* Humber which was introduced by Hibbett
2222 et al. (2007). The phylum comprises obligate parasites of
2223 animals which are distributed worldwide. Spatafora et al.
2224 (2016) did not accept Humber (2012) and proposed to
2225 maintain the subphylum *Entomophthoromycotina* under
2226 *Zoopagomycota*.

2227 We accept *Entomophthoromycota* as a distinct phylum
2228 which comprises two classes, two orders, five families and
2229 21 genera.

2230 Notes for genera

2231 *Ancylistes* Pfitzer 1872, *Ancylistaceae*, *Entomophthorales*,
2232 *Entomophthoromycetes*, *Entomophthoromycota*, five spe-
2233 cies, type: *A. closterii* Pfitzer, pathogens of desmid algae,
2234 cosmopolitan, see Humber (2012; classification), Kirk et al.
2235 (2013; genus accepted), Gryganskyi et al. (2013a; notes),
2236 cultures and sequences are unavailable.

2237 *Apterivorax* S. Keller 2005, *Neozygitaceae*, *Neozygiales*,
2238 *Neozygitomycetes*, *Entomophthoromycota*, two species,
2239 type: *A. sminthuri* (S. Keller & Steenb.) S. Keller, patho-
2240 gens, worldwide, see Humber (2012; classification), Gry-
2241 ganskyi et al. (2013a; notes), cultures and sequences are
2242 unavailable.

2243 *Batkoa* Humber 1989, *Entomophthoraceae*, *Entomophtho-*
2244 *rales*, *Entomophthoromycetes*, *Entomophthoromycota*, ten
2245 species, type: *B. apiculata* (Thaxt.) Humber, pathogens of
2246 insects, cosmopolitan, see Rocha et al. (2009; Brazil), Hum-
2247 ber (2012; classification), Hoffmann et al. (2013; phylogeny),
2248 Kirk et al. (2013; genus accepted), Gryganskyi et al. (2013a;
2249 notes), cultures and sequences are unavailable.

2250 *Completozia* Lohde 1874, *Completoziaceae*, *Entomoph-*
2251 *thorales*, *Entomophthoromycetes*, *Entomophthoromycota*,
2252 one species, type: *C. complens* Lohde, on pteridophyta,
2253 worldwide, see Humber (2012, 2016; classification),
2254 Hoffmann et al. (2013; phylogeny), Kirk et al. (2013; genus
2255 accepted), Gryganskyi et al. (2013a; notes), cultures and
2256 sequences are unavailable.

2257 *Conidiobolus* Bref. 1884, *Ancylistaceae*, *Entomophtho-*
2258 *rales*, *Entomophthoromycetes*, *Entomophthoromycota*, c.
2259 40 species, type: *C. utriculosus* Bref., pathogens or sap-
2260 robes, worldwide, see Shankar et al. (2010; recovering
2261 silver from X ray film), Vilela et al. (2010; infection on
2262 sheep), Wüppenhorst et al. (2010; human pathogen),
2263 Kimura et al. (2011), Subramanian and Sobel (2011;
2264 human conidiobolomycosis), Humber (2012; classifica-
2265 tion), Nie et al. (2012; new species), Hoffmann et al. (2013;

notes), Kirk et al. (2013; genus accepted), Gryganskyi et al.
(2013a; notes), Mackey et al. (2015; dog pathogens), John
et al. (2016; human pathogen), Yong et al. (2016; new
species), cultures and sequences are available, *C. incon-*
gruus CDC-B7586 (Chibucos et al. 2016) available at
NCBI, *C. coronatus* NRRL 28638 [25977457] available at
NCBI.

Entomophaga A. Batko 1964, *Entomophthoraceae*, *Ento-*
mophthorales, *Entomophthoromycetes*, *Entomoph-*
thoromycota, c. 17 species, type: *E. grylli* (Fresen.) A.
Batko, on insects, saprobes, cosmopolitan, see Kereselidze
et al. (2011; Georgia), Tabaković-Tošić et al. (2012; Ser-
bia), Gryganskyi et al. (2013a; phylogeny), Kirk et al.
(2013; genus accepted), cultures and sequences are
available.

Entomophthora Fresen. 1856, *Entomophthoraceae*, *Ento-*
mophthorales, *Entomophthoromycetes*, *Entomoph-*
thoromycota, c. 30 species, type: *E. muscae* (Cohn)
Fresen., on insects, saprobes, cosmopolitan, see Jensen
et al. (2009; differential divergence), Lihme et al. (2009;
epidemics), Gryganskyi et al. (2013a, b; phylogeny, species
complex), Kirk et al. (2013; genus accepted), Mendoza
et al. (2015; human pathogens), cultures and sequences are
available, genome available: *Entomophthora muscae*
[27717247] at NCBI.

Erynia (Nowak. ex A. Batko) Remaud. & Hennebert 1980,
Entomophthoraceae, *Entomophthorales*, *Entomoph-*
thoromycetes, *Entomophthoromycota*, c. 20 species, type:
E. ovispora (Nowak.) Remaud. & Hennebert, on insects,
cosmopolitan, see Gryganskyi et al. (2012, 2013a; phy-
logeny), Hoffman et al. (2013; notes), Kirk et al. (2013;
genus accepted), cultures and sequences are available.

Eryniopsis Humber 1984, *Entomophthoraceae*, *Ento-*
mophthorales, *Entomophthoromycetes*, *Entomoph-*
thoromycota, five species, type: *E. lampyridarum* (Thaxt.)
Humber, on insects, cosmopolitan, see Gryganskyi et al.
(2013a; phylogeny), Hoffman et al. (2013; notes), Kirk
et al. (2013; genus accepted), Steinkraus et al. (2017; insect
pathogens), cultures and sequences are available.

Furia (A. Batko) Humber 1989, *Entomophthoraceae*, *Ento-*
mophthorales, *Entomophthoromycetes*, *Entomoph-*
thoromycota, c. 18 species, type: *F. virescens* (Thaxt.)
Humber, on insects, cosmopolitan, see Tkaczyk et al.
(2011; Poland, Austria), Humber (2012; classification),
Gryganskyi et al. (2013a; phylogeny), Kirk et al. (2013;
genus accepted), cultures and sequences are available.

Macrobotophthora Reukauf 1912, *Ancylistaceae*, *Ento-*
mophthorales, *Entomophthoromycetes*, *Entomoph-*
thoromycota, two species, type: *M. vimariensis* Reukauf, in
soil, pathogens of nematodes, Europe, see Humber (2012;
classification), Kirk et al. (2013; genus accepted), Gry-
ganskyi et al. (2013a; notes phylogeny), Hussain et al.
(2014; mycoinsecticide), a sequence is available.

- 2319 **Massospora** Peck 1878, *Entomophthoraceae*, *Entomophthorales*, *Entomophthoromycetes*, *Entomophthoromycota*, c. 14 species, type: *M. cicadina* Peck, on insects, cosmopolitan, see Humber (2012; classification), Gryganskyi et al. (2013a, 2017; phylogeny, insect pathogens), Hoffman et al. (2013; notes), Kirk et al. (2013; genus accepted), Cooley et al. (2018; host sexual signal hijack), cultures and sequences are available.
- 2327 **Meristacrum** Drechsler 1940, *Meristacraceae*, *Entomophthorales*, *Entomophthoromycetes*, *Entomophthoromycota*, c. 15 species, type: *M. asterospermum* Drechsler, on nematodes, cosmopolitan, see Humber (2012; classification), Gryganskyi et al. (2013a; classification), Hoffman et al. (2013; notes), Kirk et al. (2013; genus accepted), cultures and sequences are unavailable.
- 2334 **Neozygites** Witlaczil 1885, *Neozygitaceae*, *Neozygiales*, *Neozygitomycetes*, *Entomophthoromycota*, 24 species, type: *N. fresenii* (Nowak.) Remaud. & S. Keller, insects, mites and springtails pathogens, worldwide, see Simelane et al. (2008; host control), Agboton et al. (2011, 2013; phylogeny, interaction with predatory mite *Typhlodromalus aripo*), Gryganskyi et al. (2013a; DNA), Kirk et al. (2013; genus accepted), Zhou et al. (2017; new species), cultures and sequences are available.
- 2343 **Orthomyces** Steinkr., Humber & J.B. Oliv. 1998, *Entomophthoraceae*, *Entomophthorales*, *Entomophthoromycetes*, *Entomophthoromycota*, one species, type: *O. aleyrodis* Steinkr., Humber & J.B. Oliv., in insects, USA, see Humber (2012, 2016; classification), Gryganskyi et al. (2013a; phylogeny, insect pathogens), Kirk et al. (2013; genus accepted), cultures and sequences are unavailable.
- 2350 **Strongwellsea** A. Batko & J. Weiser 1965, *Entomophthoraceae*, *Entomophthorales*, *Entomophthoromycetes*, *Entomophthoromycota*, three species, type: *S. castrans* A. Batko & J. Weiser, in insects, USA, see Humber (2012; classification), Gryganskyi et al. (2013a; phylogeny, insect pathogens), Kirk et al. (2013; genus accepted), cultures and a sequence are available.
- 2357 **Tabanomyces** Couch, R.V. Andrejeva, Laird & Nolan 1979, *Meristacraceae*, *Entomophthorales*, *Entomophthoromycetes*, *Entomophthoromycota*, c. 15 species, type: *T. milkoi* (Dudka & Koval) Couch, R.V. Andrejeva, Laird & Nolan, from larva of horse flies, Ukraine, see Humber (2012; classification), cultures and sequences are unavailable.
- 2364 **Tarichium** Cohn 1875, *Entomophthoraceae* or *Neozygitaceae*, *Entomophthorales*, *Entomophthoromycetes*, *Entomophthoromycota*, c. 26 species, type: *T. megaspermum* Cohn, in insects, USA, see Keller et al. (2009; new species), Humber (2012; classification, attributable in part to *Entomophthoraceae* with some mite-pathogenic species probably better classified in *Neozygites*), Gryganskyi et al. (2013a; phylogeny, insect pathogens), Kirk et al. (2013; genus accepted), Hajek et al. (2016; two species known only from resting spores but placed genomically in *Zoophthora*), some cultures and sequences are available.
- 2375 **Thaxterosporium** Ben Ze'ev & R.G. Kenneth 1987, *Neozygitaceae*, *Neozygiales*, *Neozygitomycetes*, *Entomophthoromycota*, one species, type: *T. turbinatum* (R.G. Kenneth) R.G. Kenneth & Ben Ze'ev, insect pathogens, worldwide, see Humber et al. (2012; classification), Gryganskyi et al. (2013a; DNA), Kirk et al. (2013; genus accepted), cultures and sequences are unavailable, current name of the type: *Neozygites turbinata* (R.G. Kenneth) Remaud. & S. Keller *vide* Species Fungorum (2018).
- 2384 **Zoophthora** A. Batko 1964, *Entomophthoraceae*, *Entomophthorales*, *Entomophthoromycetes*, *Entomophthoromycota*, 36 species, type: *Z. radicans* (Bref.) A. Batko, in insects, worldwide, see Guzmán-Franco et al. (2008; PCR primers), Xu et al. (2009; EST analysis), Batta et al. (2011; application), Humber (2012; classification), Mascarin et al. (2012; on *Thaumastocoris peregrines*), Gryganskyi et al. (2013a; phylogeny, insect pathogens), Kirk et al. (2013; genus accepted), Hajek et al. (2016; new species), a sequence is available.
- Glomeromycota** C. Walker & A. Schüßler
Introduction
Schüßler et al. (2001) introduced the phylum *Glomeromycota* to accommodate arbuscular mycorrhizal fungi. Subsequent studies by Hibbett et al. (2007), Kirk et al. (2008), Oehl et al. (2011d, e, g) and Redecker et al. (2013) accepted this phylum. However, Spatafora et al. (2016) introduced subphylum *Glomeromycotina* Spatafora & Stajich (demoted the phylum to subphylum) and accepted under phylum *Mucoromycota*.
We accept *Glomeromycota* (as a distinct phylum) with three classes, four orders, twelve families and 33 genera.
- Notes for genera**
Acaulospora Gerd. & Trappe 1974 (= *Kuklospora* p. p. Oehl & Sieverd. 2006), *Acaulosporaceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, c. 54 species, type: *A. laevis* Gerd. & Trappe, arbuscular mycorrhizal, terrestrial, worldwide, see Kaonongbua et al. (2010; new species), Krüger et al. (2011, 2012; new species, phylogeny), Vaingankar and Rodrigues (2011; new species), Oehl et al. (2011a, b, 2012b, c, 2014; new species, phylogeny), Furrázola et al. (2013; new species), Goto et al. (2013; new species), Redecker et al. (2013; notes, phylogeny), Błaszowski et al. (2015a; new species), Palenzuela et al. (2013a, 2014, 2015; new species), Pereira et al. (2016a, b; new species), de Souza et al. (2017; new species), Crossay et al. (2018; new species), cultures and sequences are available.

- 2422 **Ambispora** C. Walker, Vestberg & A. Schüßler 2007
 2423 (= *Appendicispora* Spain, Oehl & Sieverding
 2424 2006; = *Paracaulospora* S.P. Gautam & U.S. Patel
 2425 2007; = *Pseudoglomerus* S.P. Gautam & U.S. Patel 2007),
 2426 *Ambisporaceae*, *Archaeosporales*, *Archaeosporomycetes*,
 2427 *Glomeromycota*, c. 3-10 species depending on taxonomic
 2428 opinion, type: *A. fennica* C. Walker, Vestberg & A.
 2429 Schüßler, arbuscular mycorrhizal, terrestrial, worldwide,
 2430 see Goto et al. (2008; new species), Walker (2008; resur-
 2431 rected the family, new species), Palenzuela et al. (2011;
 2432 new species), Krüger et al. (2012; phylogeny), Oehl et al.
 2433 (2012a; new species), Redecker et al. (2013; notes, phy-
 2434 logeny), Bills and Morton (2015; accepted only three
 2435 species viz.: *A. leptoticha*, *A. gerdemanni* and
 2436 *A. granatensis*, phylogeny), cultures and sequences are
 2437 available.
- 2438 **Archaeospora** J.B. Morton & D. Redecker 2001 (= *In-
 2439 traspora* p. p. Oehl & Sieverd. 2006), *Archaeosporaceae*,
 2440 *Archaeosporales*, *Archaeosporomycetes*, *Glomeromycota*,
 2441 c. three species, type: *A. trappei* (R.N. Ames & Linderman)
 2442 J.B. Morton & D. Redecker, arbuscular mycorrhizal, ter-
 2443 restrial, worldwide, see Schüßler and Walker (2010; new
 2444 combination), Oehl et al. (2011d; new combinations),
 2445 cultures and sequences are available.
- 2446 **Bulbospora** Oehl & G.A. Silva 2014, *Gigasporaceae*,
 2447 *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, one
 2448 species, type: *B. minima* Oehl, Marinho, B.T. Goto & G.A.
 2449 Silva, mycorrhizal status unknown, terrestrial, Brazil, see
 2450 Marinho et al. (2014; taxonomy, described from field col-
 2451 lected spores), cultures are unavailable and sequences from
 2452 multi-species soil trap cultures available.
- 2453 **Cetraspora** Oehl, F. A. Souza & Sieverd. 2009, *Gigaspo-
 2454 raceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromy-
 2455 cota*, c. four species, type: *C. gilmorei* (Trappe & Gerd.)
 2456 Oehl, F.A. Souza & Sieverd, arbuscular mycorrhizal, ter-
 2457 restrial, North and South America, Azores, Europe, see
 2458 Schüßler and Walker (2010; taxonomy), Oehl et al. (2011f;
 2459 new species), Redecker et al. (2013; accepted three spe-
 2460 cies), Lima et al. (2014; new species), cultures and
 2461 sequences are available.
- 2462 **Claroideoglomerus** C. Walker & A. Schüßler 2010 (= *Al-
 2463 bahypha* p. p. Oehl, G.A. Silva, B.T. Goto & Sieverd.
 2464 2011), *Claroideoglomeraceae*, *Glomerales*, *Glom-
 2465 eromycetes*, *Glomeromycota*, eight species, type: *C. clar-
 2466 oideum* (N.C. Schenck & G.S. Sm.) C. Walker & A.
 2467 Schüßler, arbuscular mycorrhizal, terrestrial, worldwide,
 2468 see Schüßler and Walker (2010; taxonomy), Krüger et al.
 2469 (2012; phylogeny), Redecker et al. (2013; phylogeny),
 2470 cultures and sequences are available.
- 2471 **Corymbiglomerus** Błaszk. & Chwat 2012, *Diversisporaceae*,
 2472 *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, four
 2473 species, type: *C. corymbiforme* Błaszk. & Chwat, arbus-
 2474 cular mycorrhizal, terrestrial, Europe and North and South
 America, see Błaszkowski (2012; taxonomy), Redecker
 et al. (2013; notes), Medina et al. (2014; new species),
 cultures and sequences are available.
- Dentiscutata** Sieverd., F.A. Souza & Oehl (2009) [2008],
Gigasporaceae, *Diversisporales*, *Glomeromycetes*, *Glom-
 eromycota*, c. five species, type: *D. nigra* (J.F. Redhead)
 Sieverd., F.A. Souza & Oehl, arbuscular mycorrhizal, ter-
 restrial, worldwide, see Oehl et al. (2008; taxonomy),
 Redecker et al. (2013; epitype, rejection of *Fuscutata* and
Quatunica and their combination with *Dentiscutata*), cul-
 tures and sequences are available, but not for type species.
- Desertispora** Błaszk., Kozłowska, Ryszka, Al-Yahya'ei &
 Symanczik 2018, *Diversisporaceae*, *Diversisporales*,
Glomeromycetes, *Glomeromycota*, one species, type: *D.
 omaniana* (Symanczik, Błaszk. & Al-Yahya'ei) Symanc-
 zik, Błaszk., Kozłowska & Al-Yahya'ei, arbuscular myc-
 orrhizal, terrestrial, Oman, see Symanczik et al. (2018;
 taxonomy), cultures and sequences are available.
- Diversispora** C. Walker & A. Schüßler 2004, *Diversispo-
 raceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromy-
 cota*, 17 species, type: *D. spurca* (C.M. Pfeiff., C. Walker
 & Bloss) C. Walker & A. Schüßler, arbuscular mycor-
 rhizal, terrestrial, worldwide, see Gamper et al. (2009; new
 species), Schüßler and Walker (2010; new combinations),
 Estrada et al. (2011; new species), Oehl et al. (2011c; new
 combinations), Schüßler et al. (2011, b; relationships),
 Symanczik et al. (2014; new species), Błaszkowski et al.
 (2015e; new species), Balázs et al. (2015; new species),
 cultures and sequences are available.
- Dominikia** Błaszk., Chwat & Kovács 2015, *Glomeraceae*,
Glomerales, *Glomeromycetes*, *Glomeromycota*, c. 13 spe-
 cies, type: *D. minuta* (Błaszk., Tadych & Madej) Błaszk.,
 Chwat & Kovács, arbuscular mycorrhizal, terrestrial,
 worldwide, see Błaszkowski et al. (2015c, d, 2016; tax-
 onomy, phylogeny), Oehl et al. (2015a; new species),
 cultures and sequences are available.
- Entrophospora** R.N. Ames & R.W. Schneid. 1979,
Glomeromycetes genera *incertae sedis*, *Glomeromycota*,
 three species, type: *E. infrequens* (I.R. Hall) R.N. Ames &
 R.W. Schneid., arbuscular mycorrhizal, terrestrial, world-
 wide, see Oehl et al. (2011g; notes, phylogeny), Redecker
 et al. (2013; notes about unclear phylogenetic position),
 cultures and sequences are available, but sequence data and
 phylogenetic placement conflicting.
- Funneliformis** C. Walker & A. Schüßler 2010, *Glomer-
 aceae*, *Glomerales*, *Glomeromycetes*, *Glomeromycota*, c.
 12 species, type: *F. mosseae* (T.H. Nicolson & Gerd.) C.
 Walker & A. Schüßler, arbuscular mycorrhizal, terrestrial,
 worldwide, see Schüßler and Walker (2010; taxonomy),
 Oehl et al. (2011c; new combinations), Krüger et al. (2012;
 phylogeny), Redecker et al. (2013; phylogeny), cultures
 and sequences are available.

- 2527 **Geosiphon** F. Wettst. 1915 (= *Geosiphonomyces* Cif. & 2528 Tomas. 1957), *Geosiphonaceae*, *Archaeosporales*, *Glomeromycetes*, *Glomeromycota*, one species, type: *G. pyriformis* (Kütz.) F. Wettst., symbiosis with *Nostoc*, 2529 terrestrial, central Europe, see Krüger et al. (2012; phy- 2530 logeny), Ellerbeck et al. (2013; ammonium transporters), 2531 cultures and sequences are available. 2532
- 2533 **Gigaspora** Gerd. & Trappe 1974, *Gigasporaceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, seven species, type: *G. gigantea* (T.H. Nicolson & Gerd.) Gerd. & 2534 Trappe, arbuscular mycorrhizal, terrestrial, worldwide, see 2535 Kirk et al. (2013; genus), cultures and sequences are 2536 available, but not for type species. 2537
- 2538 **Glomus** Tul. & C. Tul. 1844 (= *Endogone* p. p. Link 2539 1809; =*Parapseudoglomus* p. p. S.P. Gautam & U.S. Patel, 2540 2007; = *Paurocotylis* p. p. Berk. & Broome 1855; = *Sclerocystis* p. p. Berk. & Broome 1873; = *Simigliomus* p. p. Sieverd. 2541 2011; = *Sphaeroceas* p. p. Sacc. & Ellis 1882), *Glomeraceae*, *Glomerales*, *Glomeromycetes*, *Glomeromycota*, c. 60 2542 species (most are *Glomus sensu lato* and may belong in other 2543 genera), type: *G. macrocarpum* Tul. & C. Tul., arbuscular 2544 mycorrhizal, terrestrial, worldwide, see Khade (2009; new 2545 species), Baszkowski (2010; new species), Baszkowski et al. 2546 (2010; new species), Furrzola et al. (2011; new species), 2547 Goto et al. (2012a; new species), Cai et al. (2013; new species), 2548 Baszkowski et al. (2015b; new species), cultures and 2549 sequences are available. 2550
- 2551 **Innospora** Błaszk., Kovács, Chwat & Kozłowska 2017, 2552 *Paraglomeraceae*, *Paraglomerales*, *Paraglomeromycetes*, 2553 *Glomeromycota*, one species, type: *I. majewskii* (Błaszk. & 2554 Kovács) Błaszk., Kovács, Chwat & Kozłowska, arbuscular 2555 mycorrhizal, terrestrial, worldwide, see Błaszkowski et al. 2556 (2017; taxonomy, transfer of *Paraglomus majewskii* to 2557 *Innospora*), cultures and sequences are available. 2558
- 2559 **Intraornatospora** B.T. Goto, Oehl & G.A. Silva 2012a, 2560 *Gigasporaceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, one species, type: *I. intraornata* (B.T. Goto & 2561 Oehl) B.T. Goto, Oehl & G.A. Silva, arbuscular mycorrhizal, 2562 terrestrial, Brazil, see Goto et al. (2012b; taxonomy), Redecker et al. (2013; phylogeny, discussed the 2563 genus as “orphan taxon”), multi-species cultures availability 2564 unknown and sequences from multi-species cultures are 2565 available. 2566
- 2567 **Kamienskia** Błaszk., Chwat & Kovács 2015, *Glomeraceae*, 2568 *Glomerales*, *Glomeromycetes*, *Glomeromycota*, three species, type: *K. bistrata* (Błaszk., D. Redecker, Koegel, 2569 Symanczik, Oehl & Kovács) Błaszk., Chwat & Kovács, 2570 arbuscular mycorrhizal, terrestrial, worldwide, see 2571 Błaszkowski et al. (2015c, 2016; taxonomy, phylogeny, 2572 new species), cultures and sequences are available. 2573
- 2574 **Oehlia** Błaszk., Kozłowska, Niezgodna, B.T.Goto & Dalpé 2575 2018, *Glomeraceae*, *Glomerales*, *Glomeromycetes*, *Glomeromycota*, one species, type species: *O. diaphana* (J.B. 2576 Morton & C. Walker) Błaszk., Kozłowska & Dalpé, 2577 arbuscular mycorrhizal, terrestrial, worldwide, see 2578 Błaszkowski et al. (2018; taxonomy, phylogeny), cultures 2579 and sequences are available.
- Otospora** Oehl, Palenz. & N. Ferrol 2008, *Diversisporaceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, one species, type: *O. bareae* Palenz., N. Ferrol & Oehl, arbuscular mycorrhizal, terrestrial, known from Spain, see Palenzuela et al. (2008; taxonomy), Oehl et al. (2011g; notes), Redecker et al. (2013; phylogeny, mentioning genus as questionable), cultures are unavailable, sequences available are from multi-species soil trap cultures.
- Pacispora** Sieverd. & Oehl 2004, *Pacisporaceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, seven species, type: *P. scintillans* (S.L. Rose & Trappe) Sieverd. & Oehl ex C. Walker, Vestberg & A. Schüßler, arbuscular mycorrhizal, terrestrial, known from Europe, North and South America, Asia, see Krüger et al. (2012; phylogeny), Redecker et al. (2013; notes, phylogeny), cultures are unavailable and sequences available.
- Palaeospora** Oehl, Palenz., Sánchez-Castro & G.A. Silva 2015, *Archaeosporaceae*, *Archaeosporales*, *Archaeosporomycetes*, *Glomeromycota*, one species, type: *P. spainiae* Oehl, Palenz., Sánchez-Castro & G.A. Silva, arbuscular mycorrhizal, terrestrial, known from Switzerland, see Oehl et al. (2015b; taxonomy, phylogeny), cultures and sequences are available.
- Paradentiscutata** B.T. Goto, Oehl & G.A. Silva 2012, *Gigasporaceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromycota*, two species, type: *P. bahiana* Oehl, Magna, B.T. Goto & G.A. Silva, arbuscular mycorrhizal, terrestrial, known from Brazil, see Goto et al. (2012b; taxonomy), Redecker et al. (2013; phylogeny, suggested as designated from inadequate data and described as “orphan taxon”), multi-species cultures and sequences from multi-species cultures are available.
- Paraglomus** J.B. Morton & D. Redecker 2001, *Paraglomeraceae*, *Paraglomerales*, *Paraglomeromycetes*, *Glomeromycota*, c. eight species, type: *P. occultum* (C. Walker) J.B. Morton & D. Redecker, arbuscular mycorrhizal, terrestrial, worldwide, see Oehl et al. (2011c, 2016; new combinations, new species), Krüger et al. (2012; phylogeny), de Mello et al. (2013; new species), Redecker et al. (2013; notes, phylogeny), cultures and sequences are available.
- Pervetustus** Błaszk., Chwat, Kozłowska, Symanczik & Al-Yahya’ei 2017, *Pervetustaceae*, *Paraglomerales*, *Paraglomeromycetes*, *Glomeromycota*, one species, type: *P. simplex* Błaszk., Chwat, Kozłowska, Crossay, Symanczik & Al-Yahya’ei, arbuscular mycorrhizal, terrestrial, known from Europe, Northern Africa, New Caledonia, Oman, see

- 2632 Błaszowski et al. (2017; taxonomy), cultures and
2633 sequences are available.
- 2634 **Racocetra** Oehl, F.A. Souza & Sieverd. 2009 [2008], *Gi-*
2635 *gasporaceae*, *Diversisporales*, *Glomeromycetes*, *Glom-*
2636 *eromycota*, c. 13 species, type: *R. coralloidea* (Trappe,
2637 Gerd. & I. Ho) Oehl, F.A. Souza & Sieverd., arbuscular
2638 mycorrhizal, terrestrial, known from Africa, North and
2639 South America, Asia, see Oehl et al. (2008; taxonomy),
2640 Morton and Msiska (2010; recognised the genus, Redecker
2641 et al. (2013; accepted three species viz. *R. tropicana*, *R.*
2642 *undulata* and *R. beninensis*, and, with reservation, accepted
2643 *Racocetra* as a genus), cultures and sequences are
2644 available.
- 2645 **Redeckera** C. Walker & A. Schüßler 2010, *Diversispor-*
2646 *raceae*, *Diversisporales*, *Glomeromycetes*, *Glomeromy-*
2647 *cota*, three species, type: *R. megalocarpum* (D. Redecker)
2648 C. Walker & A. Schüßler, arbuscular mycorrhizal, terres-
2649 trial, worldwide, see Schüßler and Walker (2010; taxon-
2650 omy), Krüger et al. (2012; phylogeny), Redecker et al.
2651 (2013; relationship to other genera), cultures are unavail-
2652 able and sequences available.
- 2653 **Rhizophagus** P.A. Dang. 1896 (= *Endogone* p. p. Link.
2654 1809; = *Rhizoglossum* p. p. Sieverd., G.A. Silva & Oehl
2655 2015; = *Stigeosporium* C. West 1916), *Glomeraceae*,
2656 *Glomerales*, *Glomeromycetes*, *Glomeromycota*, c. 19 spe-
2657 cies, type: *R. populinus* P.A. Dang., arbuscular mycor-
2658 rhizal, terrestrial, worldwide, see Schüßler and Walker
2659 (2010; new combinations), Redecker et al. (2013; new
2660 combination), Symanczik et al. (2014; new species),
2661 Walker et al. (2017; nomenclature, designate neotype),
2662 Crossay et al. (2018; new species), cultures and sequences
2663 are available.
- 2664 **Sacculospora** Oehl, Sieverd., G.A. Silva, B.T. Goto, I.C.
2665 Sánchez & Palenz. 2011, *Sacculosporaceae*, *Diversispor-*
2666 *ales*, *Glomeromycetes*, *Glomeromycota*, two species, type:
2667 *S. baltica* (Błasz., Madej & Tadych) Oehl, Palenz., I.C.
2668 Sánchez, B.T. Goto, G.A. Silva & Sieverd., arbuscular
2669 mycorrhizal, terrestrial, known from Europe, India, North
2670 and South America, see Redecker et al. (2013; retained
2671 genus, but phylogenetic position is unclear), Willis et al.
2672 (2016; new species), culture availability unknown,
2673 sequences are available.
- 2674 **Sclerocystis** Berk. & Broome 1873 [1875] (= *Ackermannia*
2675 Pat. 1902; = *Xenomyces* Ces. 1879) *Glomeraceae*, *Glom-*
2676 *erales*, *Glomeromycetes*, *Glomeromycota*, c. 5 species,
2677 type: *S. coremioides* Berk. & Broome, arbuscular mycor-
2678 rhizal, terrestrial, worldwide, see Kirk et al. (2013; genus
2679 accepted), cultures and sequences are available.
- 2680 **Scutellospora** C. Walker & F.E. Sanders 1986 (= *Fuscu-*
2681 *tata* p. p. Oehl, F.A. Souza & Sieverd. 2009; = *Orbispora*
2682 p. p. Oehl, G.A. Silva & D.K. Silva 2011; = *Parascutel-*
2683 *lospora* Nom. inval. S.P. Gautam & U.S. Patel
2684 2007; = *Quatunica* p. p. F.A. Souza, Sieverd. & Oehl
2009), *Gigasporaceae*, *Diversisporales*, *Glomeromycetes*,
2685 *Glomeromycota*, c. 33 species, type: *S. calospora* (T.H.
2686 Nicolson & Gerd.) C. Walker & F.E. Sanders, arbuscular
2687 mycorrhizal, terrestrial, worldwide, see Krüger et al. (2012;
2688 phylogeny), Pontes et al. (2013; new species), Redecker
2689 et al. (2013; notes, phylogeny), De Andrade et al. (2017;
2690 new species), Crossay et al. (2018; new species), cultures
2691 and sequences are available.
- 2692 **Septoglossum** Sieverd., G.A. Silva & Oehl 2011 (= *Vis-*
2693 *cospora* p. p. (T.H. Nicolson) Sieverd., Oehl & G.A. Silva
2694 2011), *Glomeraceae*, *Glomerales*, *Glomeromycetes*,
2695 *Glomeromycota*, c. ten species, type: *S. constrictum*
2696 (Trappe) Sieverd., G.A. Silva & Oehl, arbuscular mycor-
2697 rhizal, terrestrial, worldwide, see Krüger et al. (2012;
2698 phylogeny), Błaszowski et al. (2013, 2014; new species,
2699 phylogeny), Palenzuela et al. (2013a, b; new species),
2700 Redecker et al. (2013; phylogeny, genus accepted), cultures
2701 and sequences are available.
- 2702 **Tricispora** Oehl, Sieverd., G.A. Silva & Palenz. 2011,
2703 *Diversisporaceae*, *Diversisporales*, *Glomeromycetes*,
2704 *Glomeromycota*, one species, type: *T. nevadensis* (Palenz.,
2705 N. Ferrol, Azcón-Aguilar & Oehl) Oehl, Palenz., G.A.
2706 Silva & Sieverd., arbuscular mycorrhizal, terrestrial, Eur-
2707 ope, see Oehl et al. (2011e; taxonomy), Redecker et al.
2708 (2013; phylogeny, mentioning genus as questionable),
2709 culture availability unlikely, sequences available but might
2710 be dubious.
- 2711 **Kickxellomycota** Tedersoo et al. 2712
2713 Subphylum *Kickxellomycotina* Benny was upgraded to
2714 *Kickxellomycota* by Tedersoo et al. (2016). Tedersoo et al.
2715 (2016) introduced new class *Kickxellomycetes* Tedersoo
2716 et al. to accommodate *Kickxella* Coem. (in *Kickxellaceae*,
2717 *Kickxellales*) along with another five classes (viz. *Asel-*
2718 *lariomycetes*, *Barbatosporomycetes*, *Dimargaritomycetes*
2719 *Harpellomycetes*, and *Ramicandelaberomycetes*). We
2720 accept *Kickxellomycota* with six classes, six orders, seven
2721 families and 65 genera
- 2722 **Notes for genera** 2723
2724 **Asellaria** R.A. Poiss. 1932, *Asellariaceae*, *Asellariales*,
2725 *Asellariomycetes*, *Kickxellomycota*, c. seven species, type:
2726 *A. caulleryi* R.A. Poiss., associated with Isopoda, world-
2727 wide, see Guardia Valle and Cafaro (2008, new species,
2728 biology, zygosporangium production), Lichtwardt (2012; Tri-
2729 chomycete gut fungi from tropical regions), Kirk et al.
2730 (2013; genus accepted), Tretter et al. (2014; DNA, phy-
2731 logeny), Benny et al. (2016b; classification), cultures and
2732 sequences are available.
- 2733 **Austrosmittium** Lichtw. & M.C. Williams 1990, *Legeri-*
2734 *omycetaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomy-*
2735 *cota*, five species, type: *A. kiwiorum* M.C. Williams &
2736 Lichtw. (Name is invalid as in Index Fungorum 2018; Art. 2735

- 2736 40.5 (Melbourne), in insects, worldwide, see Siri and
 2737 López Lastra (2010; new species), Kirk et al. (2013; genus
 2738 accepted), Hoffmann et al. (2013; phylogeny), Benny et al.
 2739 (2016b; classification), cultures and sequences are
 2740 available.
- 2741 **Bactromyces** William & Strongman 2012, *Legeriomyc-*
 2742 *etaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomycota*,
 2743 one species, type: *B. fluminalis* William & Strongman, in
 2744 *Paracapnia angulata* nymphs, Canada, see William and
 2745 Strongman (2014; taxonomy), Benny et al. (2016b; clas-
 2746 sification), cultures and sequences are unavailable.
- 2747 **Baetimyces** L.G. Valle & Santam. 2002, *Legeriomyc-*
 2748 *etaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomycota*,
 2749 one species, type: *B. ancorae* L.G. Valle & Santam., in
 2750 hindgut of *Baetis* nymf, Spain, see Valle (2013a; Galicia),
 2751 Benny et al. (2016b; classification), cultures and sequences
 2752 are unavailable.
- 2753 **Ballocephala** Drechsler 1951, *Kickxellomycotina* genera
 2754 *incertae sedis*, *Kickxellomycota*, one species, type: *B.*
 2755 *sphaerospora* Drechsler, on tardigrades, worldwide, see
 2756 Humber (2012; classification), Gryganskyi et al. (2013a, b;
 2757 notes), Kirk et al. (2013; genus accepted), Benny et al.
 2758 (2016b; classification), cultures and sequences are
 2759 unavailable.
- 2760 **Baltomyces** Cafaro 1999, *Asellariales* genera *incertae*
 2761 *sedis*, *Kickxellomycetes*, *Kickxellomycota*, one species,
 2762 type: *B. styrax* Cafaro, in Isopoda, USA, see Oman and
 2763 White (2012; USA), Kirk et al. (2013; genus accepted),
 2764 Benny et al. (2016b; classification), cultures and sequences
 2765 are unavailable.
- 2766 **Barbatospora** M.M. White, Siri & Lichtw. 2006, *Bar-*
 2767 *batosporaceae*, *Barbatosporales*, *Barbatosporomycetes*,
 2768 *Kickxellomycota*, one species, type: *B. ambicquadata* M.M.
 2769 White, Siri & Lichtw., in hindgut of larval *Simuliidae*,
 2770 USA, see Hussain et al. (2014; mycoinsecticide), Tretter
 2771 et al. (2014; DNA, phylogeny), Corsaro et al. (2018;
 2772 phylogeny), Benny et al. (2016b; classification), cultures
 2773 and sequences are available.
- 2774 **Bojamyces** Longcore 1989, *Legeriomycetaceae*, *Harpel-*
 2775 *lales*, *Harpellomycetes*, *Kickxellomycota*, three species,
 2776 type: *B. repens* Longcore, cosmopolitan, see Hoffmann
 2777 et al. (2013; classification), Kirk et al. (2013; genus
 2778 accepted), Sato et al. (2013; Japan), Benny et al. (2016b;
 2779 classification), cultures and sequences are available.
- 2780 **Capniomyces** S.W. Peterson & Lichtw. 1983, *Legeri-*
 2781 *omycetaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomy-*
 2782 *cota*, three species, type: *C. stellatus* S.W. Peterson &
 2783 Lichtw., in insects, cosmopolitan, see Bench and White
 2784 (2012; new species), Hoffman et al. (2013; notes), Kirk
 2785 et al. (2013; genus accepted), Hussain et al. (2014;
 2786 mycopesticide), Benny et al. (2016b; classification), Cor-
 2787 saro et al (2018, phylogeny), Wang et al. (2016a, b; gen-
 2788 ome sequencing of *C. stellatus*), cultures and sequences are
 available, genomes available: *C. stellatus* [PMID: 2789
 2790 27491991] available at NCBI.
- Carouxella** Manier, Rioux & Whisler 1965, *Harpellaceae*,
 2791 *Harpellales*, *Harpellomycetes*, *Kickxellomycota*, two spe-
 2792 cies, type: *C. scalaris* Manier, Rioux & Whisler (Index
 2793 Fungorum 2017 listed the type species as invalid), in
 2794 insects, cosmopolitan, see Tretter et al. (2013; notes), Kirk
 2795 et al. (2013; genus accepted), Benny et al. (2016b; classi-
 2796 fication), cultures and sequences are available. 2797
- Caudomyces** Lichtw., Kobayasi & Indoh 1988, *Legeri-*
 2798 *omycetaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomy-*
 2799 *cota*, three species, type: *C. japonicus* Lichtw., Kobayasi &
 2800 Indoh, on insects, cosmopolitan, see Tretter et al. (2013;
 2801 notes), Kirk et al. (2013; genus accepted), Strongman and
 2802 Wang (2015; new species), Benny et al. (2016b; classifi-
 2803 cation), cultures and sequences are available. 2804
- Coemansia** Tiegh. & G. Le Monn. 1873, *Kickxellaceae*,
 2805 *Kickxellales*, *Kickxellomycetes*, *Kickxellomycota*, c. 20
 2806 species, type: *C. reversa* Tiegh. & G. Le Monn., saprobes,
 2807 worldwide, see Kurihara et al. (2008; Indonesia, new spe-
 2808 cies), Chuang and Ho (2011; Taiwan), Kirk et al. (2013;
 2809 genus accepted), Tretter et al. (2013; phylogeny), Healy
 2810 et al. (2014; mitosis), Benny et al. (2016b; classification),
 2811 Chuang et al. (2018; phylogeny), cultures and sequences
 2812 are available, *C. reversa* NRRL 1564 [25977457] at NCBI. 2813
- Coleopteromyces** Ferrington, Lichtw. & López-Lastra
 2814 1999, *Legeriomycetaceae*, *Harpellales*, *Harpellomycetes*,
 2815 *Kickxellomycota*, one species, type: *C. amnicus* Ferrington,
 2816 Lichtw. & López-Lastra, in insects, cosmopolitan, see
 2817 Tretter et al. (2013; notes), Kirk et al. (2013; genus
 2818 accepted), Wang et al. (2014a, b, c; phylogeny), Benny
 2819 et al. (2016b; classification), cultures and sequences are
 2820 available 2821
- Dacryodiomyces** Lichtw. 2011, *Legeriomycetaceae*,
 2822 *Harpellales*, *Harpellomycetes*, *Kickxellomycota*, one spe-
 2823 cies, type: *D. oklahomensis* Lichtw., in insects, USA, see
 2824 Lichtwardt et al. (2011a, b; taxonomy), Benny et al.
 2825 (2016b; classification), cultures and sequences are
 2826 available 2827
- Dimargaris** Tiegh. 1875, *Dimargaritaceae*, *Dimargari-*
 2828 *tales*, *Dimargaritomycetes*, *Kickxellomycota*, seven spe-
 2829 cies, type: *D. cristalligena* Tiegh., coprophilous,
 2830 fungicolous, cosmopolitan, see de Santiago et al. (2009;
 2831 first record in S. America), De Godoi and Rafael (2013;
 2832 new species, key), Gryganskyi et al. (2013a, b; notes), Kirk
 2833 et al. (2013; genus accepted), Tretter et al. (2013; DNA),
 2834 Nováková and Vaughan (2016; cave), Benny et al. (2016b;
 2835 classification), cultures and sequences are available. 2836
- Dipsacomycetes** R.K. Benj. 1961, *Kickxellaceae*, *Kickxel-*
 2837 *lales*, *Kickxellomycetes*, *Kickxellomycota*, one species,
 2838 type: *D. acuminosporus* R.K. Benj., saprobes, Honduras,
 2839 see Kirk et al. (2013; genus accepted), Tretter et al. (2014;
 2840

- 2841 phylogeny), Benny et al. (2016b; classification), cultures
2842 and sequences are available.
- 2843 **Dispira** Tiegh. 1875, *Dimargaritaceae*, *Dimargaritales*,
2844 *Dimargaritomyces*, *Kickxellomycota*, four species, type:
2845 *D. cornuta* Tiegh., mycoparasites, cosmopolitan, see Ho
2846 and Chuang (2010; Taiwan), Kirk et al. (2013; genus
2847 accepted), Tretter et al. (2014; DNA), Benny et al. (2016b;
2848 classification), cultures and sequences are available.
- 2849 **Ejectosporus** S.W. Peterson, Lichtw. & M.C. Williams
2850 1991, *Legeriomycetaceae*, *Harpellales*, *Harpellomyces*,
2851 *Kickxellomycota*, one species, type: *C. spica* (S.W. Peter-
2852 son & Lichtw.) Strongman, in insects, North America, see
2853 Kirk et al. (2013; genus accepted), Benny et al. (2016b;
2854 classification), cultures and sequences are unavailable
- 2855 **Ephemerellomyces** M.M. White & Lichtw. 2004, *Legeri-*
2856 *omycetaceae*, *Harpellales*, *Harpellomyces*, *Kickxellomy-*
2857 *cota*, one species, type: *E. aquilonius* M.M. White &
2858 Lichtw., from insects, cosmopolitan, see Kandel and White
2859 (2012; new species), Benny et al. (2016b; classification),
2860 cultures and sequences are unavailable.
- 2861 **Furculomyces** Lichtw. & M.C. Williams 1992, *Legeri-*
2862 *omycetaceae*, *Harpellales*, *Harpellomyces*, *Kickxellomy-*
2863 *cota*, three species, type: *F. boomerangus* (M.C. Williams
2864 & Lichtw.) M.C. Williams & Lichtw., in insects, Australia,
2865 Northern America, see Hoffmann et al. (2013; phylogeny),
2866 Kirk et al. (2013; genus accepted), Benny et al. (2016b;
2867 classification), cultures and sequences are unavailable.
- 2868 **Gauthieromyces** Lichtw. 1983, *Legeriomycetaceae*,
2869 *Harpellales*, *Harpellomyces*, *Kickxellomycota*, three
2870 species, type: *G. microsporus* Lichtw., in insects, cos-
2871 mopolitan, see Misra and Tiwari (2008; new species,
2872 India), Valle et al. (2008; new species), Strongman et al.
2873 (2010; China), Lichtwardt (2011; tropics), Kirk et al.
2874 (2013; genus accepted), Valle et al. (2013; records from
2875 Italy), Strongman and Wang (2015; notes, China), Benny
2876 et al. (2016b; classification), cultures and sequences are
2877 unavailable.
- 2878 **Genistelloides** S.W. Peterson, Lichtw. & B.W. Horn 1981,
2879 *Legeriomycetaceae*, *Harpellales*, *Harpellomyces*, *Kickx-*
2880 *ellomycota*, five species, type: *G. hibernus* S.W. Peterson,
2881 Lichtw. & B.W. Horn, in insects, cosmopolitan, see Kirk
2882 et al. (2013; genus accepted), Strongman and Wang (2015;
2883 new species, China), Benny et al. (2016b; classification),
2884 cultures and sequences are unavailable.
- 2885 **Genistellospora** Lichtw. 1972, *Legeriomycetaceae*,
2886 *Harpellales*, *Harpellomyces*, *Kickxellomycota*, six spe-
2887 cies, type: *G. homothallica* Lichtw., in insects, cos-
2888 mopolitan, see Lichtwardt (2011, 2012; tropics, new
2889 species), Hoffmann et al. (2013; classification, notes), Kirk
2890 et al. (2013; genus accepted), Benny et al. (2016b; classi-
2891 fication), cultures and sequences are unavailable.
- 2892 **Glotzia** M. Gauthier ex Manier & Lichtw. 1970, *Legeri-*
2893 *omycetaceae*, *Harpellales*, *Harpellomyces*,
Kickxellomycota, seven species, type: *G. centroptili* M.
Gauthier ex Manier & Lichtw., in insects, cosmopolitan,
see Strongman and White (2008; new species), Kirk et al.
(2013; genus accepted), Valle et al. (2013; new species,
Italy), Benny et al. (2016b; classification), cultures and
sequences are unavailable.
- Graminella** L. Léger & M. Gauthier ex Manier 1962,
Legeriomycetaceae, *Harpellales*, *Harpellomyces*, *Kickx-*
ellomycota, three species, type: *G. bulbosa* L. Léger & M.
Gauthier ex Manier, symbiote in insects, cosmopolitan, see
Chen et al. (2012, 2015; plant virus vector, genome
sequences), Kirk et al. (2013; genus accepted), Cassone
et al. (2014; genetic studies), Benny et al. (2016b; classi-
fication), Heady and Nault (2017; acoustic signals), cul-
tures and sequences are unavailable.
- Harpella** L. Léger & Duboscq 1929, *Harpellaceae*,
Harpellales, *Harpellomyces*, *Kickxellomycota*, seven
species, type: *H. melusinae* L. Léger & Duboscq, in insects,
cosmopolitan, see Misra and Tiwari (2008; India), Hapsari
et al. (2009; new species), Nelder et al. (2009; ecology
prediction), Percival and Harvey (2011; UK), Bench and
White (2012; new species), Tretter et al. (2013; notes),
Kirk et al. (2013; genus accepted), Wilson et al. (2014;
effect of fungicides), Benny et al. (2016b; classification),
cultures and sequences are available.
- Harpellomyces** Lichtw. & S.T. Moss 1984, *Harpellaceae*,
Harpellales, *Harpellomyces*, *Kickxellomycota*, four spe-
cies, type: *H. eccentricus* Lichtw. & S.T. Moss, in insects,
cosmopolitan, see Valle et al. (2013; new species, Italy),
Kirk et al. (2013; genus accepted), Jamali (2015; Iran),
Tretter et al. (2014; notes), Benny et al. (2016b; classi-
fication), cultures and sequences are available.
- Kickxella** Coem. 1862, *Kickxellaceae*, *Kickxellales*, *Kick-*
xellomyces, *Kickxellomycota*, one species, type: *K.*
alabastrina Coem., saprobes, cosmopolitan, see Hoffman
et al. (2013; notes), Kirk et al. (2013; genus accepted),
Tretter et al. (2014; phylogeny), Wang et al. (2014a, b, c;
DNA), Benny et al. (2016b; classification), cultures and
sequences are available.
- Klastostachys** Lichtw., M.C. Williams & M.M. White
2011, *Harpellaceae*, *Harpellales*, *Harpellomyces*, *Kick-*
xellomycota, one species, type: *K. reflexa* (Lichtw. & M.C.
Williams) Lichtw., M.C. Williams & M.M. White, sap-
robes, cosmopolitan, see Lichtwardt et al. (2011a, b; tax-
onomy), Benny et al. (2016b; classification, accepted as in
Legeriomycetaceae), cultures and sequences are
unavailable
- Laculus** William & Strongman 2012, *Legeriomycetaceae*,
Harpellales, *Harpellomyces*, *Kickxellomycota*, one spe-
cies, type: *L. insecticola* William & Strongman, in insects,
Canada, see William and Strongman (2012; taxonomy),
Benny et al. (2016b; classification), cultures and sequences
are unavailable.

- 2947 **Lancisporomyces** Santam. 1997, *Legeriomycetaceae*,
2948 *Harpellales*, *Harpellomycetes*, *Kickxellomycota*, five spe-
2949 cies, type: *L. vernalis* Santam., in insects, cosmopolitan,
2950 see Bench and White (2012; new species), Lichtwardt
2951 (2012; tropics), Kirk et al. (2013; genus accepted), Wang
2952 et al. (2014a, b, c; DNA), Benny et al. (2016b; classifica-
2953 tion), cultures not available but sequences are available
2954 **Legerioides** M.M. White 1999, *Legeriomycetaceae*,
2955 *Harpellales*, *Harpellomycetes*, *Kickxellomycota*, one spe-
2956 cies, type: *L. tumidus* M.M. White, in insects, North
2957 America, see Kirk et al. (2013; genus accepted), Tretter
2958 et al. (2014; DNA), Benny et al. (2016b; classification),
2959 cultures and sequences are available.
- 2960 **Legeriomyces** Pouzar 1972, *Legeriomycetaceae*, *Harpel-*
2961 *lales*, *Harpellomycetes*, *Kickxellomycota*, eleven species,
2962 type: *L. ramosus* (L. Léger & M. Gauthier) Pouzar, in
2963 insects, cosmopolitan, see Misra and Tiwari (2008; India),
2964 Strongman and White (2008; new species), Siri and López
2965 Lastra (2010; new species), Strongman (2010; Newfound-
2966 land), Strongman et al. (2010; new species), Lichtwardt
2967 (2012; tropics), Kirk et al. (2013; genus accepted), Valle
2968 (2013a; Portugal), Misra et al. (2014; new species), Tretter
2969 et al. (2014; DNA), Wang et al. (2014a, b, c; DNA), Benny
2970 et al. (2016b; classification), cultures and sequences are
2971 available.
- 2972 **Legeriosimilis** M.C. Williams, Lichtw., M.M. White &
2973 J.K. Misra 1999, *Legeriomycetaceae*, *Harpellales*,
2974 *Harpellomycetes*, *Kickxellomycota*, eight species, type: *L.*
2975 *tricaudata* M.C. Williams, Lichtw., M.M. White & J.K.
2976 Misra, in insects, cosmopolitan, see Strongman et al.
2977 (2010; new species), Strongman and White (2008, 2011;
2978 new species), White and Strongman (2012a; new species),
2979 Kirk et al. (2013; genus accepted), Tretter et al. (2013;
2980 DNA), Valle (2013b; France), Hussain et al. (2014;
2981 mycoinsecticide), Wang et al. (2014a, b, c; DNA), Benny
2982 et al. (2016b; classification), cultures and sequences are
2983 available.
- 2984 **Linderina** Raper & Fennell 1952, *Kickxellaceae*, *Kickxel-*
2985 *lales*, *Kickxellomycetes*, *Kickxellomycota*, two species,
2986 type: *L. pennispora* Raper & Fennell, saprobes, worldwide,
2987 see Kurihara et al. (2008; Indonesia), Chuang and Ho
2988 (2009; Taiwan), Zain et al. (2012; development of
2989 merosporangia), Kirk et al. (2013; genus accepted), Tretter
2990 et al. (2014; phylogeny), Benny et al. (2016b; classifica-
2991 tion), Chiranjeevi et al. (2017; anti-oxidant activity), cul-
2992 tures and sequences are available, genomes available: *L.*
2993 *pennispora* ATCC 12442 (unpublished) available at NCBI
2994 genomes.
- 2995 **Martensella** Coem. 1863, *Kickxellaceae*, *Kickxellales*,
2996 *Kickxellomycetes*, *Kickxellomycota*, one species, type: *M.*
2997 *pectinata* Coem., mycoparasites, worldwide, see Zain et al.
2998 (2012; development of merosporangia), Kirk et al. (2013;
2999 genus accepted), Tretter et al. (2014; phylogeny), Benny
et al. (2016b; classification), cultures and sequences are
available.
- Martensiomycetes** J.A. Mey. 1957, *Kickxellaceae*, *Kickxel-*
lales, *Kickxellomycetes*, *Kickxellomycota*, one species,
type: *M. pterosporus* J.A. Mey., mycoparasites, worldwide,
see Zain et al. (2012; comparison of merosporangia with
Linderina), Kirk et al. (2013; genus accepted), Tretter et al.
(2014; phylogeny), Benny et al. (2016b; classification),
cultures and sequences are available.
- Mycoemilia** Kurihara, Degawa & Tokum. 2004, *Kickxel-*
laceae, *Kickxellales*, *Kickxellomycetes*, *Kickxellomycota*,
one species, type: *M. scoparia* Kurihara, Degawa &
Tokum., saprobes, Asia, see Tretter et al. (2014; phy-
logeny), Benny et al. (2016b; classification), cultures and
sequences are available.
- Myconymphaea** Kurihara, Degawa & Tokum. 2001,
Kickxellaceae, *Kickxellales*, *Kickxellomycetes*, *Kickxel-*
lomycota, one species, type: *M. yatsukahoi* Kurihara,
Degawa & Tokum., saprobes, Asia, see Hoffmann et al.
(2013; phylogeny), Benny et al. (2016b; classification),
cultures and sequences are available.
- Orphella** L. Léger & M. Gauthier 1931, *Legeriomyc-*
etaceae, *Harpellales*, *Harpellomycetes*, *Kickxellomycota*,
c. ten species, type: *O. coronata* L. Léger & M. Gauthier,
in insects, cosmopolitan, see Kirk et al. (2013; genus
accepted), Tretter et al. (2013; DNA), Valle et al.
(2013, 2014; new species), Strongman and Wang (2015;
new species), Benny et al. (2016b; classification), Corsaro
et al (2018, phylogeny), cultures and sequences are
available.
- Pennella** Manier 1968, *Legeriomycetaceae*, *Harpellales*,
Harpellomycetes, *Kickxellomycota*, eight species, type: *P.*
hovasseyi Manier, in insects, cosmopolitan, see Strongman
and White (2008; new species), Kirk et al. (2013; genus
accepted), Tretter et al. (2013; DNA), Benny et al. (2016b;
classification), cultures and sequences are available for
unidentified species.
- Pinnaticoemansia** Kurihara & Degawa 2006, *Kickxel-*
laceae, *Kickxellales*, *Kickxellomycetes*, *Kickxellomycota*,
one species, type: *P. coronantispora* Kurihara & Degawa,
from soil, Asia, see Hoffmann et al. (2013; notes), Benny
et al. (2016b; classification), cultures and sequences are
available.
- Plecopteromyces** Lichtw., Ferrington & López-Lastra
1999, *Legeriomycetaceae*, *Harpellales*, *Harpellomycetes*,
Kickxellomycota, three species, type: *P. patagoniensis*
Lichtw., Ferrington & López-Lastra, cosmopolitan, see
Kirk et al. (2013; genus accepted), Hoffmann et al. (2013;
DNA), Benny et al. (2016b; classification), cultures and
sequences are available for unidentified species.
- Pseudoharpella** Ferrington, M.M. White & Lichtw. 2003,
Legeriomycetaceae, *Harpellales*, *Harpellomycetes*, *Kickx-*
ellomycota, one species, type: *P. arcolamylica* Ferrington,

- 3053 M.M. White & Lichtw., saprobes, USA, see Tretter et al.
 3054 (2013; phylogeny), Benny et al. (2016b; classification),
 3055 cultures and sequences are available.
- 3056 **Pteromaktron** Whisler 1963, *Legeriomycetaceae*, *Harpel-*
 3057 *lales*, *Harpellomycetes*, *Kickxellomycota*, two species,
 3058 type: *P. protrudens* Whisler, saprobes, USA, see Williams
 3059 and Strongman (2012; new species), Tretter et al. (2013;
 3060 phylogeny), Wang et al. (2014a, b, c; DNA, phylogeny),
 3061 Benny et al. (2016b; classification), cultures and sequences
 3062 are available for unidentified species.
- 3063 **Ramicandelaber** Y. Ogawa, S. Hayashi, Degawa &
 3064 Yaguchi 2001, *Ramicandelaberaceae*, *Ramicande-*
 3065 *laberales*, *Ramicandelaberomycetes*, *Kickxellomycota*, four
 3066 species, type: *R. longisporus* Y. Ogawa, S. Hayashi,
 3067 Degawa & Y. Yaguchi, from soil, from soybean cyst
 3068 nematodes, Asia, see Hoffmann et al. (2013; notes),
 3069 Chuang et al. (2009, 2013; new species, Taiwan), Tretter
 3070 et al. (2014; DNA), Benny et al. (2016b; classification),
 3071 cultures and sequences are available.
- 3072 **Simuliumyces** Lichtw. 1972, *Legeriomycetaceae*, *Harpel-*
 3073 *lales*, *Harpellomycetes*, *Kickxellomycota*, one species,
 3074 type: *S. microsporus* Lichtw., in insect larva, USA, see
 3075 Benny et al. (2016b; classification), cultures and sequences
 3076 are unavailable.
- 3077 **Sinotrichium** Juan Wang, S.Q. Xu & Strongman 2010,
 3078 *Legeriomycetaceae*, *Harpellales*, *Harpellomycetes*, *Kickx-*
 3079 *ellomycota*, one species, type: *S. chironomidarum* Juan
 3080 Wang, S.Q. Xu & Strongman, in insect larva, China, see
 3081 Wang et al. (2010; taxonomy), Benny et al. (2016b; clas-
 3082 sification), cultures and sequences are unavailable.
- 3083 **Smittium** R.A. Poiss. 1937, *Legeriomycetaceae*, *Harpel-*
 3084 *lales*, *Harpellomycetes*, *Kickxellomycota*, c. 80 species,
 3085 type: *S. arvernense* R.A. Poiss., in insect larva, China, see
 3086 Vojvodic and McCreadie (2008, 2009; species interaction,
 3087 morphological difference), Wang et al.
 3088 (2010, 2013b, 2014a, b, c; taxonomy, overview, phy-
 3089 logeny), Lichtwardt and White (2011; typification), Misra
 3090 (2012; systemics), White and Strongman (2012b; new
 3091 species), Kirk et al. (2013; genus accepted), Benny et al.
 3092 (2016b; classification), genomes available: *S. culicis*
 3093 GSMNP and ID-206-W2, *S. mucronatum* strain ALG-7-
 3094 W6 [27343289] are available at NCBI genomes.
- 3095 **Spartiella** Tuzet & Manier ex Manier 1968, *Legeriomyc-*
 3096 *etaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomycota*,
 3097 three species, type: *S. barbata* Tuzet & Manier ex Manier,
 3098 in insect larva, Europe, Canada, see White and Strongman
 3099 (2012a; new species), Kirk et al. (2013; genus accepted),
 3100 Benny et al. (2016b; classification), cultures and sequences
 3101 are available.
- 3102 **Spinalia** Vuill. 1904, *Dimargaritales* genera *incertae sedis*,
 3103 *Dimargaritomycetes*, one species, type: *S. radians* Vuill.,
 3104 mycoparasites, Europe, see Kirk et al. (2013; genus
 accepted), Benny et al. (2016b; classification), cultures and
 sequences are unavailable.
- Spirodactylon** R.K. Benj. 1959, *Kickxellaceae*, *Kickxel-*
lales, *Kickxellomycetes*, *Kickxellomycota*, one species,
 type: *S. aureum* R.K. Benj., saprobes, USA, see Hoffmann
 et al. (2013; notes), Tretter et al. (2014; DNA), Benny et al.
 (2016b; classification), cultures and sequences are
 available.
- Spiromyces** R.K. Benj. 1963, *Kickxellaceae*, *Kickxellales*,
Kickxellomycetes, *Kickxellomycota*, two species, type: *S.*
minus R.K. Benj., saprobes, USA, see Hoffmann et al.
 (2013; notes), Tretter et al. (2014; DNA), Benny et al.
 (2016b; classification), Corsaro et al (2018, phylogeny),
 cultures and sequences are available.
- Stachylina** L. Léger & M. Gauthier 1932, *Harpellaceae*,
Harpellales, *Harpellomycetes*, *Kickxellomycota*, 40 spe-
 cies, type: *S. macrospora* L. Léger & M. Gauthier, sap-
 robes, cosmopolitan, Strongman (2010; new species),
 Wang et al. (2010, 2014a, b, c; new species, phylogeny),
 Misra (2012; systemics), White and Strongman (2012b;
 new species), Kirk et al. (2013; genus accepted), William
 and Strongman (2013; new species), Valle (2013a; new
 species), cultures and sequences are unavailable.
- Stachylinoides** Lichtw. & López-Lastra 1999, *Harpel-*
laceae, *Harpellales*, *Harpellomycetes*, *Kickxellomycota*,
 one species, type: *S. arctata* Ferrington, Lichtw. & López-
 Lastra, in insects, South America, see Kirk et al. (2013;
 genus accepted), Benny et al. (2016b; classification), cul-
 tures and sequences are unavailable.
- Stipella** L. Léger & M. Gauthier 1932, *Legeriomycetaceae*,
Harpellales, *Harpellomycetes*, *Kickxellomycota*, two spe-
 cies, type: *S. vigilans* L. Léger & M. Gauthier, in insect
 larva, Europe, see Kirk et al. (2013; genus accepted),
 Benny et al. (2016b; classification), cultures and sequences
 are available, the genus is treated as a synonym of *Sty-*
pomyces Doweld in Index Fungorum (2018).
- Stypomyces** Doweld 2014, *Legeriomycetaceae*, *Harpel-*
lales, *Harpellomycetes*, *Kickxellomycota*, two species,
 type: *S. vigilans* (L. Léger & M. Gauthier) Doweld,
 replaced synonym of *Stipella* L. Léger & M. Gauthier 1932
 (see Index Fungorum 2018).
- Tectomyces** L.G. Valle & Santam. 2002, *Legeriomyc-*
etaceae, *Harpellales*, *Harpellomycetes*, *Kickxellomycota*,
 three species, type: *T. leptophlebiidarum* L.G. Valle &
 Santam., in insect larva, Europe, see (2010, 2013; zygos-
 pore description, new species), Benny et al. (2016b; clas-
 sification), cultures and sequences are available.
- Tieghemiomyces** R.K. Benj. 1959, *Dimargaritaceae*, *Di-*
margaritales, *Dimargaritomycetes*, *Kickxellomycota*, two
 species, type: *T. californicus* R.K. Benj., mycoparasites,
 cosmopolitan, see Kirk et al. (2013; genus accepted),
 Tretter et al. (2014; DNA), Benny et al. (2016b; classifi-
 cation), cultures and sequences are available.

- 3158 **Trichozygospora** Lichtw. 1972, *Legeriomycetaceae*, 3208
 3159 *Harpellales*, *Harpellomycetes*, *Kickxellomycota*, one spe- 3209
 3160 cies, type: *T. chironomidarum* Lichtw., in insects, cos- 3210
 3161 mopolitan, see Kirk et al. (2013; genus accepted), Tretter 3211
 3162 et al. (2013; DNA), Benny et al. (2016b; classification), 3212
 3163 cultures and sequences are available. 3213
 3164 **Trifoliellum** Strongman & M.M. White 2011, *Legeri-* 3214
 3165 *omycetaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomy-* 3215
 3166 *cota*, one species, type: *T. bioblitzii* Strongman & M.M. 3216
 3167 White., in insects, cosmopolitan, see Strongman and White 3217
 3168 (2011; taxonomy), Benny et al. (2016b; classification), 3218
 3169 cultures and sequences are unavailable. 3219
 3170 **Trissocladomyces** Doweld 2013, *Harpellales* genera *in-* 3220
 3171 *certae sedis*, *Harpellomycetes*, *Kickxellomycota*, one spe- 3221
 3172 cies, type: *T. digitatus* (L. Léger & M. Gauthier) Doweld, 3222
 3173 ?in insects, cosmopolitan, see Doweld (2013a). 3223
 3174 **Zancudomyces** Yan Wang, Tretter, Lichtw. & M.M. White 3224
 3175 2013, *Legeriomycetaceae*, *Harpellales*, *Harpellomycetes*, 3225
 3176 *Kickxellomycota*, one species, type: *Z. culisetae* (Lichtw.) 3226
 3177 Yan Wang, Tretter, Lichtw. & M.M. White, in insects, 3227
 3178 worldwide, see Tretter et al. (2013; DNA), Ellenberger 3228
 3179 et al. (2014; genetics), Benny et al. (2016b; classification), 3229
 3180 Wang et al. (2016a, b; genetics, gene transferring), *Z.* 3230
 3181 *culisetae* [27343289] is available at NCBI genomes. 3231
 3182 **Zygnemomyces** K. Miura 1973, *Kickxellomycotina* genera 3232
 3183 *incertae sedis*, *Kickxellomycota*, two species, type: *Z.* 3233
 3184 *mexicana echinulatus* K. Miura., in nematode, ?human 3234
 3185 pathogens, south America, see Humber (2012; excluded 3235
 3186 from *Meristacraceae*), Gryganskyi et al. (2013a, b; 3236
 3187 accepted as in *Kickxellomycotina*), Kirk et al. (2013; genus 3237
 3188 accepted), Benny et al. (2016b; classification), cultures and 3238
 3189 sequences are unavailable. 3239
 3190 **Zygotoparis** S.T. Moss, Lichtw. & Manier 1975, *Legeri-* 3240
 3191 *omycetaceae*, *Harpellales*, *Harpellomycetes*, *Kickxellomy-* 3241
 3192 *cota*, two species, type: *Z. ephemeridarum* S.T. Moss, 3242
 3193 Lichtw. & Manier, in insects, cosmopolitan, see Hoffman 3243
 3194 et al. (2013; notes), Benny et al. (2016b; classification), 3244
 3195 cultures and sequences are available. 3245
- 3196 **Monoblepharomycota** Doweld 3246
 3197 Doweld (2001) introduced *Monoblepharomycota* based 3247
 3198 on *Monoblepharis* Cornu. Tedersoo et al. (2016) accepted 3248
 3199 *Monoblepharomycota* and introduced *Sanchytriomycetes* 3249
 3200 Tedersoo et al. We accept three classes, three orders, seven 3250
 3201 families and eight genera in *Monoblepharomycota*. 3251
- 3202 **Notes for genera** 3252
 3203 **Amoeboradix** Karpov, Lopez-Garcia, Mamkaeva & Mor- 3253
 3204 eira 2018, *Sanchytriaceae*, *Sanchytriales*, *Sanchytri-* 3254
 3205 *omycetes*, *Monoblepharomycota*, one species, type: *A.* 3255
 3206 *gromovi* Karpov, Lopez-Garcia, Mamkaeva & Moreira, 3256
 3207 parasite, aquatic, Russia, see Karpov et al. (2018; light 3257
 microscopy, electron microscopy, molecular phylogeny), 3258
 sequences are available. 3259
Gonapodya A. Fisch. 1892, *Gonapodyaceae*, *Monoble-* 3210
pharidales, *Monoblepharidomycetes*, *Monoblepharomy-* 3211
cota, one species, type: *G. prolifera* (Cornu) Fisch., 3212
 saprobes, cosmopolitan, see Kirk et al. (2013, genus 3213
 accepted), cultures and sequences are available. 3214
Harpochytrium Lagerh. 1890 (= *Fulminaria* Gobi et al. 3215
 1891; = *Rhabdium* P.A. Dang.), *Harpochytriaceae*, 3216
Monoblepharidales, *Monoblepharidomycetes*, *Monoble-* 3217
pharomycota, c. ten species, type: *H. hyalothecae* Lagerh., 3218
 on green algae, marine, South America, see Kirk et al. 3219
 (2013; genus accepted), cultures and sequences are 3220
 available. 3221
Hyaloraphidium Korshikov 1931, *Hyaloraphidiaceae*, 3222
Hyaloraphidiales, *Hyaloraphidiomycetes*, *Monoble-* 3223
pharomycota, one species, type: *H. curvatum* Korshikov, 3224
 saprobes, cosmopolitan, see Kirk et al. (2013; genus 3225
 accepted), cultures and sequences are available. 3226
Monoblepharella Sparrow 1940, *Gonapodyaceae*, *Mono-* 3227
blepharidales, *Monoblepharidomycetes*, *Monoble-* 3228
pharomycota, five species, type: *M. taylorii* (Sparrow) 3229
 Sparrow, saprobes, cosmopolitan, see Kirk et al. (2013, 3230
 genus accepted), cultures and sequences are available. 3231
Monoblepharis Cornu 1871 (= *Diblepharis* Lagerh. 1900 3232
 [1899]; = *Monoblephariopsis* Laib. 1927), *Monoblephari-* 3233
daceae, *Monoblepharidales*, *Monoblepharidomycetes*, 3234
Monoblepharomycota, five species, type: *M. sphaerica* 3235
 Cornu, saprobes, cosmopolitan, see Kirk et al. (2013, genus 3236
 accepted), cultures and sequences are available. 3237
Oedogoniomyces Kobayasi & M. Ôkubo 1954, *Oedogo-* 3238
niomycetaceae, *Monoblepharidales*, *Monoblephar-* 3239
idomycetes, *Monoblepharomycota*, one species, type: *O.* 3240
lymnaeae Kobayasi & M. Ôkubo, on shells of *Lymnaea* 3241
 spp., Asia, see Kirk et al. (2013; genus accepted), Zhang 3242
 et al. (2015; population study), cultures and sequences are 3243
 available. 3244
Sanchytrium Karpov & Aleoshin 2017, *Sanchytriaceae*, 3245
Sanchytriales, *Sanchytriomycetes*, *Monoblepharomycota*, 3246
 one species, type: *S. tribonematis* Karpov & Aleoshin, 3247
 fresh water, Russia, see Karpov et al. (2017a; taxonomy), 3248
 cultures and sequences are available. 3249
Telasphaerula Longcore & T.Y. James 2017, *Telas-* 3250
phaerulaceae, *Monoblepharidales*, *Monoblephar-* 3251
idomycetes, *Monoblepharomycota*, one species, type: *T.* 3252
gracilis Longcore & T.Y. James, saprobes, fresh water, 3253
 USA, see Karpov et al. (2017a; taxonomy), cultures and 3254
 sequences are available. 3255
- Mortierellomycota** Tedersoo et al. 3256
 Tedersoo et al. (2016) upgraded *Mortierellomycotina* 3257
 Kerst. Hoffm. to a phylum. Currently the phylum com- 3258
 prises one class, one order, one family and six genera. 3259

3260 **Notes for genera**

3261 **Aquamortierella** Embree & Indoh 1967, *Mortierellaceae*,
3262 *Mortierellales*, *Mortierellomycetes*, *Mortierellomycota*,
3263 one species, type: *A. elegans* Embree & Indoh, on midge
3264 larva, aquatic, New Zealand, Japan, see Hoffmann et al.
3265 (2013; classification, notes), Kirk et al. (2013; genus
3266 accepted), Wagner et al. (2013; classification), Benny et al.
3267 (2016b; classification), cultures and sequences are
3268 unavailable.

3269 **Dissophora** Thaxt. 1914, *Mortierellaceae*, *Mortierellales*,
3270 *Mortierellomycetes*, *Mortierellomycota*, three species,
3271 type: *D. decumbens* Thaxt., saprobes, worldwide, see Takó
3272 et al. (2012; production of lipase), Hoffmann et al. (2013;
3273 classification, notes), Kirk et al. (2013; genus accepted),
3274 Wagner et al. (2013; treated as a synonym of *Dissophora*),
3275 Benny et al. (2016b; classification), cultures and sequences
3276 are available.

3277 **Gamsiella** (R.K. Benj.) Benny & M. Blackw. 2004,
3278 *Mortierellaceae*, *Mortierellales*, *Mortierellomycetes*,
3279 *Mortierellomycota*, one species, type: *G. multidivariata*
3280 (R.K. Benj.) Benny & M. Blackw., saprobes, North
3281 America, see Petkovits et al. (2011; DNA), Hoffmann et al.
3282 (2013; classification, phylogeny), Wagner et al. (2013;
3283 phylogeny), Benny et al. (2016b; classification), cultures
3284 and sequences are available.

3285 **Mortierella** Coem. 1863, *Mortierellaceae*, *Mortierellales*,
3286 *Mortierellomycetes*, *Mortierellomycota*, c. 100 species,
3287 type: *M. polycephala* Coem., saprobes, in soil, worldwide,
3288 see Fakas et al. (2009a; single cell oil production, fatty acid
3289 composition), Sakuradani et al. (2009; hybrid for oil pro-
3290 duction), Sato et al. (2010; interactions with bacteria),
3291 Wang et al. (2011a, b, 2013a; metabolism, genomic stud-
3292 ies), Petkovits et al. (2011; notes, classification), Hoffmann
3293 et al. (2013; classification, notes), Kirk et al. (2013; genus
3294 accepted), Smith et al. (2013; DNA, phylogeny), Wagner
3295 et al. (2013; classification), Edgington et al. (2014; insecti-
3296 cides), Hao et al. (2014a, b, 2015; enzymes, metabolism),
3297 Ariyawansa et al. (2015; new species), Benny et al. (2016b;
3298 classification), Werner et al. (2016; biology), Hyde et al.
3299 (2017b; new species), Ge et al. (2018, biotechnology), Luo
3300 et al. (2017; biotechnology), Uehling et al. (2017; com-
3301 parative genomics), Zhang et al. (2017; biotechnology),
3302 cultures and sequences are available, genome available: *M.*
3303 *alpina* CDC-B6842 (Etienne et al. 2014), CCTCC
3304 M207067 and ATCC 32222 [22174787], *M. elongata* AG-
3305 77 [28076891], *M. verticillata* NRRL 6337 available at
3306 NCBI genomes.

3307 **Modicella** Kanouse 1936, *Mortierellaceae*, *Mortierellales*,
3308 *Mortierellomycetes*, *Mortierellomycota*, two species, type:
3309 *M. malleola* (Harkn.) Gerd. & Trappe, saprobes, in soil,
3310 water, worldwide, see Petkovits et al. (2011; classification),
3311 Hoffmann et al. (2013; classification, notes), Kirk et al.

(2013; genus accepted), Smith et al. (2013; DNA, phy- 3312
3313 logeny), Wagner et al. (2013; classification), Benny et al.
3314 (2016b; classification), cultures and sequences are
3315 available.

3316 **Lobosporangium** M. Blackw. & Benny 2004, *Mortierel-*
3317 *laceae*, *Mortierellales*, *Mortierellomycetes*, *Mortierel-*
3318 *lomycota*, one species, type: *L. transversale* (Malloch) M.
3319 Blackw. & Benny, saprobes, North America, see Petkovits
3320 et al. (2011; DNA), Hoffmann et al. (2013; classification),
3321 Wagner et al. (2013; DNA), Benny et al. (2016b; classifi-
3322 cation), cultures and sequences are available, genomes
3323 available: *L. transversale* strain NRRL 3116 (unpublished)
3324 available at NCBI genomes.

3325 **Mucoromycota** Doweld

3326 Doweld (2001) introduced *Mucoromycota* but Kirk et al.
3327 (2008) accepted the subphylum *Mucoromycotina* to
3328 accommodate *Mucor* Fresen. However, Spatafora et al.
3329 (2016) accepted *Mucoromycota* as a distinct phylum with
3330 three subphyla viz. *Glomeromycotina* (in this study we do
3331 not accept this rank under *Mucoromycota*), *Mortierel-*
3332 *lomycotina* and *Mucoromycotina*. The members of *Mu-*
3333 *coromycota* occur as saprobes and rarely as facultative
3334 parasites (Figs. 5 and 6) (Kirk et al. 2008).

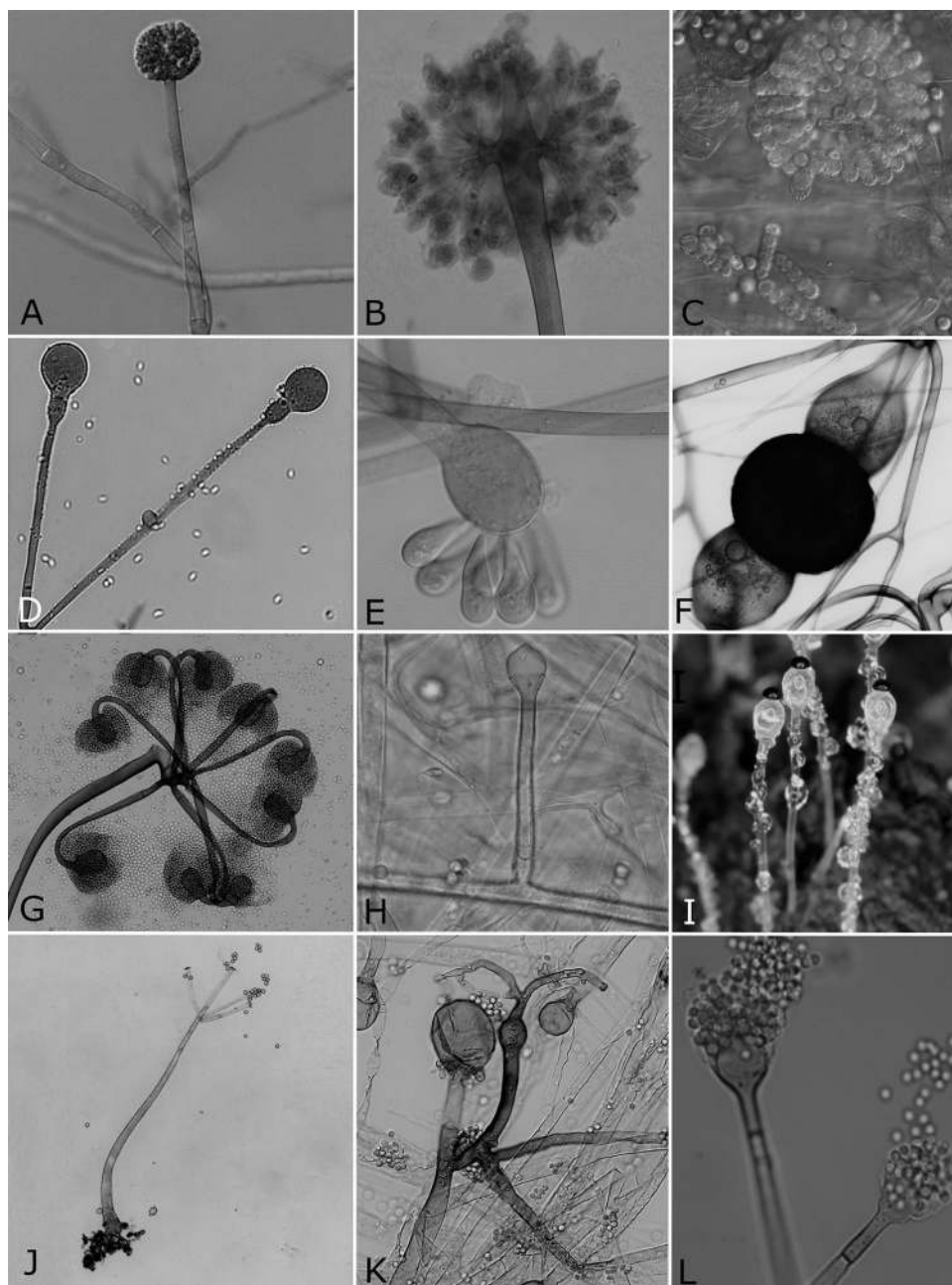
3335 We accept three class, three orders, 16 families and 66
3336 genera in *Mucoromycota*.

3337 **Notes for genera**

3338 **Absidia** Tiegh. 1878, *Cunninghamellaceae*, *Mucorales*,
3339 *Mucoromycetes*, *Mucoromycota*, c. 20 species, type: *A.*
3340 *reflexa* Tiegh., saprobes or pathogens of human and ani-
3341 mals, in soil, animal dung, worldwide, see Hoffmann and
3342 Voigt (2009; introduced *Lentamyces* for *A. parvicida* and
3343 *A. zychae*), Richardson (2009; notes), Hoffmann et al.
3344 (2013; phylogeny), Kirk et al. (2013; genus accepted),
3345 Walther et al. (2013; phylogeny), Ariyawansa et al. (2015;
3346 new species, phylogeny), Li et al. (2016; new species),
3347 Wang et al. (2017e; fermentation), cultures and sequences
3348 are available, genomes available: *A. padenii* NRRL 2977
3349 (unpublished) at JGI portal (Grigoriev et al. 2014), *A.*
3350 *repens* NRRL 1336 (Mondo et al. 2017) genomes at JGI
3351 portal (Grigoriev et al. 2014).

3352 **Actinomucor** Schostak. 1898, *Mucoraceae*, *Mucorales*,
3353 *Mucoromycetes*, *Mucoromycota*, one species and three
3354 varieties, type: *A. elegans* (Eidam) C.R. Benj. & Hesselt.,
3355 opportunistic pathogens of human and animals, in soil, on
3356 human, worldwide, see Li et al. (2008; debittering effect),
3357 Tully et al. (2009; human pathogens), Gomes et al. (2011;
3358 mucormycosis, review), Mahmud et al. (2012; cause of
3359 mucormycosis), Hoffmann et al. (2013; phylogeny), Kirk
3360 et al. (2013; genus accepted), Walther et al. (2013; phy-
3361 logeny), Kia et al. (2014; mutualism with *Abutilon theo-*
3362 *phrasti*), Mou et al. (2014; biotransformation of

Fig. 5 Mucoromycota:
A *Umbelopsis* sp.
B *Thamnostylum piriforme*.
C *Syncephalastrum racemosum*.
D *Gongronella* sp.
E *Cunninghamella* sp.
F Zygospore of *Syzygites megalocarpus*. **G** *Circinella umbellata*. **H** *Lichtheimia* sp.
I *Pilobolus* sp. **J** *Mortierella* sp.
K *Rhizomucor pusillus*.
L *Absidia* sp



3363 resibufogenin), Wang et al. (2014a, c; enhanced glu-
 3364 cosamine production and biotransformation of resibufo-
 3365 genin), Zhou et al. (2014; biotechnology), Karimi et al.
 3366 (2015, pathogen of chafer beetle), Dorin et al. (2017;
 3367 diagnosis methods combining molecular tools, mucormy-
 3368 cosis), Li et al. (2018; biotechnology), genomes available:
 3369 *A. elegans* JCM_22485 at NCBI genomes.
 3370 **Ambomucor** R.Y. Zheng & X.Y. Liu 2014, *Mucoraceae*,
 3371 *Mucorales*, *Mucoromycetes*, *Mucoromycota*, three species
 3372 and three varieties, type: *A. seriatoinflatus* X.Y. Liu & R.Y.
 3373 Zheng, in soil, China, see Zheng and Liu (2014;

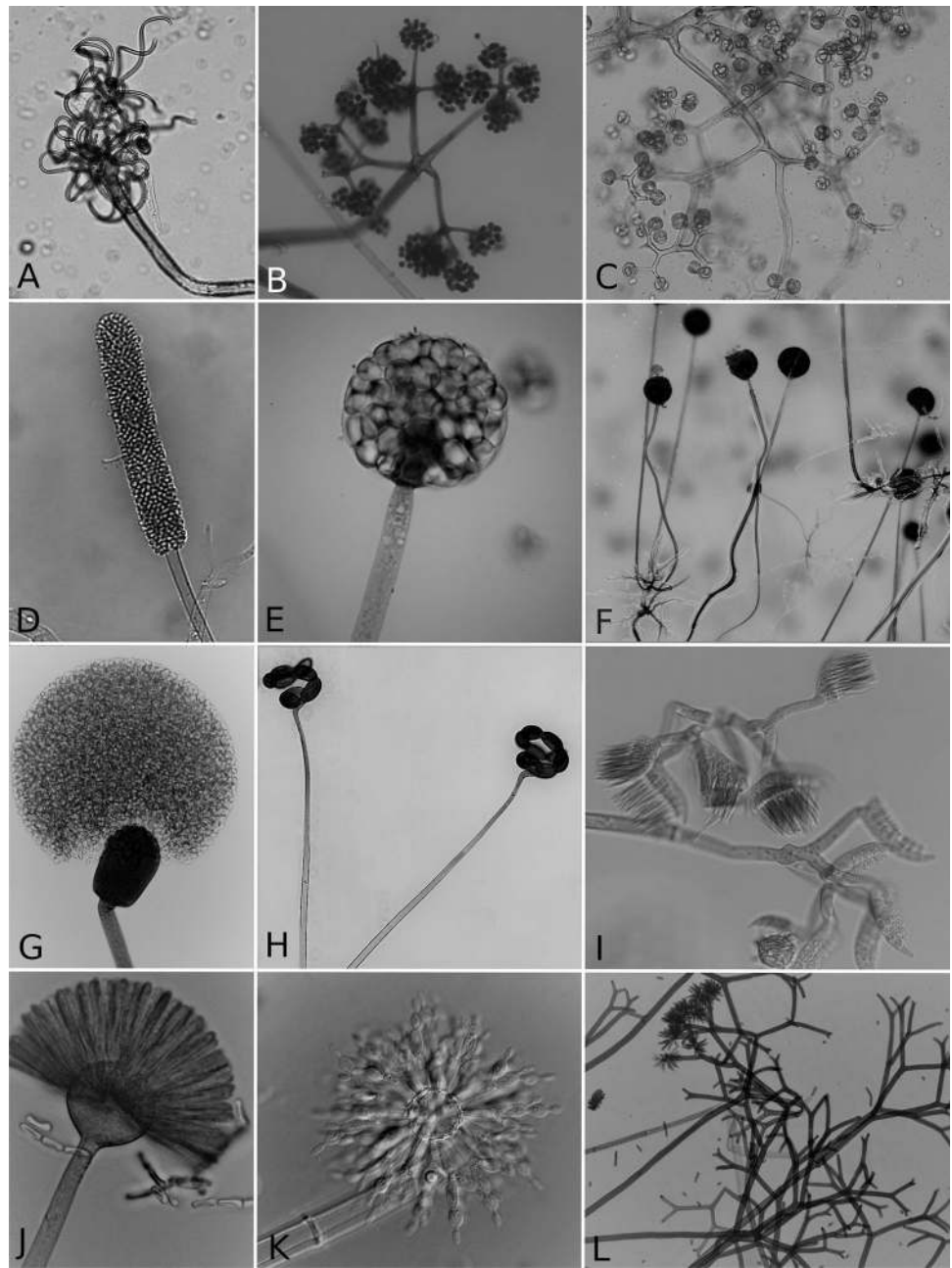
taxonomy), Liu and Zheng (2015; new species), cultures
 and sequences are available.

Amylomyces Calmette 1892, *Rhizopodaceae*, *Mucorales*,
Mucoromycetes, *Mucoromycota*, one species, type: *A.*
rouxii Calmette, use in food production, cosmopolitan, see
 Kito et al. (2009; phylogeny), Kirk et al. (2013; genus
 accepted), Walther et al. (2013; phylogeny, in *Rhizopus*
arrhizus var. *arrhizus*), Benny et al. (2016b; classification),
 cultures and sequences are available.

Apophysomyces P.C. Misra 1979, *Saksenaaceae*, *Muco-*
rales, *Mucoromycetes*, *Mucoromycota*, five species, type:

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Fig. 6 A–G Mucoromycota:
A *Cokeromyces recurvatus*.
B *Chaetocladium* sp.
C *Thamnidium elegans*.
D *Mycotypha microspora*.
E *Mucor* sp. **F** *Rhizopus* sp.
G *Mucor* sp. **H**–
 Zoopagomycota:
H *Helicocephalum* sp.
I *Coemansia* sp. **J** *Syncephalis*
 sp. **K** *Dimargaris* sp.
L *Piptocephalis* sp



3385 *A. elegans* P.C. Misra, K.J. Srivast. & Lata, in soil, human
 3386 and animal pathogens, cosmopolitan, see Álvarez et al.
 3387 (2010b; new species, human pathogens, phylogeny),
 3388 **3388** Guarro et al. (2011; human pathogens), Hoffmann et al.
 3389 (2013; phylogeny, notes), Kirk et al. (2013; genus accep-
 3390 ted), Walther et al. (2013; phylogeny), Bonifaz et al. (2014;
 3391 new species, Mexico), Dave et al. (2014; novel cause of
 3392 endogenous endophthalmitis), Al-Zaydani et al. (2015;
 3393 pathogenic on a child), Benny et al. (2016b; classification),
 3394 Bertumen et al. (2016; clinical diagnosis difficulties),
 3395 Kennedy et al. (2016; mucormycosis in Australia), Prakash
 3396 et al. (2016, 2017; environmental sources, genome

sequencing), Wolkow et al. (2017; chronic orbital and
 calvarial fungal infection), cultures and sequences are
 available, genomes available: *A. elegans* CDC-B7760
 (Chibucos et al. 2016), and *A. trapeziformis* CDC-B9324
 (Chibucos et al. 2016) and *A. variabilis* NCCPF 102052
 [PMID: 28923009] available at NCBI genomes.
Backusella Hesselt. & J.J. Ellis 1969, *Backusellaceae*,
Mucorales, *Mucoromycetes*, *Mucoromycota*, 14 species,
 type: *B. circina* J.J. Ellis & Hesselt., in soil, in excrements
 of animals, worldwide, see Nyilasi et al. (2008; molecular
 identification), Santiago et al. (2011b; in excrement of non-
 ruminant), Li et al. (2012; biodiversity), Kirk et al. (2013;

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- 3409 genus accepted), Walther et al. (2013; phylogeny), Hoffmann et al. (2013; phylogeny), de Souza et al. (2014; new species), Benny et al. (2016b; classification), Lima et al. (2016; new species), cultures and sequences are available, genomes available: *Backusella circina* FSU 941 unpublished genome at JGI portal (Grigoriev et al. 2014).
- 3415 **Benjaminiella** Arx 1981, *Mycotyphaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, three species, type: *B. poitrasii* (R.K. Benj.) Arx, in soil, cosmopolitan, see Hoffmann et al. (2013; classification), Joshi et al. (2013; dimorphism mechanism), Kirk et al. (2013; genus accepted), Walther et al. (2013; classification), Benny et al. (2016b; classification), Mane et al. (2017; Chitosan production), Pathan et al. (2017; reference genes for quantitative real-time RT-PCR), cultures and sequences are available.
- 3425 **Bifiguratus** Torr.-Cruz & Porras-Alfaro 2017, *Mucoromycotina* genera *incertae sedis*, one species, type: *B. adelaidae* Torr.-Cruz & Porras-Alfaro, from photosynthetic tissue of *Leucobryum* in Arizona, USA, see Torres-Cruz et al. (2017), cultures and sequences are available, genomes available: *B. adelaidae* strain AZ0501 [28876195] genome available at NCBI.
- 3432 **Blakeslea** Thaxt. 1914, *Choanephoraceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, two species, type: *B. trispora* Thaxt., worldwide, see Choudhari et al. (2008; β -carotene and lycopene), Mantzouridou et al. (2008; glycerol in media), Schachtschabel et al. (2008; trisporoid synthesis), Sun et al. (2012; metabolites), Hoffmann et al. (2013; classification), Kirk et al. (2013; genus accepted), Sahadevan et al. (2013; biotechnology), Benny et al. (2016b; classification), cultures and sequences are available, genome available: *B. trispora* NRRL 2456 unpublished genome at JGI portal (Grigoriev et al. 2014).
- 3443 **Chaetocladium** Fresen. 1863, *Mucoraceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, two species, type: *C. jonesiae* (Berk. & Broome) Fresen., fungicolous, cosmopolitan, see Ho et al. (2008; Taiwan), Hoffmann et al. (2013; notes), Kirk et al. (2013; genus accepted), Walther et al. (2013; phylogeny), Benny et al. (2016b; classification), cultures and sequences are available.
- 3450 **Chlamydoabsidia** Hesselt. & J.J. Ellis 1966, *Cunninghamellaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, two species, type: *A. padenii* Hesselt. & J.J. Ellis, saprobes, cosmopolitan, see Hoffmann et al. (2013; phylogeny), Kirk et al. (2013; genus accepted), Walther et al. (2013; phylogeny), cultures and sequences are available.
- 3456 **Choanephora** Curr. 1873, *Choanephoraceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, two species, type: *C. infundibulifera* (Curr.) D.D. Cunn., worldwide, however, disease development is more common in tropical and subtropical regions characterized by high temperatures and humidity, see Siddiqui et al. (2008, 2009; control by *Trichoderma*, Tea), Kagiwada et al. (2010; infection in *Mesembryanthemum crystallinum*, Japan), Saroj et al. (2012; infection in *Withania somnifera*, India), Sun et al. (2012; metabolites), Hoffmann et al. (2013; classification), Kirk et al. (2013; genus accepted), Walther et al. (2013; phylogeny), Benny et al. (2016b; classification), Min et al. (2017; genome analyses of *C. cucurbitarum*), cultures and sequences are available, genome available: *C. cucurbitarum* KUS-F28377 at NCBI genomes [28091548]
- 3471 **Circinella** Tiegh. & G. Le Monn. 1873, *Syncephalastreaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, eleven species, type: *C. umbellata* Tiegh. & G. Le Monn., saprobes, coprophilous, worldwide, see Alpat et al. (2008; biosensor), Gonzalez et al. (2010; Mexico), Hoffmann et al. (2013; phylogeny), Kirk et al. (2013; genus accepted), Walther et al. (2013; phylogeny), Benny et al. (2016b; classification), Lima et al. (2017; taxonomy), de Souza et al. (2017; notes), Zheng et al. (2017; new species), cultures and sequences are available, genome available, *C. umbellata* NRRL1351 unpublished genome at JGI portal (Grigoriev et al. 2014).
- 3483 **Cokeromyces** Shanor 1950, *Mycotyphaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, one species, type: *C. recurvatus* Poitras, human pathogen, worldwide, see Ryan et al. (2011; fatal pneumonia), Hoffmann et al. (2013; notes), Kirk et al. (2013; genus accepted), Walther et al. (2013; phylogeny), Gade et al. (2016; molecular diagnostics), Benny et al. (2016b; classification), Chibucos et al. (2016; mucormycosis causing fungi), cultures and sequences are available, *C. recurvatus* NRRL 2243 (CBS 158.50) unpublished genome at JGI portal (Grigoriev et al. 2014) and CDC-B5483 (Chibucos et al. 2016) available at NCBI.
- 3494 **Cunninghamella** Matr. 1903, *Cunninghamellaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, two species, type: *C. echinulata* (Thaxt.) Thaxt. ex Blakeslee, saprobes, human pathogen, cosmopolitan, see Asha and Vidyavathi (2009; review), Fakas et al. (2009b; substrates for oil production), Pastor et al. (2010; antifungal properties), Hoffmann et al. (2013; phylogeny), Kirk et al. (2013; genus accepted), Walther et al. (2013; phylogeny), Berger et al. (2014; biotechnology), Ganjali Dashti et al. (2014; biosynthesis of lipase), Saad et al. (2014; Lipid and Gamma Linolenic Acid Production), Silva et al. (2014; metabolites), Zawadzka et al. (2015; Carbazole hydroxylation), Dube and Kumar (2017; in biotransformation), Siddiqui et al. (2017; biotransformation), cultures and sequences are available, available genomes: *C. echinulata* NRRL 1382 unpublished genome at JGI portal (Grigoriev et al. 2014), *C. elegans* CDC-B9769 and *C. bertholletiae* 175 and CDC-B7461 (Chibucos et al. 2016) available at NCBI genomes.
- 3513 **Densospora** McGee 1996, *Endogonaceae*, *Endogonales*, *Endogonomycetes*, *Mucoromycota*, nine species, type: *D.*

- 3515 *tubiformis* (P.A. Tandy) McGee, mycorrhizal, Australia, 3568
 3516 Northern Hemisphere, see Kirk et al. (2013; genus accep- 3569
 3517 ted), Desirò et al. (2017ecology and phylogeny), Truong 3570
 3518 et al. (2017; phylogeny), Yamamoto et al. (2017a, b; 3571
 3519 reported from Northern Hemisphere), cultures unavailable, 3572
 3520 sequences available. 3573
 3521 **Dichotomocladium** Benny & R.K. Benj. 1975, 3574
 3522 *Lichtheimiaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromy-* 3575
 3523 *cota*, five species, type: *D. elegans* Benny & R.K. Benj., 3576
 3524 saprobes, worldwide, see Hoffmann et al. (2013; phy- 3577
 3525 logeny), Kirk et al. (2013; genus accepted), Walther et al. 3578
 3526 (2013; phylogeny), Benny et al. (2016b; classification), 3579
 3527 cultures and sequences are available, genome available *D.* 3580
 3528 *elegans* RSA 919 unpublished genome at JGI portal 3581
 3529 (Grigoriev et al. 2014) 3582
 3530 **Dicranophora** J. Schröt. 1886, *Mucoraceae*, *Mucorales*, 3583
 3531 *Mucoromycetes*, *Mucoromycota*, one species, type: *D.* 3584
 3532 *fulva* J. Schröt., saprobes, cosmopolitan, see Hoffmann 3585
 3533 et al. (2013; phylogeny), Kirk et al. (2013; genus accepted), 3586
 3534 Benny et al. (2016b; classification), cultures and sequences 3587
 3535 are unavailable. 3588
 3536 **Ellisomyces** Benny & R.K. Benj. 1975, *Mucoraceae*, *Mu-* 3589
 3537 *corales*, *Mucoromycetes*, *Mucoromycota*, one species, 3590
 3538 type: *E. anomalus* (Hesselt. & P. Anderson) Benny & R.K. 3591
 3539 Benj., saprobes, cosmopolitan, see Hoffmann et al. (2013; 3592
 3540 phylogeny), Kirk et al. (2013; genus accepted), Walther 3593
 3541 et al. (2013; phylogeny), Benny et al. (2016b; classifica- 3594
 3542 tion), cultures and sequences are available. 3595
 3543 **Endogone** Link 1809 (= *Youngiomyces* Y.J. Yao 1995 fide 3596
 3544 Desirò et al. 2017), *Endogonaceae*, *Endogonales*, *Endo-* 3597
 3545 *gonomycetes*, *Mucoromycota*, c. 21 species, type: *E. pisi-* 3598
 3546 *formis* Link, in mycorrhiza, cosmopolitan, see Bidartondo 3599
 3547 et al. (2011; symbiosis with plants), Schüßler et al. (2011; 3600
 3548 arbuscular mycorrhizal fungi), Desirò et al. 3601
 3549 (2013, 2015, 2017; phylogeny, endobacteria, symbioses 3602
 3550 with hornworts), Kirk et al. (2013; genus accepted), 3603
 3551 Yamamoto et al. (2015, 2017a, b; morphology, phylogeny, 3604
 3552 oak forests, new species), Benny et al. (2016b; classifica- 3605
 3553 tion), Benitez et al. (2017; species in rhizosphere), cultures 3606
 3554 and sequences are available. 3607
 3555 **Fennellomyces** Benny & R.K. Benj. 1975, *Syncephalas-* 3608
 3556 *tracaeae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, four 3609
 3557 species, type: *F. linderi* (Hesselt. & Fennell) Benny & R.K. 3610
 3558 Benj., saprobes, coprophilous, worldwide, see Xess et al. 3611
 3559 (2012; phylogeny, De Azevedo Santiago et al. (2013; 3612
 3560 coprophilous, Brazil), Hoffmann et al. (2013; phylogeny), 3613
 3561 Kirk et al. (2013; genus accepted), Walther et al. (2013; 3614
 3562 phylogeny), Benny et al. (2016b; classification), cultures 3615
 3563 and sequences are available, genome available: *Fennel-* 3616
 3564 *lomyces* sp. T-0311 unpublished genome at JGI portal 3617
 3565 (Grigoriev et al. 2014) 3618
 3566 **Gilbertella** Hesselt. 1960, *Choanephoraceae*, *Mucorales*, 3619
 3567 *Mucoromycetes*, *Mucoromycota*, two species, type: *G.* 3620
persicaria (E.D. Eddy) Hesselt., worldwide, plant patho- 3621
 3568 gen, see Amiri et al. (2011; abiotic factors effect), Guo 3622
 3569 et al. (2012; rot in dragon fruit), Sun et al. (2012; 3623
 3570 metabolites), Hoffmann et al. (2013; phylogeny), Kirk 3624
 3571 et al. (2013; genus accepted), Walther et al. (2013; phy- 3625
 3572 logeny), Karthikeyan and Gopalakrishnan (2014; infection 3626
 3573 on shrimp), Uloth et al. (2015; associated with calcium 3627
 3574 oxalate crystals), Benny et al. (2016b; classification), Cruz- 3628
 3575 Lachica et al. (2016; papaya fruit rot), cultures and 3629
 3576 sequences are available, genome available: *G. persicaria* 3630
 3577 var. *persicaria* CBS 190.32-T unpublished genome at JGI 3631
 3578 portal (Grigoriev et al. 2014) 3632
 3579 **Gongronella** Ribaldi 1952, *Cunninghamellaceae*, *Muco-* 3633
 3580 *rales*, *Mucoromycetes*, *Mucoromycota*, six species, type: *G.* 3634
 3581 *butleri* (Lendn.) Peyronel & Dal Vesco, saprobes, cos- 3635
 3582 mopolitan, see Nwe et al. (2009; chitosan for tissue 3636
 3583 regeneration), Ghizelini et al. (2012; record from Brazil), 3637
 3584 Hoffmann et al. (2013; phylogeny), Kirk et al. (2013; genus 3638
 3585 accepted), Walther et al. (2013; phylogeny), Zhang et al. 3639
 3586 (2013; Enhancement of chitosanase production), Adamčík 3640
 3587 et al. (2015; new species), Ariyawansa et al. (2015; new 3641
 3588 species), Babu et al. (2015; *G. butleri* from Korea), Li et al. 3642
 3589 (2016; new species), Tibpromma et al. (2017; new species), 3643
 3590 cultures and sequences are available., genome available, *G.* 3644
 3591 *butleri* CBS 227.36 unpublished genome at JGI portal 3645
 3592 (Grigoriev et al. 2014), *Gongronella* sp. W5 (unpublished) 3646
 3593 available at NCBI. 3647
 3594 **Halteromyces** Shipton & Schipper 1975, *Cunninghamel-* 3648
 3595 *laceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, one 3649
 3596 species, type: *H. radiatus* Shipton & Schipper, saprobes, 3650
 3597 Australia, see Hoffmann et al. (2013; phylogeny), Kirk 3651
 3598 et al. (2013; genus accepted), Walther et al. (2013; phy- 3652
 3599 logeny), cultures and sequences are available. 3653
 3600 **Helicostylum** Corda 1842, *Mucoraceae*, *Mucorales*, *Mu-* 3654
 3601 *coromycetes*, *Mucoromycota*, c. two species, type: *H. ele-* 3655
 3602 *gans* Corda., saprobes, cosmopolitan, see Hoffmann et al. 3656
 3603 (2013; phylogeny), Kirk et al. (2013; genus accepted), 3657
 3604 Walther et al. (2013; phylogeny), Benny et al. (2016b; 3658
 3605 classification), cultures and sequences are available. 3659
 3606 **Hesseltinella** H.P. Upadhyay 1970, *Cunninghamellaceae*, 3660
 3607 *Mucorales*, *Mucoromycetes*, *Mucoromycota*, one species, 3661
 3608 type: *H. vesiculosa* H.P. Upadhyay, saprobes, South 3662
 3609 America, see Hoffmann et al. (2013; phylogeny), Kirk 3663
 3610 et al. (2013; genus accepted), Walther et al. (2013; phy- 3664
 3611 logeny), Benny et al. (2016b; classification), Spatafora 3665
 3612 et al. (2016; phylogeny), cultures and sequences are 3666
 3613 available, *H. vesiculosa* NRRL3301 (Mondo et al. 2017) 3667
 3614 **Hyphomucor** Schipper & Lunn 1986, *Mucoraceae*, *Mu-* 3668
 3615 *corales*, *Mucoromycetes*, *Mucoromycota*, one species, 3669
 3616 type: *H. assamensis* (B.S. Mehrotra & B.R. Mehrotra) 3670
 3617 Schipper & Lunn., saprobes, cosmopolitan, see Hoffmann 3671
 3618 et al. (2013; phylogeny), Kirk et al. (2013; genus accepted), 3672
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- 3620 Walther et al. (2013; phylogeny), Benny et al. (2016b; 3673
 3621 classification), cultures and sequences are available. 3674
 3622 **Isomucor** J.I. Souza, Pires-Zottar. & Harakava 2012, *Mu-* 3675
 3623 *coraceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, two 3676
 3624 species, type: *I. trufemiae* J.I. Souza, Pires-Zottar. & Har- 3677
 3625 akava, from soil, Brazil, see de Souza et al. (2012; taxon- 3678
 3626 omy), Walther et al. (2013; phylogeny), Benny et al. 3679
 3627 (2016b; classification), cultures and sequences are 3680
 3628 available. 3681
 3629 **Jingerdemannia** Trappe, Desirò, M.E. Sm., Bonito & 3682
 3630 Bidartondo 2017, *Endogonaceae*, *Endogonales*, *Endogon-* 3683
 3631 *omycetes*, *Mucoromycota*, two species, type: *J. flammi-* 3684
 3632 *corona* (Trappe & Gerd.) Trappe, Desirò, M.E. Sm., Bonito 3685
 3633 & Bidartondo, Desirò et al. (2017; phylogeny), cultures 3686
 3634 unavailable, sequences available. 3687
 3635 **Kirkiana** L.S. Loh, Kuthub. & Nawawi 2001, *Mucoraceae*, 3688
 3636 *Mucorales*, *Mucoromycetes*, *Mucoromycota*, one species, 3689
 3637 type: *K. ramosa* L.S. Loh, Kuthub. & Nawawi, saprobes, 3690
 3638 cosmopolitan, see Benny et al. (2016b; classification), 3691
 3639 cultures and sequences are unavailable. 3692
 3640 **Kirkomyces** Benny 1996, *Mycotyphaceae*, *Mucorales*, 3693
 3641 *Mucoromycetes*, *Mucoromycota*, one species, type: *K.* 3694
 3642 *cordensis* (B.S. Mehrotra & B.R. Mehrotra) Benny, sap- 3695
 3643 robes, Asia, see Hoffmann et al. (2013; phylogeny), Kirk 3696
 3644 et al. (2013; genus accepted), Walther et al. (2013; phy- 3697
 3645 logeny), Benny et al. (2016b; classification), Satari and 3698
 3646 Karimi (2017; biologically active molecule production), 3699
 3647 cultures and sequences are unavailable. 3700
 3648 **Lentamyces** Kerst. Hoffm. & K. Voigt 2008 [2009], *Lent-* 3701
 3649 *amyacetaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromy-* 3702
 3650 *cota*, four species, type: *L. parricidus* (Renner & Muskat ex 3703
 3651 Hesselt. & J.J. Ellis) Kerst. Hoffm. & K. Voigt, pathogens, 3704
 3652 cosmopolitan, see Hoffmann and Voigt (2009; taxonomy), 3705
 3653 Budziszewska et al. (2010a; Poland), Hoffmann et al. 3706
 3654 (2013; phylogeny), Walther et al. (2013; phylogeny), 3707
 3655 Gebremariam et al. (2014; notes), Tretter et al. (2014; 3708
 3656 DNA), Benny et al. (2016b; classification), cultures and 3709
 3657 sequences are available. 3710
 3658 **Lichtheimia** Vuill. 1903, *Lichtheimiaceae*, *Mucorales*, 3711
 3659 *Mucoromycetes*, *Mucoromycota*, c. wight species, type: *L.* 3712
 3660 *corymbifera* (Cohn) Vuill., worldwide, saprobes and 3713
 3661 pathogens, see Kirk et al. (2008; treated as a synonym of 3714
 3662 *Absidia*), Garcia-Hermoso et al. (2009; molecular Parasitology), 3715
 3663 Alastruey-Izquierdo et al. (2010a, b; clinical), 3716
 3664 Hoffmann et al. (2009a, b, 2013; introduction of family, 3717
 3665 phylogeny), Bellanger et al. (2010; farmer lung disease), 3718
 3666 Borrás et al. (2010; clinical), Gomes et al. (2011; human 3719
 3667 pathogens), Neves et al. (2011; enzyme production), 3720
 3668 Schrödl et al. (2011; MALDI ToF), Schwartz et al. 3721
 3669 (2012, 2014a, b; pathogenicity, genomics), Kirk et al. 3722
 3670 (2013; genus accepted), Walther et al. (2013; DNA), André 3723
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- 3726 **Nawawiella** L.S. Loh & Kuthub. 2001, *Mucoraceae*, *Mu-* 3779
 3727 *corales*, *Mucoromycetes*, *Mucoromycota*, one species, 3780
 3728 type: *N. apophysa* L.S. Loh & Kuthub., saprobes, in soil, 3781
 3729 South East Asia, see Walther et al. (2013; phylogeny), 3782
 3730 Benny et al. (2016b; classification), cultures and sequences 3783
 3731 are unavailable. 3784
 3732 **Nothadelphia** Degawa & W. Gams 2004, *Mucoromycota* 3785
 3733 genera *incertae sedis*, one species, type: *N. mortierelicola* 3786
 3734 Degawa & W. Gams, mycoparasite of *Mortierella*, on bat 3787
 3735 dung, Japan, see Benny et al. (2016b; classification), cul- 3788
 3736 tures and sequences are available. 3789
 3737 **Palaeoendogone** Strullu-Derr., Kenrick, Pressel, Duckett, 3790
 3738 J.P. Rioult & Strullu 2014, *Mucoromycotina* genera *in-* 3791
 3739 *certae sedis*, one species, type: *O. gwynne-vaughaniae* 3792
 3740 Strullu-Derr., Kenrick, Pressel, Duckett, J.P. Rioult & 3793
 3741 Strullu, in plants (fossil fungi), UK, see Strullu-Derrien 3794
 3742 et al. (2014; taxonomy), cultures and sequences are 3795
 3743 unavailable. 3796
 3744 **Parasitella** Bainier 1903, *Mucoraceae*, *Mucorales*, *Mu-* 3797
 3745 *coromycetes*, *Mucoromycota*, one species, type: *P. para-* 3798
 3746 *sitica* (Bainier) Syd., parasites, cosmopolitan, see Burmeste 3799
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 3748 phylogeny), Walther et al. (2013; phylogeny), Ellenberger 3801
 3749 et al. (2014; complete mitochondrion sequence), Benny 3802
 3750 et al. (2016b; classification), cultures and sequences 3803
 3751 are available, genome available: *P. parasitica* genome at NCBI 3804
 3752 genomes. 3805
 3753 **Peridiospora** C.G. Wu & Suh J. Lin 1997, *Endogonaceae*, 3806
 3754 *Endogonales*, *Endogonomycetes*, *Mucoromycota*, two spe- 3807
 3755 cies, type: *P. tatchia* C.G. Wu & Suh J. Lin, in mycor- 3808
 3756 rhiza, Taiwan, see Kirk et al. (2013; genus accepted), 3809
 3757 Benny et al. (2016b; classification), Benitez et al. (2017; 3810
 3758 species in rhizosphere), cultures and sequences are 3811
 3759 unavailable. 3812
 3760 **Phascolomyces** Boedijn ex Benny & R.K. Benj. 1976, 3813
 3761 *Syncephalastraceae*, *Mucorales*, *Mucoromycetes*, *Mu-* 3814
 3762 *coromycota*, one species, type: *P. articulatus* Boedijn ex 3815
 3763 Benny & R.K. Benj., ?coprophilous, saprobes, worldwide, 3816
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 3765 genus accepted), Walther et al. (2013; phylogeny), Benny 3818
 3766 et al. (2016b; classification), cultures and sequences are 3819
 3767 available, genome available: *P. articulatus* unpublished 3820
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 3769 **Phycomyces** Kunze 1823, *Phycomycetaceae*, *Mucorales*, 3822
 3770 *Mucoromycetes*, *Mucoromycota*, three species, type: *P.* 3823
 3771 *nitens* (C. Agardh) Kunze, saprobes, worldwide, see Sanz 3824
 3772 et al. (2009, 2011; interactions with the environment, 3825
 3773 functional analysis), Chaudhary et al. (2013; genetic link- 3826
 3774 age map), Hoffmann et al. (2013; phylogeny), Kirk et al. 3827
 3775 (2013; genus accepted), Walther et al. (2013; phylogeny), 3828
 3776 Shakya and Idnurm (2014; uniparental mitochondrial 3829
 3777 inheritance), Žižić et al. (2014; vanadate influence on 3830
 3778 metabolism), Benny et al. (2016b; classification), cultures 3830
 and sequences are available, genome available: *P. bla-* 3779
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Pirella Bainier 1882, *Mucoraceae*, *Mucorales*, *Mu-* 3802
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 tion), cultures and sequences are available. 3815
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 (2013; phylogeny), Kirk et al. (2013; genus accepted), 3827
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 classification), *R. spectabilis* NRRL 2753 unpublished 3829
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- 3831 **Rhizomucor** Lucet & Costantin 1900, *Lichtheimiaceae*,
 3832 *Mucorales*, *Mucoromycetes*, *Mucoromycota*, eight species,
 3833 type: *R. pusillus* (Lindt) Schipper, saprobes, human
 3834 pathogens, cosmopolitan, see Lu et al. (2009; endemic
 3835 zygomycosis), Zheng et al. (2009; new species), Budzis-
 3836 zewska et al. (2010b; taxonomic revision), Rodrigues and
 3837 Fernandez-Lafuente (2010; lipase as biocatalyst), Tajdini
 3838 et al. (2010; Chitosan), Tawil et al. (2010; α -amylase),
 3839 Hoffmann et al. (2013; phylogeny), Kirk et al. (2013; genus
 3840 accepted), Martinez et al. (2013; biotransformation of fatty
 3841 acid), Walther et al. (2013; phylogeny), Bard et al. (2014,
 3842 3843 **3842** pathogenicity) Benny et al. (2016b; classification), *R.*
 3844 *variabilis* (Chibucos et al. 2016), *R. miehei* CAU432
 3845 [24746234] and *R. pusillus* (no publication) available at
 3846 NCBI genomes.
- 3846 **Rhizopodopsis** Boedijn 1959, *Mucoraceae*, *Mucorales*,
 3847 *Mucoromycetes*, *Mucoromycota*, one species, type: *R.*
 3848 *javensis* Boedijn, saprobes, Indonesia, see Hoffmann et al.
 3849 (2013; phylogeny), Kirk et al. (2013; genus accepted),
 3850 Benny et al. (2016b; classification), cultures and sequences
 3851 are unavailable.
- 3852 **Rhizopus** Ehrenb. 1821, *Rhizopodaceae*, *Mucorales*, *Mu-*
 3853 *coromycetes*, *Mucoromycota*, c. ten species, type: *R. sto-*
 3854 *lonifer* (Ehrenb.) Vuill., saprobes, worldwide, in soil, plant
 3855 pathogen, human pathogen, see monograph with key
 3856 (Zheng et al. 2017), Hernandez-Lauzardo et al. (2008;
 3857 Chitosan effect), Qin et al. (2008; biodiesel production),
 3858 Abedinifar et al. (2009; ethanol production), Ma et al.
 3859 (2009; Genomics), Abe et al. (2010; molecular phylogeny),
 3860 Gryganskyi et al. (2010; phylogeny), Xu et al. (2010;
 3861 fumaric acid production), Das et al. (2012; gold nanopar-
 3862 ticles), Hoffmann et al. (2013; notes), Kirk et al. (2013;
 3863 genus accepted), Dolatabadi et al. (2014; nomenclature of
 3864 *Rhizopus arrhizus*), Kaerger et al. (2015; virulence),
 3865 Mendoza et al. (2015; human pathogens), Benny et al.
 3866 (2016b; classification), Li et al. (2016; new species), Zhang
 3867 et al. (2013, xylanase production), Wu et al. (2018, fumaric
 3868 acid production), Canet et al. (2017; biodiesel synthesis),
 3869 Liu et al. (2016; food waste fermentation), Baggio et al.
 3870 (2017; phytopathology), Gryganskyi et al. (2018; phyloge-
 3871 nomics), NRRL 21446, NRRL 21477, NRRL 21447,
 3872 NRRL 21789 (Chibucos et al. 2016) available at NCBI
 3873 genomes, *R. microsporus* CDC-B7455 and CDC-B9738
 3874 (Chibucos et al. 2016), available at NCBI genomes, *R.*
 3875 *microsporus* ATCC 11559, ATCC 52813, ATCC 52814,
 3876 B9738 and B7455 available at NCBI genomes, *R. micro-*
 3877 *sporus* CCTCC M201021 (Wang et al. 2013a, b, c, d)
 3878 available at NCBI genomes, *R. oryzae* 99-892, CDC-
 3879 B7407, HUMC 02, NRRL 13440, NRRL 18148, NRRL
 3880 21396 (Chibucos et al. 2016), 99-133 and 97-1192 avail-
 3881 able at NCBI genomes, *R. stolonifer* CDC-B9770 (Chibu-
 3882 cos et al. 2016) available at NCBI genomes, cultures and
 3883 sequences are available.
- Saksena** S.B. Saksena 1953, *Saksenaaceae*, *Mucorales*,
 3884 *Mucoromycetes*, *Mucoromycota*, five species, type: *S.*
 3885 *vasiformis* S.B. Saksena, human pathogen, cosmopolitan,
 3886 see García-Martínez et al. (2008; human pathogen),
 3887 Lechevalier et al. (2008; molecular diagnosis), Baradkar
 3888 and Kumar (2009; cutaneous zygomycosis), Alvarez et al.
 3889 (2010a, b; new species), Hospenthal et al. (2011; fatal
 3890 infection), Salas et al. (2012; disseminated infection by
 3891 *Saksena* *vasiformis*), Kirk et al. (2013; genus accepted),
 3892 Tretter et al. (2014; notes), Benny et al. (2016b; classifi-
 3893 cation), Crous et al. (2016, 2017; new species), *S.*
 3894 *oblongispora* B3353 and *S. vasiformis* B4078 (Chibucos
 3895 et al. 2016) available at NCBI genomes. 3896
- Sclerogone** Warcup 1990, *Endogonaceae*, *Endogonales*,
 3897 *Endogonomycetes*, *Mucoromycota*, one species, type: *S.*
 3898 *eucalypti* Warcup, in mycorrhiza, Australia, see Kirk et al.
 3899 (2013; genus accepted), Benny et al. (2016b; classifica-
 3900 tion), Desirò et al. (2017; notes, provisionally accepted as
 3901 in *Endogonaceae*), cultures and sequences are unavailable.
 3902
- Sphaeroceas** Sacc. & Ellis 1882, *Endogonaceae*, *Endog-*
 3903 *onales*, *Endogonomycetes*, *Mucoromycota*, type: *S. pub-*
 3904 *escens* Sacc. & Ellis, four species, plant related, Hirose
 3905 et al. (2014; classification), Desirò et al. (2017; phylogeny),
 3906 cultures unavailable, sequences available. 3907
- Spinellus** Tiegh. 1875, *Phycomycetaceae*, *Mucorales*,
 3908 *Mucoromycetes*, *Mucoromycota*, five species, type: *S.*
 3909 *fusiger* (Link) Tiegh., mycoparasites, worldwide, see
 3910 Hoffmann et al. (2013; phylogeny), Kirk et al. (2013; genus
 3911 accepted), Walther et al. (2013; phylogeny), Benny et al.
 3912 (2016b; classification), *S. fusiger* NRRL 22323 unpub-
 3913 lished genome at JGI portal (Grigoriev et al. 2014). 3914
- Sporodiniella** Boedijn 1959, *Rhizopodaceae*, *Mucorales*,
 3915 *Mucoromycetes*, *Mucoromycota*, one species, type: *S.*
 3916 *umbellata* Boedijn, saprobes, mild (and minor) ento-
 3917 mopathogen, worldwide, see Hoffmann et al. (2013; notes),
 3918 Kirk et al. (2013; genus accepted), Walther et al. (2013;
 3919 phylogeny), Benny et al. (2016b; classification), *S.*
 3920 *umbellata* MES 1446 unpublished genome at JGI portal
 3921 (Grigoriev et al. 2014). 3922
- Syncephalastrum** J. Schröt. 1886, *Syncephalastraceae*,
 3923 *Mucorales*, *Mucoromycetes*, *Mucoromycota*, two species,
 3924 type: *S. racemosum* Cohn ex J. Schröt., saprobes, human
 3925 pathogens worldwide, see Baradkar et al. (2008; infection),
 3926 Mathur et al. (2010; emulsification), Batista et al. (2013;
 3927 wastewater treatment), Hoffmann et al. (2013; phylogeny),
 3928 Kirk et al. (2013; genus accepted), cultures and sequences
 3929 are available, genomes available: Walther et al. (2013;
 3930 phylogeny), Huang et al. (2014; nematicide), Benny et al.
 3931 (2016b; classification), *S. racemosum* NRRL 2496 (Mondo
 3932 et al. 2017), *S. racemosum* B6101 and *S. monosporum*
 3933 B8922 (Chibucos et al. 2016) available at NCBI genomes. 3934
- Syzygites** Ehrenb. 1818 (= *Sporodinia* Link), *Rhizopo-*
 3935 *daceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, one
 3936

- 3937 species, type: *S. megalocarpus* Ehrenb., mycoparasites, 3990
 3938 saprobes, cosmopolitan, see Beyer et al. (2013; on button 3991
 3939 mushroom), Hoffmann et al. (2013; notes), Kirk et al. 3992
 3940 (2013; genus accepted), Walther et al. (2013; phylogeny), 3993
 3941 Benny et al. (2016b; classification), cultures and sequences 3994
 3942 are available. 3995
 3943 **Thamnidium** Link 1809, *Mucoraceae*, *Mucorales*, *Mu-* 3996
 3944 *coromycetes*, *Mucoromycota*, one species, type: *T. elegans* 3997
 3945 Link, saprobes, cosmopolitan, see Papanikolaou et al. 3998
 3946 (2010; lipid production), Akar et al. (2013; environmental 3999
 3947 clean-up), Hoffmann et al. (2013; notes), Kirk et al. (2013; 4000
 3948 genus accepted), Walther et al. (2013; phylogeny), Benny 4001
 3949 et al. (2016b; classification), *T. elegans* unpublished gen- 4002
 3950 ome at JGI portal (Grigoriev et al. 2014). 4003
 3951 **Thamnostylum** Arx & H.P. Upadhyay 1970, *Syncephala-* 4004
 3952 *lastraceae*, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, 4005
 3953 four species, type: *T. piriforme* (Bainier) Arx & H.P. 4006
 3954 Upadhyay, coprophilous, human pathogens, worldwide, 4007
 3955 see Xess et al. (2012; human pathogen), De Azevedo et al. 4008
 3956 (2013; coprophilous), Hoffmann et al. (2013; phylogeny), 4009
 3957 Kirk et al. (2013; genus accepted), Walther et al. (2013; 4010
 3958 phylogeny), Benny et al. (2016b; classification), cultures 4011
 3959 and sequences are available. 4012
 3960 **Thermomucor** Subrahm., B.S. Mehrotra & Thirum. 1977, 4013
 3961 *Lichtheimiaceae*, *Mucorales*, *Mucoromycetes*, *Mucoromy-* 4014
 3962 *cota*, one species, type: *T. indicae-seudaticae* Subrahm., 4015
 3963 B.S. Mehrotra & Thirum., saprobes, India, see Hoffmann 4016
 3964 et al. (2013; phylogeny), Kirk et al. (2013; genus accepted), 4017
 3965 Walther et al. (2013; phylogeny), Benny et al. (2016b; 4018
 3966 classification), *T. indicae-seudaticae* HACC 243 available 4019
 3967 at NCBI genomes. 4020
 3968 **Tortumyces** L.S. Loh 2001, *Mucoraceae*, *Mucorales*, *Mu-* 4021
 3969 *coromycetes*, *Mucoromycota*, two species, type: *T. fimicola* 4022
 3970 L.S. Loh, saprobes, Asia, see Benny et al. (2016b; classi- 4023
 3971 fication), cultures and sequences are unavailable. 4024
 3972 **Umbelopsis** Amos & H.L. Barnett 1966, *Umbelopsidaceae*, 4025
 3973 *Umbelopsis*, *Umbelopsidomycetes*, *Mucoromycota*, 16 4026
 3974 species, type: *T. versiformis* Amos & H.L. Barnett, sap- 4027
 3975 robes, in soil, worldwide, see Meeuwse et al. (2011; lipid 4028
 3976 accumulation), Ogawa et al. (2011; polyphyly), Hoffmann 4029
 3977 et al. (2013; phylogeny), Kirk et al. (2013; genus accepted), 4030
 3978 Walther et al. (2013; phylogeny), Wang et al. 4031
 3979 (2013c, 2015; new species, taxonomy), Takeda et al. 4032
 3980 (2014; genome sequence), Benny et al. (2016b; classifica- 4033
 3981 tion), Janicki et al. (2016; endocrine disruptors' degrada- 4034
 3982 tion), Crous et al. (2017; new species), cultures and 4035
 3983 sequences are available, genome available: *U. isabellina* 4036
 3984 NBRC 7784 [24578268] and B7317 (Chibucos et al. 2016) 4037
 3985 available at NCBI genomes, *U. isabellina* AD026 unpub- 4038
 3986 lished genome at JGI portal (Grigoriev et al. 2014), *U.* 4039
 3987 *ramanniana* AG unpublished genome at JGI portal (Grig- 4040
 3988 oriev et al. 2014), *Umbelopsis* sp. nov. AD052 unpublished 4041
 3989 genome at JGI portal (Grigoriev et al. 2014). 4042
- Utharomyces** Boedijn ex P.M. Kirk & Benny 1980, 3990
Pilobolaceae, *Mucorales*, *Mucoromycetes*, *Mucoromycota*, 3991
 one species and one sub-species, type: *U. epallocaulus* 3992
 Boedijn ex P.M. Kirk & Benny, saprobes, coprophilous, 3993
 cosmopolitan, see Hoffmann et al. (2013; notes), Kirk et al. 3994
 (2013; genus accepted), Walther et al. (2013; phylogeny), 3995
 Benny et al. (2016b; classification), cultures and sequences 3996
 are available. 3997
- Zychoaea** Benny & R.K. Benj. 1975, *Syncephalastraceae*, 3998
Mucorales, *Mucoromycetes*, *Mucoromycota*, one species, 3999
 type: *Z. mexicana* Benny & R.K. Benj., coprophilous, 4000
 ?human pathogens, South America, see Xess et al. (2012; 4001
 phylogeny, represent *Thamnostylum* spp.), Hoffmann et al. 4002
 (2013; phylogeny), Kirk et al. (2013; genus accepted), 4003
 Walther et al. (2013; phylogeny), Benny et al. (2016b; 4004
 classification), *Z. mexicana* RSA 1403 unpublished gen- 4005
 ome at JGI portal (Grigoriev et al. 2014). 4006
- Neocallimastigomycota** M.J. Powell 4007
 Hibbett et al. (2007) introduced *Neocallimastigomycota*, 4008
 with *Neocallimastix* Vávra & Joyon ex I.B. Heath as the 4009
 type genus. The phylum comprises anaerobic taxa (in- 4010
 cluding gut fungi, coprophilous taxa) and the phylum was 4011
 accepted in several subsequent studies since Hibbett et al. 4012
 (2007), (Griffith et al. 2010; Ligginstoffer et al. 2010; 4013
 Gruninger et al. 2014). 4014
 We accept one class, one order, three families and ten 4015
 genera in *Neocallimastigomycota*. 4016
- Notes for genera** 4017
- Anaeromyces** Breton, Bernalier, Dusser, Fonty, B. Gaillard 4018
 & J. Guillot 1990, *Anaeromycetaceae*, *Neocallimastigales*, 4019
Neocallimastigomycetes, *Neocallimastigomycota*, four 4020
 species, type: *A. mucronatus* Breton, Bernalier, Dusser, 4021
 Fonty, B. Gaillard & J. Guillot, inside animal colon, in 4022
 dung, cosmopolitan, see Kirk et al. (2013; new species, 4023
 genus accepted), Doweld (2014a; introduced *Anaeromyc-* 4024
etaceae), Li et al. (2016; new species), cultures and 4025
 sequences are available, ITS of the type culture 4026
 NR_111156.1. 4027
- Buwchfawromyces** T.M. Callaghan & G.W. Griff. 2015, 4028
Neocallimastigaceae, *Neocallimastigales*, *Neocalli-* 4029
mastigomycetes, *Neocallimastigomycota*, one species, type: 4030
B. eastonii T.M. Callaghan & G.W. Griff., from buffalo 4031
 dung, anaerobic, terrestrial, Europe, see Callaghan et al. 4032
 (2015; taxonomy), Wang et al. (2017a, b, c, d, e; phy- 4033
 logeny), cultures and sequences are available, ITS of the 4034
 type culture NR_132002. 4035
- Caecomycetes** J.J. Gold 1988, *Neocallimastigaceae*, *Neo-* 4036
callimastigales, *Neocallimastigomycetes*, *Neocalli-* 4037
mastigomycota, five species, type: *C. f equi* J.J. Gold, in 4038
 caecum animals, cosmopolitan, see Kirk (2012; new spe- 4039
 cies), Kirk et al. (2013; genus accepted), Henske et al. 4040

4041 (2018; new species), Li et al. (2016; new species), cultures
4042 and sequences are available.

4043 **Cyllamyces** Ozkose, B.J. Thomas, D.R. Davies, G.W.
4044 Griff. & Theodorou 2001, *Neocallimastigaceae*, *Neocalli-*
4045 *mastigales*, *Neocallimastigomycetes*, *Neocallimastigomy-*
4046 *cota*, one species, type: *C. aberensis* Ozkose, B.J. Thomas,
4047 D.R. Davies, G.W. Griff. & Theodorou, from cow faeces,
4048 UK, see Sridhar et al. (2014; new species), cultures and
4049 sequences are available.

4050 **Neocallimastix** Vávra & Joyon ex I.B. Heath 1983, *Neo-*
4051 *callimastigaceae*, *Neocallimastigales*, *Neocalli-*
4052 *mastigomycetes*, *Neocallimastigomycota*, seven species,
4053 type: *N. frontalis* (R.A. Braune) Vávra & Joyon ex I.B.
4054 Heath, coprophilous, in rumen of cattle, sheep, worldwide,
4055 see Kirk et al. (2013; genus accepted), Ariyawansa et al.
4056 (2015; new species), Li et al. (2016; new species), cultures
4057 and sequences are available.

4058 **Oontomyces** Dagar, Puniya & G.W. Griff. 2015, *Neocal-*
4059 *limastigaceae*, *Neocallimastigales*, *Neocalli-*
4060 *mastigomycetes*, *Neocallimastigomycota*, one species, type:
4061 *O. anksri* Dagar, Puniya & G.W. Griff., in rumen of camel,
4062 Asia, see Dagar et al. (2015; taxonomy), cultures and
4063 sequences are available, ITS of the type: NR_132022.

4064 **Orpinomyces** D.J.S. Barr, H. Kudo, Jakober & K.J. Cheng
4065 1989, *Neocallimastigaceae*, *Neocallimastigales*, *Neocalli-*
4066 *mastigomycetes*, *Neocallimastigomycota*, two species,
4067 type: *O. bovis* D.J.S. Barr, H. Kudo, Jakober & K.J. Cheng,
4068 in digestive tract of Holstein, Canada, see Kirk et al. (2013;
4069 genus accepted), cultures and sequences are available.

4070 **Pecoramycetes** Hanafy, N.H. Youssef, G.W. Griff. &
4071 Elshahed 2017, *Neocallimastigaceae*, *Neocallimastigales*,
4072 *Neocallimastigomycetes*, *Neocallimastigomycota*, one spe-
4073 cies, type: *P. ruminantium* Hanafy, N.H. Youssef, G.W.
4074 Griff. & Elshahed, USA, see Hanafy et al. (2017; taxon-
4075 omy), cultures and sequences are available, ITS of the type:
4076 NR_152323.

4077 **Piromyces** J.J. Gold, I.B. Heath & Bauchop 1988 (= *Pir-*
4078 *omonas* E. Liebet. 1910), *Neocallimastigaceae*, *Neocalli-*
4079 *mastigales*, *Neocallimastigomycetes*,
4080 *Neocallimastigomycota*, six species, type: *P. communis* J.J.
4081 Gold, I.B. Heath & Bauchop, worldwide, see Kirk (2012;
4082 new species), Kirk et al. (2013; genus accepted), Ariya-
4083 wansa et al. (2015; new species), Li et al. (2016; DNA),
4084 cultures and sequences are available.

4085 **Sphaeromonas** E. Liebet. 1910, *Sphaeromonadaceae*,
4086 *Neocallimastigales*, *Neocallimastigomycetes*, *Neocalli-*
4087 *mastigomycota*, four species, type: *S. communis* E. Liebet.,
4088 stomach of ruminant, Europe, see Kirk et al. (2013; genus
4089 accepted), cultures and sequences are unavailable.

4090 **Olpidiomycota** Doweld
4091 Doweld (2013c) introduced *Olpidiomycota* to accom-
4092 modate *Olpidiales* which was accepted in

Chytridiomycetes (Kirk et al. 2008). The members of *Ol-*
pidiomycota showed broad range of life modes as saprobes
and parasites (in algae, aquatic fungi, rotifers *vide* Kirk
et al. 2008).

We accept one class, one order, one family and four
genera in *Olpidiomycota*.

Notes for genera

Chytridhaema Moniez 1887, *Olpidiaceae*, *Olpidiales*, *Ol-*
pidiomycetes, *Olpidiomycota*, one species, type: *C. clado-*
cerarum Moniez, saprobes, Europe, see Kirk et al. (2013;
genus accepted), cultures and sequences are unavailable.

Cibdelia Juel 1925, *Olpidiaceae*, *Olpidiales*, *Olpid-*
iomycetes, *Olpidiomycota*, one species, type: *C. infestans*
Juel, Europe, see Kirk et al. (2013; genus accepted), cul-
tures and sequences are unavailable.

Leiopidium Doweld 2014, *Olpidiaceae*, *Olpidiales*, *Ol-*
pidiomycetes, *Olpidiomycota*, five species, type: *L. cucur-*
bitacearum (D.J.S. Barr & Dias) Doweld, intracellular
parasites of roots, cosmopolitan, see Doweld (2014j;
nomenclature), cultures and sequences are unavailable.

Olpidium (A. Braun) J. Schröt. 1886, *Olpidiaceae*, *Ol-*
pidiales, *Olpidiomycetes*, *Olpidiomycota*, c. 50 species,
type: *O. endogenum* (A. Br.) Schroet., parasitic, cos-
mopolitan, see Kirk et al. (2013; genus accepted), cultures
and sequences are available.

Rozellomycota Doweld

Doweld (2013d) introduced *Rozellomycota* which
mostly comprises aquatic parasites. Tedersoo et al. (2016)
accepted *Microsporidea* Corliss & Levine as a class in
Rozellomycota. However, the classification of *Rozellomy-*
cota is still poorly known thus, we follow Catalogue of Life
(2018) (<http://www.catalogueoflife.org>).

Notes for genera

Abelspora Azevedo 1987, *Abelsporidae*, *Glugeida*,
Microsporidea, *Rozellomycota*, one species, type: *A. por-*
tucalensis C. Azevedo, parasites of crabs, aquatic, South
America, see Azevedo (1987a, b; generic description),
Sprague et al. (1992; taxonomic review), sequences are
unavailable.

Acarispora Radek and Alberti 2015, *Chytridiopsidae*,
Chytridiopsida, *Microsporidea*, *Rozellomycota*, one spe-
cies, type: *I. acarivora* Larsson, M.Y. Steiner & Bjørnson,
parasites of mites, Europe, see Radek et al. (2015; taxon-
omy), sequences are unavailable.

Aedispora Kilochitskii 1997, *Amblyosporidae*, *Meiodi-*
haplophasida, *Microsporidea*, *Rozellomycota* one species,
type: *A. dorsalis* Kilochitskii, parasites of mosquitoes,
aquatic, Europe, see Kilochitskii (1997; taxonomy),
Andreadis (2007; reported on mosquito larva), sequences
are unavailable.

- 4143 **Agglomerata** Larsson & Yan 1988, *Gurleyidae*, *Glugeida*,
4144 *Microsporidea*, *Rozellomycota*, five species, type: *A. sidae*
4145 (Jirovec) Larsson & Yan, parasites of crustaceans, aquatic,
4146 worldwide, see Larsson and Yan (1988; taxonomy), Larsson
4147 et al. (1996a, b; new species), Larsson and Voronin
4148 (2000; new species), Bronnvall (2001; microscopic cytology),
4149 Ovcharenko and Wita (2001; new species), Sokolova
4150 et al. (2016; *Agglomerata cladocera* from Siberian
4151 microcrustaceans, phylogeny), sequences are available.
- 4152 **Agmasoma** Hazard & Oldacre 1975, *Mrazekiidae*, *Dissociodihaplophasida*,
4153 *Microsporidea*, *Rozellomycota*, three species, type: *A. penaei* (Sprague)
4154 Hazard & Oldacre, parasites of shrimps, aquatic, North America, see
4155 Laisutisan et al. (2009; ultrastructure), Sokolova et al. (2015;
4156 phylogeny), sequences are available.
- 4157 **Alfvenia** Larsson 1983, *Microsporidea* genera incertae
4158 sedis, *Rozellomycota*, four species, type: *A. nuda* Larsson,
4159 parasites of crustaceans, aquatic, Eurasia, see Sokolova
4160 et al. (2016; new species), sequences are available.
- 4161 **Alloglugea** Paperna & Lainson 1995, *Glugeidae*, *Glugeida*,
4162 *Haplophasea*, *Rozellomycota*, one species, type: *A. bufonis*
4163 Paperna & Lainson, parasites of fishes and amphibia,
4164 aquatic, worldwide, see Paperna and Lainson (1995a, b;
4165 taxonomy), Lom and Dyková (2005; on fishes), sequences
4166 are unavailable.
- 4167 **Amazospora** Azevedo & Matos 2003, *Glugeidae*, *Glugeida*,
4168 *Microsporidea*, *Rozellomycota*, one species, type: *A. portucalensis*
4169 C. Azevedo, parasites of fishes, aquatic, South America, Azevedo
4170 (2003a, b; taxonomy), sequences are unavailable.
- 4171 **Amblyospora** Hazard & Oldacre 1975, *Amblyosporidae*,
4172 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, c. 90
4173 species, type: *A. californica* (Kellen & Lipa) Hazard &
4174 Oldacre, parasites of mosquitoes, aquatic, worldwide, see
4175 Andreadis et al. (2012; taxonomy), Simakova (2014; phylogeny),
4176 sequences are available.
- 4177 **Ameson** Sprague 1977, *Pereziiidae*, *Meiodihaplophasida*,
4178 *Microsporidea*, *Rozellomycota*, five species, type: *A. michaelis*
4179 (Sprague) Sprague, parasites of crustaceans, aquatic, worldwide,
4180 Wang et al. (2017a, b, c, d, e; new species), sequences are available.
- 4181 **Amphiacantha** Caullery & Mesnil 1914, *Amphiacanthidae*,
4182 *Metchnikovellida*, *Rudimicrosporea*, *Rozellomycota*,
4183 two species, type: *A. longa* Caullery & Mesnil, parasites of
4184 gregarines, aquatic, Europe, see Larsson (2014a, b; notes),
4185 Paskerova et al. (2016; notes), sequences are available for
4186 unidentified species.
- 4187 **Amphiambllys** Caullery & Mesnil 1914, *Amphiacanthidae*,
4188 *Metchnikovellida*, *Rudimicrosporea*, *Rozellomycota*, two
4189 species, type: *A. capitellides* (Caullery & Mesnil) Caullery
4190 & Mesnil, parasites of gregarines, aquatic, Europe, see
4191 Larsson (2014a, b; notes), Mikhailov et al. (2016; genomic
4192 study), sequences are available for unidentified species.
- 4193 **Andreanna** Simakova, Vossbrinck & Andreadis 2008, 4196
4197 *Amblyosporidae*, *Meiodihaplophasida*, *Microsporidea*,
4198 *Rozellomycota*, one species, type: *A. caspii* Simakova, C.R.
4199 Vossbrinck & Andreadis, parasites of mosquitoes, aquatic,
4200 Asia, see Simakova et al. (2008; taxonomy), sequences are
4201 available.
- 4202 **Anisofilariata** Tokarev, Voronin, Seliverstova, Dolgikh,
4203 Pavlova, Ignatieva & Issi 2010, *Microsporidea* genera
4204 *incertae sedis*, *Rozellomycota*, one species, type: *A. chironomi*
4205 Tokarev, Voronin, Seliverstova, Dolgikh, Pavlova,
4206 Ignatieva & Issi, parasites of chironomids, aquatic, Europe,
4207 see Tokarev et al. (2010a, b, taxonomy), sequences are
4208 available.
- 4209 **Annaliia** Issi, Krylova & V.M. Nikolaeva 1993, *Tubulinosematidae*,
4210 *Microsporidea* families *incertae sedis*,
4211 *Rozellomycota*, six species, type: *A. meligethi* (Issi &
4212 Radishcheva) Issi, Krylova & V.M. Nikolaeva, parasites of
4213 insects and humans, worldwide, see Cali et al. (2010;
4214 human infection of *A. algerae*), Monaghan et al. (2011;
4215 in vitro growth of *A. algerae*), Panek et al. (2014; *A. algerae*
4216 as a parasite), Watts et al. (2014; *A. algerae* microsporidial
4217 myositis), sequences are available.
- 4218 **Anostracospora** Rode, Landes, Lievens, Flaven, Segard,
4219 Jabbour-Zahab, Michalakis, Agnew, Vivarés & Lenormand
4220 2013, *Mrazekiidae*, *Dissociodihaplophasida*, *Microsporidea*,
4221 *Rozellomycota*, one species, type: *A. rigaudi*
4222 N Rode, Landes, Lievens, Flaven, Segard, Jabbour-Zahab,
4223 Michalakis, Agnew, Vivarés & Lenormand, parasites of
4224 shrimps, aquatic, Europe, see Rode et al. (2013; taxonomy),
4225 sequences are available.
- 4226 **Antonospora** Fries, Paxton, Tengo, Slemenda, da Silva, &
4227 Pieniazek 1999, *Ovavesiculidae*, *Dissociodihaplophasida*,
4228 *Microsporidea*, *Rozellomycota*, two species, type: *A. scoticcae*
4229 Fries, Paxton, Tengo, Slemenda, da Silva, & Pieniazek,
4230 parasites of insects, worldwide, see Sokolova et al.
4231 (2010a, b; new species), sequences are available.
- 4232 **Areospora** Stentiford, Bateman, Feist, Oyarzún, Uribe,
4233 Palacios & Stone 2014, *Areosporiidae*, *Microsporidea*
4234 families *incertae sedis*, *Rozellomycota*, one species, type:
4235 *A. rohanae* Stentiford, Bateman, Feist, Oyarzún, Uribe,
4236 Palacios & Stone, parasites of king crabs, aquatic, South
4237 America, see Stentiford et al. (2014; taxonomy), Simakova
4238 et al. (2011; identification), sequences are available.
- 4239 **Auraspora** Weiser & K. Purrini 1980, *Microsporidea*
4240 genera *incertae sedis*, *Rozellomycota*, one species, type: *A. canningae*
4241 Weiser & K. Purrini, parasites of springtails,
4242 Europe, see Weiser and Purrini (1980; taxonomy),
4243 sequences are unavailable.
- 4244 **Bacillidium** Janda 1928, *Neopereziiidae*, *Microsporidea*
4245 families *incertae sedis*, *Rozellomycota*, five species, type:
4246 *B. criodrili* Janda, parasites of invertebrates, aquatic,
4247 worldwide, see Nielsen (1999) sequences are available.

- 4248 **Baculea** Loubès & Akbarieh 1978, *Microsporidea* genera
4249 *incertae sedis, Rozellomycota*, one species, type: *B. daph-*
4250 *niae* Loubès & Akbarieh, parasites of cladocerans, aquatic,
4251 Europe, see Loubès and Akbarieh (1978; taxonomy),
4252 sequences are unavailable.
- 4253 **Becnelia** Tonka & Weiser 2000, *Amblyosporidae*,
4254 *Meiodihaplophasida, Microsporidea, Rozellomycota*, one
4255 species, type: *B. sigarae* Tonka & Weiser, parasites of
4256 bugs, aquatic, Europe, see Tonka and Weiser (2000; tax-
4257 onomy), sequences are unavailable.
- 4258 **Berwaldia** Larsson 1981, *Berwaldiidae, Microsporidea*
4259 families *incertae sedis, Rozellomycota*, four species, type:
4260 *B. singularis* Larsson, parasites of crustaceans, worldwide,
4261 see Larsson (1981; taxonomy), Vávra et al. (2017; new
4262 species, biology), Simakova et al. (2018a, b; new species,
4263 taxonomy), sequences are available.
- 4264 **Binucleata** Refardt, Decaestecker, Johnson & Vávra 2008,
4265 *Gurleyidae, Glugeida, Microsporidea, Rozellomycota*, one
4266 species, type: *B. daphniae* Decaestecker, Johnson & Vávra,
4267 parasites of daphniids, aquatic, Europe, see Refardt et al.
4268 (2008; taxonomy), sequences are available.
- 4269 **Binucleospora** A.M. Bronnvall & Larsson 1995, *Cau-*
4270 *dosporidae, Dissociodihaplophasida, Microsporidea,*
4271 *Rozellomycota*, one species, type: *B. elongata* A.M.
4272 Bronnvall & Larsson, parasites of ostracods, aquatic, Eur-
4273 ope, see Stentiford et al. (2013; emergent pathogens in
4274 aquatic systems), sequences are unavailable.
- 4275 **Bohuslavia** Larsson 1985, *Thelohaniidae, Meiodihap-*
4276 *lophasida, Microsporidea, Rozellomycota*, one species,
4277 type: *B. asterias* (Weiser) Larsson, parasites of chirono-
4278 mids, aquatic, Europe, see Larsson (1985; taxonomy),
4279 sequences are unavailable.
- 4280 **Bryonosema** Canning, Refardt, Vossbrinck, Okamura &
4281 Curry 2002, *Neopereziiidae, Microsporidea* families *in-*
4282 *certae sedis, Rozellomycota, Rozellomycota*, two species,
4283 type: *B. plumatellae* Canning, Refardt, Vossbrinck, Oka-
4284 mura & Curry, parasites of bryozoans, aquatic, Europe, see
4285 Canning et al. (2002a, b, 2004; taxonomy, correction of the
4286 type species), sequences are available.
- 4287 **Burenella** Jouvenaz & Hazard 1978, *Burenellidae,*
4288 *Meiodihaplophasida, Microsporidea, Rozellomycota*, one
4289 species, type: *B. dimorpha* Jouvenaz & Hazard, parasites of
4290 ants, North America, see Jouvenaz and Hazard (1978;
4291 taxonomy), sequences are unavailable.
- 4292 **Burkea** Sprague 1977, *Burkeidae, Chytridiopsida, Mi-*
4293 *crosporidea, Rozellomycota*, two species, type: *B. gatesi*
4294 (de Puytorac & Tourret) Sprague, parasites of oligochaetes,
4295 aquatic, worldwide, see Sprague (1977a, b; taxonomy),
4296 sequences are unavailable.
- 4297 **Buxtehudea** Larsson 1980, *Buxtehudiidae, Chytridiopsida,*
4298 *Microsporidea, Rozellomycota*, one species, type: *B. sca-*
4299 *niae* Larsson, parasites of bristletails, Europe, see Larsson
(1980, 2014a, b; taxonomy, notes), sequences are
unavailable.
- Campanulospora** Issi, Radishcheva & Dolzhenko 1983,
Microsporidea genera *incertae sedis, Rozellomycota*, one
species, type: *C. denticulata* Issi, Radishcheva & Dolz-
henko, parasites of flies, Europe, see Issi et al. (1983;
taxonomy), Sokolova et al. (2018; Microsporidia described
in the Former Soviet Union and Russia in twentieth centu-
ry), sequences are unavailable.
- Canningia** Weiser Wegensteiner & Žižka 1995, *Unikary-*
onidae, Glugeida, Microsporidea, Rozellomycota, two
species, type: *C. spinidentis* Weiser, Wegensteiner &
Žižka, parasites of beetles, Europe, see Weiser et al. (1995;
taxonomy), sequences are unavailable.
- Caudospora** Weiser 1946, *Caudosporidae, Dissociodi-*
haplophasida, Microsporidea, Rozellomycota, one species,
type: *C. simulii* Weiser, parasites of blackflies, see Voss-
brinck and Debrunner-Vossbrinck (2005; phylogeny),
sequences are available.
- Caulleryetta** Dogiel 1922, *Microsporidea* genera *incertae*
sedis, Rozellomycota, one species, type: *C. mesnili* Dogiel,
parasites of gregarines, aquatic, Europe, sequences are
unavailable.
- Chapmanium** Hazard & Oldacre 1975, *Thelohaniidae,*
Meiodihaplophasida, Microsporidea, Rozellomycota, four
species, type: *C. cirritus* Hazard & Oldacre, parasites of
phantom midges, aquatic, North America, see Hazard and
Oldacre (1975; taxonomy), sequences are unavailable.
- Chytridioides** Tregouboff 1913, *Microsporidea* genera *in-*
certae sedis, Rozellomycota, one species, type: *C. schizo-*
phylli Tregouboff, parasites of millipedes, Europe,
sequences are unavailable.
- Chytridiopsis** Schneider 1884, *Chytridiopsidae, Chytrid-*
iopsida, Microsporidea, Rozellomycota, eleven species,
type: *C. socia* Schneider, parasites of insects, Europe, see
Burjanadze and Goginashvili (2009; infections on *Ips*
typographus), Takov and Pilarska (2009; infections on *Ips*
typographus), Tonka et al. (2010; development of *C.*
typographi), Larsson (2014a, b; taxonomy, notes),
sequences are unavailable.
- Ciliatosporidium** Foissner & Foissner 1995, *Mi-*
crosporidea genera *incertae sedis, Rozellomycota*, one
species, type: *C. platyophryae* I. Foissner & W. Foissner,
parasites of ciliates, aquatic, North America, see Foissner
and Foissner (1995; taxonomy), sequences are unavailable.
- Coccospora** Kudo 1925, *Thelohaniidae, Meiodihap-*
lophasida, Microsporidea, Rozellomycota, one species,
type: *C. micrococcus* (Léger & Hesse) Kudo, parasites of
chironomids, aquatic, Europe, sequences are unavailable.
- Cougourdella** Hesse 1935, *Cougourdellidae, Mi-*
crosporidea families *incertae sedis, Rozellomycota*, seven
species, type: *C. magna* Hesse, parasites of daphniids,
aquatic, worldwide, see Heilveil et al. (2001; life cycle and

- 4353 transmission), Hyliš et al. (2007; phylogeny), sequences
4354 are available.
- 4355 ***Crepidulospora*** Simakova, Pankova & Issi 2004, *Amblyosporidae*,
4356 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one species, type: *C. beklemishevi* (Simakova,
4357 Pankova & Issi) Simakova, Pankova & Issi, parasites of
4358 mosquitoes, aquatic, Asia, see Simakova et al. (2004;
4359 taxonomy), sequences are unavailable.
- 4360 ***Crispospora*** Tokarev, Voronin, Seliverstova, Pavlova &
4361 Issi 2010, *Microsporidea* genera *incertae sedis*, *Rozellomycota*, one species, type: *C. chironomi* Tokarev, Voronin,
4362 Seliverstova, Pavlova & Issi, parasites of
4363 chironomids, aquatic, Europe, see Tokarev et al. (2010a, b,
4364 taxonomy), sequences are available.
- 4365 ***Cryptosporina*** Hazard & Oldacre 1975, *Microsporidea*
4366 genera *incertae sedis*, *Rozellomycota*, one species, type: *C. brachyfila* Hazard & Oldacre, parasites of spiders, North
4367 America, sequences are unavailable.
- 4368 ***Cristulospora*** Khodzhaeva & Issi 1989, *Amblyosporidae*,
4369 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, three
4370 species, type: *C. sherbani* Khodzhaeva & Issi, parasites of
4371 blackflies, Asia, see Khodzhaeva & Issi (1989; taxonomy),
4372 sequences are unavailable.
- 4373 ***Cucumispora*** Ovcharenko, Bacela, Wilkinson, Ironside,
4374 Rigaud & Wattier 2010, *Thelohaniidae*, *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, two species,
4375 type: *C. dikerogammari* (Ovcharenko & Kurandina)
4376 Ovcharenko, Bacela, Wilkinson, Ironside, Rigaud & Wattier,
4377 parasites of crustaceans, aquatic, Europe, see
4378 Ovcharenko et al. (2010; taxonomy), Bojko et al. (2015;
4379 new species), sequences are available.
- 4380 ***Culicospora*** Weiser 1977, *Amblyosporidae*, *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, two species,
4381 type: *C. magna* (Kudo) Weiser, parasites of mosquitoes,
4382 worldwide, see Simakova (2014; comparison with other
4383 mosquito parasitic *Microsporidea*), sequences are
4384 available.
- 4385 ***Culicosporella*** Weiser 1977, *Amblyosporidae*, *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one species,
4386 type: *C. lunata* (Hazard & Savage) Hazard & Savage,
4387 parasites of insects, Europe, sequences are available.
- 4388 ***Cylindrospora*** Issi & Voronin 1986, *Cylindrosporidae*,
4389 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, two
4390 species, type: *C. chironomi* Issi & Voronin, parasites of
4391 insects, aquatic, Europe, see Sokolova et al. (2018;
4392 *Microsporidia* from USSR in twentieth Century), sequences
4393 are unavailable.
- 4394 ***Cystosporogenes*** Canning, Barker, Nicholas & Page 1984,
4395 *Microsporidea* genera *incertae sedis*, *Rozellomycota*, four
4396 species, type: *C. operophterae* (Canning) Canning, Barker,
4397 Nicholas & Page, parasites of insects, worldwide, sequences
4398 are unavailable.
- 4399 ***Dasyatispora*** Diamant, Goren, Yokes, Galil, Klopman,
4400 Huchon, Szitenberg & Karhan, 2010, *Pleistophoridae*,
4401 *Glugeida*, *Microsporidea*, *Rozellomycota*, one species,
4402 type: *D. levantinae* Diamant, Goren, Yokes, Galil, Klopman,
4403 Huchon, Szitenberg & Karhan, parasites of stringgrays,
4404 aquatic, Europe, see Diamant et al. (2010; taxonomy),
4405 sequences are available.
- 4406 ***Desmozoon*** Freeman & Sommerville 2009, *Enterocytozoonidae*, *Chytridiopsida*, *Microsporidea*, *Rozellomycota*, one species, type: *D. lepeophterii* Freeman & Sommerville, parasites of sea lice, Europe, see Freeman and Sommerville (2009, 2011; taxonomy), Matthews et al. (2013; pathology), Tokarev et al. (2016; synonymy with *Paranucleospora*), Gunnarsson et al. (2017; pathology), Weli et al. (2017; pathology), sequences are available.
- 4418 ***Desportesia*** Issi & Voronin 1986, *Metchnikovellidae*,
4419 *Metchnikovellida*, *Rudimicrosporea*, *Rozellomycota*, one
4420 species, type: *D. laubieri* (Desportes & Théodorides) Issi &
4421 Voronin, parasites of gregarines, aquatic, Europe, sequences
4422 are unavailable.
- 4423 ***Dictyocoela*** Terry, Smith, Sharpe, Rigaud, Littlewood,
4424 Ironside, Rollinson, Bouchon, MacNeil, Dick & Dunn
4425 2004, *Unikaryonidae*, *Glugeida*, *Microsporidea*, *Rozellomycota*, eight species, type: need typification, parasites of
4426 gammarids, aquatic, worldwide, see Wilkinson et al. (2011;
4427 genetic diversity), Winters and Faisal (2014; new species),
4428 sequences are available.
- 4429 ***Dimeiospora*** Simakova, Pankova & Issi 2003, *Amblyosporidae*, *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one species, type: *C. palustris* Simakova,
4430 Pankova & Issi, parasites of mosquitoes, aquatic, Asia, see
4431 Simakova et al. (2003; taxonomy), sequences are
4432 unavailable.
- 4433 ***Duboscqia*** Pérez 1908, *Duboscqiidae*, *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, eleven species,
4434 type: *D. legeri* Pérez, parasites of arthropods, Europe,
4435 sequences are unavailable.
- 4436 ***Edhazardia*** Becnel, Sprague & Fukuda 1989, *Amblyosporidae*, *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one species, type: *E. aedis* (Kudo) Becnel,
4437 Sprague & Fukuda, parasites of mosquitoes, aquatic,
4438 worldwide, see Becnel et al. (1989; taxonomy), Williams
4439 et al. (2008; genome sequencing), sequences are available.
- 4440 ***Encephalitozoon*** Levaditi, Nicolau & Schoen 1923, *Encephalitozoonidae*, *Glugeida*, *Microsporidea*, *Rozellomycota*, twelve species, type: *E. cuniculi* Levaditi, Nicolau & Schoen, parasites of insects and vertebrates, worldwide, see
4441 Levaditi et al. (1923; generic description), Wilson (1979;
4442 review), Sprague et al. (1992; taxonomic review), Vossbrinck et al. (1993; phylogeny), Didier et al. (1995; identification), Moss et al. (1999; flow cytometry), Vivarès and Méténier (2000; review on genome), Vivarès and Méténier (2001; review), Akerstedt (2002; ELISA-based detection),
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- 4458 Wolk et al. (2002; Real-time PCR), Hoffman et al. (2003; 4511
4459 populations of *E. intestinalis*), Menotti et al. (2003; real- 4512
4460 time PCR assay), Valencáková et al. (2005; diagnosis), 4513
4461 Furuya (2009; review), Corradi et al. (2010; whole gen- 4514
4462 ome), Valencakova et al. (2012; molecular identification), 4515
4463 Němejc et al. (2013; diversity), Tsukada et al. (2013; 4516
4464 parasitology), Myšková et al. (2014; in archaeological 4517
4465 material), sequences are available.
- 4466 **Endoreticulatus** Brooks, Becnel & Kennedy 1988, *Mi-* 4518
4467 *crosporidea* genera incertae sedis, *Rozellomycota*, five 4519
4468 species, type: *E. fidelis* (Hostounský & Weiser) Brooks, 4520
4469 Becnel & Kennedy, parasites of insects, worldwide, see 4521
4470 Brooks et al. (1988; generic description), Sprague et al. 4522
4471 (1992; taxonomic revision), Dong et al. (2010a, b; phy- 4523
4472 logeny), Xu et al. (2012; phylogeny), Pilarska et al. (2015; 4524
4473 taxonomic review), sequences are available.
- 4474 **Enterocytopora** Rode, Landes, Lievens, Flaven, Segard, 4525
4475 Jabbour-Zahab, Michalakis, Agnew, Vivarés & Lenormand 4526
4476 2013, *Microsporidea* genera incertae sedis, *Rozellomycota*, 4527
4477 one species, type: *E. artemiae* Rode, Landes, Lievens, 4528
4478 Flaven, Segard, Jabbour-Zahab, Michalakis, Agnew, 4529
4479 Vivarés & Lenormand, parasites of shrimps, aquatic, Eur- 4530
4480 ope, see Rode et al. (2013; taxonomy), sequences are 4531
4481 available.
- 4482 **Enterospora** Stentiford, Bateman, Longshaw & Feist 2007, 4532
4483 *Enterocytozoonidae*, *Chytridiopsida*, *Microsporidea*, 4533
4484 *Rozellomycota*, two species, type: *E. canceri* Stentiford, 4534
4485 Bateman, Longshaw & Feist, parasites of crabs, aquatic, 4535
4486 Europe, see Stentiford et al. (2017; taxonomy), Palenzuela 4536
4487 et al. (2014; new species), sequences are available.
- 4488 **Episeptum** Larsson 1986, *Gurleyidae*, *Glugeida*, *Mi-* 4537
4489 *crosporidea*, *Rozellomycota*, six species, type: *E. inversum* 4538
4490 Larsson, parasites of caddisflies, aquatic, Europe, see 4539
4491 Larsson (1986a, b; taxonomy), Hylíš et al. (2007; phy- 4540
4492 logeny), sequences are available.
- 4493 **Euplotespora** Fokin, Di Giuseppe, Erra & Dini 2008, 4541
4494 *Mrazekiidae*, *Dissociodihaplophasida*, *Microsporidea*, 4542
4495 *Rozellomycota*, one species, type: *E. binucleata* Fokin, Di 4543
4496 Giuseppe, Erra & Dini, parasites of ciliates, aquatic, Eur- 4544
4497 ope, see Fokin et al. (2008; taxonomy), sequences are 4545
4498 available.
- 4499 **Evlachovaia** Voronin 1986, *Microsporidea* genera incertae 4546
4500 sedis, *Rozellomycota*, one species, type: *E. chironomi* 4547
4501 Voronin & Issi, parasites of chironomids, aquatic, Europe, 4548
4502 see Sokolova et al. (2018; Microsporidia described from 4549
4503 USSR in twentieth century), sequences are unavailable.
- 4504 **Facilispora** Jones, Prospero-Porta & Kim 2012, *Facil-* 4550
4505 *isporidae*, *Microsporidea* families incertae sedis, *Rozel-* 4551
4506 *lomycota*, one species, type: *F. margolisi* Prospero-Porta & 4552
4507 Kim, parasites of sea lice, worldwide, see Jones et al. 4553
4508 (2012a, b; taxonomy), Poley et al. (2017; biology, reported 4554
4509 as parasites of pacific salmon louse), sequences are 4555
4510 available.
- Fibrillanosema** Slothouber Galbreath, Smith, Terry, Bec- 4556
nel, & Dunn 2004, *Berwaldiidae*, *Microsporidea* families 4557
incertae sedis, *Rozellomycota*, two species, type: *F. cran-* 4558
gonycis Slothouber Galbreath, Smith, Terry, Becnel, & 4559
Dunn, parasites of crustaceans, Europe, see Slothouber 4560
Galbreath et al. (2004; taxonomy), Simakova et al. (2018a; 4561
phylogeny), sequences are available.
- Flabelliforma** Canning, Killick-Kendrick & Killick-Ken- 4562
drick 1991, *Caudosporidae*, *Dissociodihaplophasida*, *Mi-* 4563
crosporidea, *Rozellomycota*, four species, type: *F. montana* 4564
Canning, Killick-Kendrick & Killick-Kendrick, parasites 4565
of sand flies, aquatic, Europe, see Canning et al. (1991; 4566
taxonomy), sequences are available.
- Geusia** Rühl & Korn 1979, *Microsporidea* genera incertae 4567
sedis, *Rozellomycota*, one species, type: *G. gamocystis* 4568
Rühl & Korn, parasites of mayflies, aquatic, Europe, 4569
sequences are unavailable.
- Globulispora** Vávra, Hylíš, Viala, Nebesarova 2016, *Mi-* 4570
crosporidea genera incertae sedis, *Rozellomycota*, one 4571
species, type: *G. mitoportans* Vávra, Hylíš, Viala, Nebe- 4572
sarova, parasites of daphniids, aquatic, Europe, see Vávra 4573
et al. (2016; taxonomy), sequences are available.
- Glugea** Thélohan 1891, *Glugeidae*, *Glugeida*, *Mi-* 4574
crosporidea, *Rozellomycota*, 40 species, type: *G. micro-* 4575
spora Thélohan, parasites of fishes, aquatic, worldwide, see 4576
Thélohan (1891; generic description), Voronin (1976; type 4577
description), Sprague et al. (1992; taxonomic revision), 4578
Lovy et al. (2009; new species, phylogeny), Su et al. (2014; 4579
new species, phylogeny), Abdel-Baki et al. (2015; new 4580
species, phylogeny), Azevedo et al. (2016; new species, 4581
phylogeny), sequences are available.
- Glugoides** (Chatton) Larsson, Ebert, Vávra & Voronin 4582
1996, *Microsporidea* genera incertae sedis, *Rozellomycota*, 4583
one species, type: *G. intestinalis* (Chatton) Larsson, Ebert, 4584
Vávra & Voronin, parasites of daphniids, Europe, see 4585
Larsson et al. (1996a, b; generic description), Refardt et al. 4586
(2002; phylogeny), Refardt and Ebert (2006; quantitative 4587
PCR), Refardt and Mouton (2007; phylogeny), sequences 4588
are available.
- Golbergia** Weiser 1977, *Golbergiidae*, *Dissociodihap-* 4589
lophasida, *Microsporidea*, *Rozellomycota*, one species, 4590
type: *G. spinosa* (Golberg) Weiser, parasites of insects, 4591
aquatic, Europe, sequences are unavailable.
- Gurleyides** Voronin 1986, *Microsporidea* genera incertae 4592
sedis, *Rozellomycota*, one species, type: *G. biformis* Vor- 4593
onin, parasites of crustaceans, aquatic, Europe, see Voronin 4594
(1986a, b; taxonomy), Sokolova et al. (2018; Microsporidia 4595
described from USSR in twentieth century), sequences are 4596
unavailable.
- Hamiltosporidium** Haag, Larsson, Refardt, and Ebert, 4597
2011, *Microsporidea* genera incertae sedis, *Rozellomycota*, 4598
two species, type: *H. tvaerminnensis* Haag, Larsson, 4599
4510

- 4563 Refardt, and Ebert, 2011. Parasites of daphniids, see Haag
4564 et al. (2011: taxonomy), sequences are available.
- 4565 **Hazardia** Weiser 1977, *Microsporidea* genera incertae
4566 sedis, *Rozellomycota*, two species, type: *H. milleri* (Hazard
4567 & Fukuda) Weiser, parasites of mosquitoes, aquatic,
4568 worldwide, see Simakova (2014; comparison with other
4569 mosquito parasitic *Microsporidea*), sequences are
4570 available.
- 4571 **Helmichia** Larsson 1982, *Mrazekiidae*, *Dissociodihap-*
4572 *lophasida*, *Microsporidea*, *Rozellomycota*, five species,
4573 type: *H. aggregata* Larsson, parasites of dipterans, aquatic,
4574 worldwide, see Tokarev et al. (2012; phylogeny of *H.*
4575 *lacustris*), sequences are available.
- 4576 **Hepatospora** Stentiford, Bateman, Dubuffet, Chambers &
4577 Stone 2011, *Enterocytozoonidae*, *Chytridiopsida*, *Mi-*
4578 *crosporidea*, *Rozellomycota*, one species, type: *H. eri-*
4579 *ocheir* (Wang & Chen) Stentiford, Bateman, Dubuffet,
4580 Chambers & Stone, parasites of crabs, aquatic, Asia, see
4581 Stentiford et al. (2011; taxonomy), Bateman et al. (2016;
4582 phylogeny), Ding et al. (2017, 2018; PCR assays for the
4583 detection, metabolic consequences), sequences are
4584 available.
- 4585 **Hessea** Ormières & Sprague 1973, *Hesseidae*, *Chytrid-*
4586 *iopsida*, *Microsporidea*, *Rozellomycota*, one species, type:
4587 *H. squamosa* Ormières & Sprague, parasites of gnats,
4588 France, sequences are unavailable.
- 4589 **Heterosporis** Schubert 1969, *Pleistophoridae*, *Glugeida*,
4590 *Microsporidea*, *Rozellomycota*, four species, type: *H. finki*
4591 Schubert., parasites of fishes, aquatic, worldwide, see Al-
4592 Quraishy et al. (2012; new species), Phelps et al. (2015;
4593 new species), Saleh et al. (2016a, b; in-vitro studies on
4594 antimicrobial activity of gold nanoparticles against *H.*
4595 *saurida*, in-vitro gene slicing), sequences are available.
- 4596 **Heterovesicula** Lange, Macvean, Henry & Streett 1995,
4597 *Heterovesiculidae*, *Microsporidea* families incertae sedis,
4598 *Rozellomycota*, one species, type: *H. cowani* Lange, Mac-
4599 vean, Henry & Streett, parasites of Mormon crickets,
4600 *Anabrus simplex*, North America, see Lange et al. (1995;
4601 taxonomy), Sokolova et al. (2008; phylogeny), sequences
4602 are available.
- 4603 **Hirsutosporos** Batson 1983, *Microsporidea* genera incertae
4604 sedis, *Rozellomycota*, one species, type: *H. austrosimulii*
4605 Batson, parasites of blackflies, Australasia, see Batson
4606 (1983; taxonomy), sequences are unavailable.
- 4607 **Holobispora** Voronin 1986, *Microsporidea* genera incertae
4608 sedis, *Rozellomycota*, one species, type: *H. thermocyclopi-*
4609 *s* Voronin, parasites of cyclops, aquatic, Europe, see Voronin
4610 (1986a, b; taxonomy), Sokolova et al. (2018; Microsporidia
4611 described from USSR in twentieth century), sequences are
4612 unavailable.
- 4613 **Hrabyeia** Lom & Dyková 1990, *Mrazekiidae*, *Dissociodihap-*
4614 *lophasida*, *Microsporidea*, *Rozellomycota*, one species,
4615 type: *H. xerkophora* Lom & Dyková, parasites of
oligochaetes, aquatic, Europe, see Stentiford et al. (2013;
pathogens in aquatic systems), sequences are available.
- 4616 **Hyalinocysta** Hazard & Oldacre 1975, *Amblyosporidae*,
4617 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, two
4618 species, type: *C. chapmani* Hazard & Oldacre, parasites of
4619 mosquitoes, aquatic, North America, see Hazard and Old-
4620 acre (1975; taxonomy), sequences are available.
- 4621 **Hyperspora** Stentiford, Ramilo, Abollo, Kerr, Bateman,
4622 Feist, Bass & Villalba 2017, *Thelohaniidae*, *Meiodihap-*
4623 *lophasida*, *Microsporidea*, *Rozellomycota*, one species,
4624 type: *H. aquatica* Stentiford, Ramilo, Abollo, Kerr, Bate-
4625 man, Feist, Bass & Villalba, parasites of paramyxids,
4626 aquatic, Europe, see Stentiford et al. (2017; taxonomy),
4627 sequences are available.
- 4628 **Ichthyosporidium** Caullery & Mesnil 1905, *Glugeidae*,
4629 *Glugeida*, *Microsporidea*, *Rozellomycota*, five species,
4630 type: *I. giganteum* (Thélohan) Swarczewsky, parasites of
4631 fishes, aquatic, worldwide, see Verma (2008; diagnosis,
4632 treatment), Sanders et al. (2012; new species), sequences
4633 are available.
- 4634 **Inodosporus** Overstreet & Weidner 1974, *Spragueidae*,
4635 *Dissociodihaplophasida*, *Microsporidea*, *Rozellomycota*,
4636 two species, type: *C. spraguei* Overstreet & Weidner,
4637 parasites of crustaceans, aquatic, worldwide, see Overstreet
4638 and Weidner (1974; taxonomy), Stentiford et al. (2018;
4639 trophic transfer, synonymy with *Kabatana*), sequences are
4640 available.
- 4641 **Intexta** Larsson, Steiner & Bjørnson 1997, *Chytridiopsi-*
4642 *dae*, *Chytridiopsida*, *Microsporidea*, *Rozellomycota*, one
4643 species, type: *I. acarivora* Larsson, Steiner & Bjørnson,
4644 parasites of mites, Europe, see Larsson et al. (1997a, b;
4645 taxonomy), Larsson (2014a, b; taxonomy, notes), Radek
4646 et al. (2015; compare with *Acarispora*), sequences are
4647 unavailable.
- 4648 **Intrapredatorus** Chen, Kuo & Wu 1998, *Amblyosporidae*,
4649 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, two
4650 species, type: *I. barri* Chen, Kuo & Wu, parasites of
4651 mosquitoes, Asia, see Chen et al. (1998; taxonomy),
4652 sequences are available.
- 4653 **Issia** Weiser 1977, *Microsporidea* genera incertae sedis,
4654 *Rozellomycota*, three species, type: *I. trichopterae* (Weiser)
4655 Weiser, parasites of caddisflies, aquatic, Europe, see Wei-
4656 ser (1977; taxonomy), Sokolova et al. (2018; Microsporidia
4657 described in the Former Soviet Union and Russia in
4658 twentieth century), sequences are unavailable.
- 4659 **Janacekia** Larsson 1983, *Microsporidea* genera incertae
4660 sedis, *Rozellomycota*, six species, type: *J. debaisieuxi*
4661 (Jírovec) Larsson, parasites of insects, Europe, see Larsson
4662 (1983; taxonomy), sequences are available.
- 4663 **Jirovecia** Weiser 1977, *Mrazekiidae*, *Dissociodihap-*
4664 *lophasida*, *Microsporidea*, *Rozellomycota*, seven species,
4665 type: *J. caudata* (L. Léger & Hesse) Weiser, parasites of
4666 invertebrates, Europe, sequences are unavailable.

- 4669 **Jiroveciana** Larsson 1981, *Buxtehudiidae*, *Chytridiopsida*,
4670 *Microsporidea*, *Rozellomycota*, one species, type: *J. lim-*
4671 *nodrili* (Jírovec) Larsson, parasites of oligochaetes, Eur-
4672 ope, sequences are unavailable.
- 4673 **Johenrea** Lange, Becnel, Razafindratiana, Przybyszewski
4674 & Razafindrafara 1996, *Glugeidae*, *Glugeida*, *Micro-*
4675 *sporidea*, *Rozellomycota*, one species, type: *J. locustae*
4676 Lange, Becnel, Razafindratiana, Przybyszewski &
4677 Razafindrafara, parasites of locusts, Africa, see Lange et al.
4678 (1996; generic description), sequences are unavailable.
- 4679 **Kabatana** Lom, Dyková & Tonguthai 2000, *Spragueidae*,
4680 *Dissociodihaplophasida*, *Microsporidea*, *Rozellomycota*,
4681 four species, type: *K. arthuri* Lom, Dyková & Tonguthai,
4682 parasites of fishes, aquatic, worldwide, sequences are
4683 available.
- 4684 **Kinorhynchospora** Adrianov & Rybakov 1991, *Micro-*
4685 *sporidea* genera *incertae sedis*, *Rozellomycota*, one
4686 species, type: *K. japonica* Adrianov & Rybakov, parasites
4687 of fishes, aquatic, Asia, see Adrianov and Rybakov (1991;
4688 taxonomy), sequences are unavailable.
- 4689 **Kneallhazia** Y.Y. Sokolova & Fuxa 2008 *Tubulinose-*
4690 *matidae*, *Microsporidea* families *incertae sedis*, *Rozel-*
4691 *lomycota*, two species, type: *K. solenopsae* (J.D. Knell,
4692 G.E. Allen & Hazard) Y.Y. Sokolova & Fuxa, parasites of
4693 ants, North America, see Sokolova and Fuxa (2008; tax-
4694 onomy), Oi et al. (2009; decapitating flies as vectors),
4695 Ascunce et al. (2010; molecular diversity), Valles et al.
4696 (2011; new species), sequences are available.
- 4697 **Krishtalia** Kilochitskii 1997, *Golbergiidae*, *Dissociodi-*
4698 *haplophasida*, *Microsporidea*, *Rozellomycota*, one species,
4699 type: *K. pipiens* Kilochitskii, parasites of mosquitoes,
4700 aquatic, Europe, see Kilochitskii (1997; taxonomy),
4701 Andreadis (2007; as biological control agent of mosqui-
4702 toes), sequences are unavailable.
- 4703 **Lanatospora** Voronin 1986, *Gurleyidae*, *Glugeida*, *Micro-*
4704 *sporidea*, *Rozellomycota*, four species, type: *L. macro-*
4705 *cyclopis* (Voronin) Voronin, parasites of crustaceans,
4706 aquatic, Europe, see Voronin (1986a, b; taxonomy), Vávra
4707 et al. (2016; new species), sequences are available.
- 4708 **Larssonia** Vidtmann & Sokolova 1994, *Gurleyidae*, *Gluge-*
4709 *ida*, *Microsporidea*, *Rozellomycota*, two species, type: *L.*
4710 *obtusa* (Moniez) Vidtmann & Sokolova, parasites of
4711 daphniids, aquatic, Europe, see Vidtmann and Sokolova
4712 (1994; taxonomy), sequences are available.
- 4713 **Larssoniella** Weiser & David 1997, *Unikaryonidae*, *Gluge-*
4714 *ida*, *Microsporidea*, *Rozellomycota*, two species, type: *L.*
4715 *resinellae* Weiser & David, parasites of insects, Europe,
4716 see Weiser and David (1997; taxonomy), Lukášová and
4717 Holuša (2013; host specificity of *L. duplicati*), sequences
4718 are unavailable.
- 4719 **Liebermannia** Sokolova, Lange & Fuxa 2006, *Micro-*
4720 *sporidea* genera *incertae sedis*, *Rozellomycota*, three
4721 species, type: *L. patagonica* Sokolova, Lange & Fuxa,
parasites of orthopterans, South America, see Sokolova
et al. (2009; new species), sequences are available.
- Loma** Morrison & Sprague (1981), *Glugeidae*, *Glugeida*,
Microsporidea, *Rozellomycota*, twelve species, type: *L.*
branchialis (Nemeczek) Morrison & Sprague, parasites of
fishes, aquatic, worldwide, see Morrison and Sprague
(1981; generic description), Sprague et al. (1992; tax-
onomic revision), Casal et al. (2009; new species), Brown
et al. (2010; new species, phylogeny, species boundaries),
sequences are available.
- Mariona** Stempel 1909, *Microsporidea* genera *incertae*
sedis, *Rozellomycota*, one species, type: *M. marionis*
(Thélohan, 1895) Stempel, parasites of myxosporeans,
aquatic, Europe, sequences are unavailable.
- Marssoniella** Lemmermann 1900, *Gurleyidae*, *Glugeida*,
Microsporidea, *Rozellomycota*, one species, type: *M. ele-*
gans Lemmermann, parasites of cyclops, aquatic, Europe,
see Dong et al. (2010a, b; phylogeny), González-Tortuero
et al. (2016; compare with *Daphnia*), sequences are
available.
- Merocinta** Pell & Canning 1993, *Microsporidea* genera
incertae sedis, *Rozellomycota*, one species, type: *M. davidii*
Pell & Canning, parasites of mosquitoes, aquatic, Africa,
see Pell and Canning (1993; taxonomy), sequences are
unavailable.
- Metchnikovella** Caullery & Mesnil 1897, *Metchnikovelli-*
dae, *Metchnikovellida*, *Rudimicrosporea*, *Rozellomycota*,
21 species, type: *M. spionis* Caullery & Mesnil, parasites of
gregarines, worldwide, see Sokolova et al. (2013, 2014;
fine structure of *Metchnikovella incurvata*, new species),
sequences are unavailable.
- Microfilum** Faye, Toguebaye & Bouix 1991, *Microfilidae*,
Glugeida, *Microsporidea*, *Rozellomycota*, one species,
type: *M. lutjani* Faye, Toguebaye & Bouix, parasites of
fishes, aquatic, Europe, see Faye et al. (1991; taxonomy),
sequences are unavailable.
- Microgemma** Ralphs & Matthews 1986, *Spragueidae*,
Dissociodihaplophasida, *Microsporidea*, *Rozellomycota*,
six species, type: *M. hepaticus* Ralphs & Matthews, para-
sites of fishes, aquatic, worldwide, see Ralphs and Mat-
thews (1986; generic description), Sprague et al. (1992;
taxonomic review), Amigó et al. (1996; reassignment of
the genus), Pomport-Castillon et al. (1997; ribotyping),
Leiro et al. (1999; new combination, phylogeny), Cheney
et al. (2000; phylogeny), Canning et al. (2005; new spe-
cies), Mansour et al. (2005; new species), Casal et al.
(2012; new species, phylogeny), sequences are available.
- Microsporidiopsis** Schereschewsky 1925, *Metchnikovelli-*
dae, *Metchnikovellida*, *Rudimicrosporea*, *Rozellomycota*,
one species, type: *M. nereidis* Schereschewsky, parasites of
gregarines, aquatic, Europe, sequences are unavailable.
- Microsporidium** Balbiani 1884, *Microsporidea* genera *in-*
certae sedis, *Rozellomycota*, 118 species epithets are listed

- 4775 in Index Fungorum (2018), type: need typification, para- 4828
 4776 sites of animals, worldwide, sequences are available. 4829
 4777 **Mitoplastophora** Codreanu 1966, *Duboscqiidae*, *Meiodi-* 4830
 4778 *haplophasida*, *Microsporidea*, *Rozellomycota*, one species, 4831
 4779 type: *M. angularis* Codreanu, parasites of mayflies, aquatic, 4832
 4780 worldwide, sequences are unavailable. 4833
 4781 **Mitosporidium** Haag, James, Pombert, Larsson, Schaer, 4834
 4782 Refardt & Ebert 2014, *Rozellomycota*, genera *incertae* 4835
 4783 *sedis*, one species, type: *M. daphniae* Haag, James, Pom- 4836
 4784 bert, Larsson, Schaer, Refardt & Ebert, parasites of daph- 4837
 4785 niids, aquatic, Europe, see Haag et al. (2014; taxonomy), 4838
 4786 Corsaro et al. (2016; phylogeny), sequences are available. 4839
 4787 **Mockfordia** Sokolova, Sokolov & Carlton 2010, *En-* 4840
 4788 *cephalitozoonidae*, *Glugeida*, *Microsporidea*, *Rozellomy-* 4841
 4789 *cota*, one species, type: *M. xanthocaeciliae* Sokolova, 4842
 4790 Sokolov & Carlton, parasites of bark lice, North America, 4843
 4791 see Sokolova et al. (2010a, b; generic description), 4844
 4792 sequences are available. 4845
 4793 **Mrazekia** Léger & Hesse 1916, *Mrazekiidae*, *Dissociodi-* 4846
 4794 *haplophasida*, *Microsporidea*, *Rozellomycota*, 17 species, 4847
 4795 type: *M. argoisi* Léger and Hesse, parasites of crustaceans, 4848
 4796 aquatic, worldwide, see Issi et al. (2010; new species), 4849
 4797 sequences are available. 4850
 4798 **Multilamina** Becnel, Scheffrahn, Vossbrinck & Bahder, 4851
 4799 2013, *Microsporidea* genera *incertae sedis*, *Rozellomycota*, 4852
 4800 one species, type: *M. teevani* Becnel, Scheffrahn, Voss- 4853
 4801 brinck & Bahder, parasites of termites, South America, see 4854
 4802 Becnel et al. (2013; taxonomy), sequences are available. 4855
 4803 **Myospora** Stentiford, Bateman, Small, Moss, Shields, 4856
 4804 Reece & Tuck 2010, *Myosporidae*, *Microsporidea* genera 4857
 4805 *incertae sedis*, *Rozellomycota*, one species, type: *M.* 4858
 4806 *metanephrops* Stentiford, Bateman, Small, Moss, Shields, 4859
 4807 Reece & Tuck, parasites of lobsters, aquatic, Australasia, 4860
 4808 see Stentiford et al. (2010; taxonomy), sequences are 4861
 4809 available. 4862
 4810 **Myosporidium** Baquero, Rubio, Moura, Pieniazek & Jor- 4863
 4811 dana 2005, *Pleistophoridae*, *Glugeida*, *Microsporidea*, 4864
 4812 *Rozellomycota*, one species, type: Baquero, Rubio, Moura, 4865
 4813 Pieniazek & Jordana, parasite of fishes, aquatic, Africa, see 4866
 4814 Baquero et al. (2005; taxonomy), sequences are available. 4867
 4815 **Myrmecomorba** Plowes, Becnel, LeBrun, Oi, Valles, 4868
 4816 Jones, & Gilbert 2015, *Caudosporidae*, *Dissociodihap-* 4869
 4817 *lophasida*, *Microsporidea*, *Rozellomycota*, one species, 4870
 4818 type: *M. nylanderiae* Plowes, Becnel, LeBrun, Oi, Valles, 4871
 4819 Jones, & Gilbert, parasites of ants, North America, see 4872
 4820 Plowes et al. (2015; taxonomy), sequences are available. 4873
 4821 **Myxocystis** Mrazek, 1897, *Microsporidea* genera *incertae* 4874
 4822 *sedis*, *Rozellomycota*, one species, type: *M. ciliata* Mrazek, 4875
 4823 1897, parasites of oligochaetes, aquatic, Europe, sequences 4876
 4824 are unavailable. 4877
 4825 **Nadelspora** Olson, Tiekotter & Reno 1994, *Pereziiidae*, 4878
 4826 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one 4879
 4827 species, type: *N. canceri* Olson, Tiekotter & Reno, 4828
 parasites of crabs, aquatic, North America, see Olson et al. 4829
 (1994; taxonomy), sequences are available. 4830
Napamichum Larsson 1990, *Thelohaniidae*, *Meiodihap-* 4831
lophasida, *Microsporidea*, *Rozellomycota*, three species, 4832
 type: *N. dispersum* (Larsson) Larsson, parasites of chi- 4833
 ronomids, aquatic, Europe, see Larsson (1990a; taxonomy), 4834
 sequences are unavailable. 4835
Nelliemelba Larsson 1983, *Tuzetiidae*, *Glugeida*, *Mi-* 4836
crosporidea, *Rozellomycota*, one species, type: *L. boeck-* 4837
ella (Milner & J.A. Mayer) Larsson, parasites of copepods, 4838
 aquatic, worldwide, see Larsson (1983; taxonomy), 4839
 sequences are unavailable. 4840
Nematocinator Sapir, Dillman, Connon, Grupe, Ingels, 4841
 Mundo-Ocampo, Levin, Bladwin, Orphan & Sternberg 4842
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 one species, type: *N. marisprofundi* Sapir, Dillman, Con- 4844
 non, Grupe, Ingels, Mundo-Ocampo, Levin, Bladwin, 4845
 Orphan & Sternberg, parasites of nematodes, aquatic, 4846
 North America, see Sapir et al. (2014; taxonomy, ecology), 4847
 sequences are available. 4848
Nematocida Troemel, Félix, Whiteman, Barrière & 4849
 Ausubel 2008, *Microsporidea* genera *incertae sedis*, 4850
Rozellomycota, one species, type: *N. parisii* Troemel, 4851
 Félix, Whiteman, Barrière & Ausubel, parasites of nema- 4852
 todes, Europe, see Haag et al. (2014; taxonomy), Corsaro 4853
 et al. (2016; phylogeny), sequences are available. 4854
Neoflabelliforma Morris & Freeman 2010, *Caudosporidae*, 4855
Dissociodihaplophasida, *Microsporidea*, *Rozellomycota*, 4856
 two species: type: *N. aurantiae* Morris & Freeman, para- 4857
 sites of myxosporeans and oligochaetes, aquatic, Europe, 4858
 sequences are available. 4859
Neonosemoides Faye & Toguebaye 1992, *Neonosemoidi-* 4860
idae, *Microsporidea* families *incertae sedis*, *Rozellomy-* 4861
cota, four species, type: *N. tilapiae* (Sakiti & Bouix) Faye 4862
 & Toguebaye, parasites of fishes, worldwide, see Faye 4863
 et al. (1996; taxonomy), Reda (2010; reported from Egypt), 4864
 sequences are unavailable. 4865
Neoperezia Issi & Voronin 1979, *Neopereziiidae*, *Mi-* 4866
crosporidea families *incertae sedis*, *Rozellomycota*, two 4867
 species, type: *N. chironomi* Issi & Voronin, parasites of 4868
 chironomids, Europe, see Issi et al. (2012; taxonomy, 4869
 synonymy with *Semenovaia*), sequences are available. 4870
Nolleria Beard, Butler & Becnel 1990, *Chytridiopsidae*, 4871
Chytridiopsida, *Microsporidea*, *Rozellomycota*, one spe- 4872
 cies, type: *N. pulicis* C Beard, Butler & Becnel, parasites of 4873
 fleas, North America, see Larsson (2014a, b; taxonomy, 4874
 notes), Radek et al. (2015; compare with *Acarispora*), 4875
 sequences are unavailable. 4876
Norlevinea Vávra 1984, *Gurleyidae*, *Glugeida*, *Mi-* 4877
crosporidea, *Rozellomycota*, one species, type: *N. daph-* 4878
niae (Weiser) Vávra, parasites of daphniids, aquatic, 4879
 Europe, see Vávra (1984; taxonomy), Stentiford et al.

- 4880 (2013; pathogens in aquatic systems), sequences are
4881 unavailable.
- 4882 **Nosema** Nägeli 1857, *Nosematidae*, *Dissociodihap-*
4883 *lophasida*, *Microsporidea*, *Rozellomycota*, 20 species,
4884 type: *N. bombycis* Nägeli, parasites of insects, worldwide,
4885 see Iwano and Ishihara (1991: dimorphic development),
4886 Baker et al. (1994: relationships with *Vairimorpha*), Ni
4887 et al. (1995: new species), Kyei-Poku et al. (2008, 2012:
4888 molecular data and phylogeny), Kyei-Poku and Sokolova
4889 (2017: spore dimorphism), Tokarev et al. (2016: species
4890 redefinition), Hopper et al. (1996: pathogenicity), Hajek
4891 et al. (2018: new species from bugs), Grushevaya et al.
4892 (2018: spore dimorphism), sequences are available.
- 4893 **Nosemoides** Vinckier 1975, *Microsporidea* genera *incertae*
4894 *sedis*, *Rozellomycota*, five species, type: *N. vivieri*
4895 (Vinckier, Devauchelle & Prensier) Vinckier, parasites of
4896 gregarines, aquatic, Europe, see Vinckier (1975; taxon-
4897 omy), sequences are unavailable.
- 4898 **Novothelohania** Andreadis, Simakova, Vossbrinck, Shep-
4899 ard & Yurchenko, 2012. *Amblyosporidae*, *Meiodihap-*
4900 *lophasida*, *Microsporidea*, *Rozellomycota*, one species,
4901 type: *N. ovalae* Andreadis, Simakova, Vossbrinck, Shepard
4902 & Yurchenko, parasites of mosquitoes, aquatic, Asia, see
4903 Andreadis et al. (2012: taxonomy), sequences are available.
- 4904 **Nucleospora** Hedrick, Groff & Baxa 1991, *Enterocyto-*
4905 *zoonidae*, *Chytridiopsida*, *Microsporidea*, *Rozellomycota*,
4906 three species, type: *N. salmonis* Hedrick, Groff & Baxa,
4907 parasites of fishes, worldwide, see Foltz et al. (2009;
4908 detection in in steelhead trout, *Oncorhynchus mykiss*),
4909 Sakai et al. (2009; in cutthroat trout (*Oncorhynchus clarki*)
4910 and rainbow trout (*Oncorhynchus mykiss*), Freeman and
4911 Kristmundsson (2013; infecting the Atlantic lumpfish
4912 (*Cyclopterus lumpus*), Freeman et al. (2013; new species),
4913 Alarcón et al. (2016; infection in farmed lumpfish, *Cy-*
4914 *clopterus lumpus*), sequences are available.
- 4915 **Nudispora** Larsson 1990, *Thelohaniidae*, *Meiodihap-*
4916 *lophasida*, *Microsporidea*, *Rozellomycota*, one species,
4917 type: *N. biformis* Larsson, parasites of dragonflies, Europe,
4918 see Larsson (1990b; taxonomy), sequences are unavailable.
- 4919 **Obruspora** Diamant, Rothman, Goren, Galil, Yokes,
4920 Szitenberg & Huchon 2014. *Enterocytozoonidae*, *Chytrid-*
4921 *iopsida*, *Microsporidea*, *Rozellomycota*, one species, type:
4922 *O. papernae* Diamant, Rothman, Goren, Galil, Yokes,
4923 Szitenberg & Huchon, parasites of fishes, aquatic, Europe,
4924 see Diamant et al. (2010: taxonomy), sequences are
4925 available.
- 4926 **Octosporea** Flu 1911, *Caudosporidae*, *Dissociodihap-*
4927 *lophasida*, *Microsporidea*, *Rozellomycota*, 18 species,
4928 type: *O. muscaedomesticae* Flu, parasites of daphniids,
4929 aquatic, worldwide, see Roth et al. (2008; parasites of
4930 *Daphnia magna*), Corradi et al. (2009; genome study of *O.*
4931 *bayeri*), Vossbrinck et al. (2010; phylogeny), sequences are
4932 available.
- Octotetraspora** Issi, Kadyrova, Pushkar, Khodzhaeva &
Krylova 1990, *Thelohaniidae*, *Meiodihaplophasida*, *Mi-*
crosporidea, *Rozellomycota*, one species, type: *O. para-*
doxa Issi, Kadyrova, Pushkar, Khodzhaeva & Krylova,
parasites of blackflies, Asia, sequences are unavailable.
- Oligosporidium** Codreanu-Balcescu, Codreanu & Traciuc
1981, *Nosematidae*, *Dissociodihaplophasida*, *Mi-*
crosporidea, *Rozellomycota*, two species, type: *O. arach-*
nicolum (Codreanu-Bălcescu, Codreanu, & Traciuc)
Codreanu-Bălcescu, Codreanu, and Traciuc, parasites of
spiders and mites, worldwide, see Codreanu-Bălcescu et al.
(1981; taxonomy), Becnel et al. (2002; parasites of mites),
sequences are available.
- Ordospora** Larsson, Ebert & Vávra 1997, *Ordosporidae*,
Microsporidea families *incertae sedis*, *Rozellomycota*, two
species, type: *O. colligata* Larsson, Ebert & Vávra, para-
sites of crustaceans, aquatic, worldwide, see Larsson et al.
(1997a, b; taxonomy), Pombert et al. (2015; genome
study), sequences are available.
- Ormieresia** Vivarès, Bouix & Manier 1977, *Thelohaniidae*,
Meiodihaplophasida, *Microsporidea*, *Rozellomycota*, one
species, type: *O. carcini* Vivarès, Bouix & Manier, para-
sites of crabs, aquatic, Europe, see Vivarès et al. (1977;
taxonomy), sequences are unavailable.
- Orthosomella** Canning, Wigley & Barker 1991, *Mi-*
crosporidea genera *incertae sedis*, *Rozellomycota*, three
species, type: *O. operophtherae* (Canning) Canning, Wigley
& Barker, parasites of insects, Europe, see Ovcharenko
et al. (2013; new species), sequences are available.
- Orthothelohania** Codreanu & Codreanu-Balcescu 1974,
Thelohaniidae, *Meiodihaplophasida*, *Microsporidea*,
Rozellomycota, one species, type: *O. octospora* (Hen-
neguy) Codreanu & Codreanu-Balcescu, parasites of
prawns, aquatic, Europe, see Codreanu et al. (1974),
sequences are unavailable.
- Ovavesicula** Andreadis & Hanula 1987, *Ovavesiculidae*,
Dissociodihaplophasida, *Microsporidea*, *Rozellomycota*,
one species, type: *O. popilliae* Andreadis & Hanula, para-
sites of grubs, North America), see Andreadis and Hanula
(1987; taxonomy), Sprague et al. (1992; taxonomic
review), Vossbrinck and Andreadis (2007; phylogeny),
sequences are available.
- Ovipleistophora** Pekkarinen, Lom & Nilsen 2002,
Pleistophoridae, *Glugeida*, *Microsporidea*, *Rozellomycota*,
two species, type: *O. mirandellae* (Vaney & Conte)
Pekkarinen, Lom & Nilsen, parasites of fishes, Europe, see
Pekkarinen et al. (2002; taxonomy), Phelps and Goodwin
(2008; vertical transmission), sequences are available.
- Pankovaia** Simakova, Tokarev & Issi 2009, *Tuzetidae*,
Glugeida, *Microsporidea*, *Rozellomycota*, one species,
type: *P. semitubulata* Simakova, Tokarev & Issi, parasites
of mayflies, aquatic, Asia, see Simakova et al. (2009a, b;
taxonomy), sequences are unavailable.

- 4986 **Paradoxium** Stentiford, Ross, Kerr, Bass & Bateman 2015, 5039
 4987 *Thelohaniidae*, *Meiodihaplophasida*, *Microsporidea*, 5040
 4988 *Rozellomycota*, one species, type: *P. irvingi* Stentiford, 5041
 4989 Ross, Kerr, Bass & Bateman, parasites of shrimps, aquatic, 5042
 4990 Europe, see Stentiford et al. (2015; taxonomy), sequences 5043
 4991 are available. 5044
 4992 **Paraepiseptum** Hylíš, Oborník, Nebesářová & Vávra 2007, 5045
 4993 *Gurleyidae*, *Glugeida*, *Microsporidea*, *Rozellomycota*, four 5046
 4994 species, type: *P. plectrocnemiae* Hylíš, Oborník, Nebesář- 5047
 4995 ová & Vávra, parasites of insects, aquatic, Europe, see 5048
 4996 Hylíš et al. (2007, 2013; taxonomy, host taxa), sequences 5049
 4997 are available. 5050
 4998 **Paramicrosporidium** Corsaro, Walochnik, Venditti, 5051
 4999 Steinmann, Müller & Michel 2014, *Rozellomycota*, genera 5052
 5000 *incertae sedis*, two species, type: *P. saccamoebae* Corsaro, 5053
 5001 Walochnik, Venditti, Steinmann, Müller & Michel, parasites 5054
 5002 of amoebae, aquatic, Europe, see Corsaro et al. (2014; 5055
 5003 taxonomy), Quandt et al. (2017; genome study), sequences 5056
 5004 are available. 5057
 5005 **Paranosema** Sokolova, Dolgikh, Morzhina, Nasonova, 5058
 5006 Issi, Terry, Ironside, Smith & Vossbrinck 2003, *Ovavesi-* 5059
 5007 *culidae*, *Dissociodihaplophasida*, *Microsporidea*, *Rozel-* 5060
 5008 *lomycota*, four species, type: *P. grylli* (Sokolova, 5061
 5009 Seleznirov, Dolgikh & Issi) Sokolova, Dolgikh, Morzhina, 5062
 5010 Nasonova, Issi, Terry, Ironside, Smith & Vossbrinck, 5063
 5011 parasites of insects, worldwide, see Lange and Azzaro 5064
 5012 (2008; persistence), Shi et al. (2009; parasites of 5065
 5013 grasshoppers), Senderskiy et al. (2014; protein secretion in 5066
 5014 to host cells), Chen et al. (2017; novel wall protein), Pyle 5067
 5015 et al. (2017; Amalga-like virus), sequences are available. 5068
 5016 **Paranucleospora** Nylund, Watanabe, Nylund, Sævareid, 5069
 5017 Erik Arnesen & Karlsbakk 2009, *Enterocytozoonidae*, 5070
 5018 *Chytridiopsida*, *Microsporidea*, *Rozellomycota*, three spe- 5071
 5019 cies, type: *N. theridion* Nylund, Watanabe, Nylund, 5072
 5020 Sævareid, Erik Arnesen & Karlsbakk, parasites of sea lice 5073
 5021 and fishes, aquatic, worldwide, see Nylund et al. 5074
 5022 (2010, 2011; taxonomy), Sveen et al. (2012; infection 5075
 5023 dynamics), sequences are available. 5076
 5024 **Parapleistophora** Issi, Kadyrova, Pushkar, Khodzhaeva & 5077
 5025 Krylova 1990, *Glugeidae*, *Glugeida*, *Microsporidea*, 5078
 5026 *Rozellomycota*, one species, type: *P. ectospora* Issi, 5079
 5027 Kadyrova, Pushkar, Khodzhaeva & Krylova, parasites of 5080
 5028 blackflies, Asia, see Issi et al. (1990; generic description), 5081
 5029 Sokolova et al. (2018; taxonomic revision), sequences are 5082
 5030 unavailable. 5083
 5031 **Parastempellia** Khodzhaeva 1988, *Amblysporidae*, 5084
 5032 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, two 5085
 5033 species, type: *P. odagmiae* Khodzhaeva, parasites of 5086
 5034 blackflies, Asia, see Sokolova et al. (1998; taxonomy), 5087
 5035 sequences are unavailable. 5088
 5036 **Parathelohania** Codreanu 1966, *Amblysporidae*, 5089
 5037 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, 25 5090
 5038 species, type: *P. legeri* (Hesse) Codreanu, parasites of 5091
 mosquitoes, worldwide, see Codreanu (1966; taxonomy), 5039
 Simakova et al. (2014, phylogeny), sequences are 5040
 available. 5041
Paratuzetia Poddubnaya, Tokarev & Issi 2006, *Tuzetiidae*, 5042
Glugeida, *Microsporidea*, *Rozellomycota*, one species, 5043
 type: *P. kupermani* Poddubnaya, Tokarev & Issi, parasites 5044
 of cestodes, aquatic, Europe, see Poddubnaya et al. (2006; 5045
 taxonomy), sequences are unavailable. 5046
Pegmatheca Hazard & Oldacre 1975, *Thelohaniidae*, 5047
Meiodihaplophasida, *Microsporidea*, *Rozellomycota*, two 5048
 species, type: *P. simulii* Hazard & Oldacre, parasites of 5049
 blackflies, aquatic, North America, see Hazard and Oldacre 5050
 (1975; taxonomy), sequences are unavailable. 5051
Perezia Léger & Duboscq 1909, *Pereziiidae*, *Meiodihap-* 5052
lophasida, *Microsporidea*, *Rozellomycota*, twelve species, 5053
 type: *P. lankesteriae* L. Léger & Duboscq, parasites of 5054
 gregarines and crustaceans, aquatic, worldwide, see Can- 5055
 ning et al. (2002a, b; ultrastructure), Stentiford et al. (2010; 5056
 taxonomy), sequences are available. 5057
Pernicivesicula Bylén & Larsson 1994, *Pereziiidae*, 5058
Meiodihaplophasida, *Microsporidea*, *Rozellomycota*, one 5059
 species, type: *P. gracilis* E.K.C. Bylén & Larsson, parasites 5060
 of chironomids, aquatic, Europe, see Bylén and Larsson 5061
 (1994; taxonomy), sequences are unavailable. 5062
Pilosorella Hazard & Oldacre 1975, *Burenellidae*, 5063
Meiodihaplophasida, *Microsporidea*, *Rozellomycota*, two 5064
 species, type: *P. fishi* Hazard & Oldacre, parasites of 5065
 insects, North America, see Hazard and Oldacre (1975; 5066
 taxonomy), sequences are unavailable. 5067
Pleistophora Gurley 1893, *Pleistophoridae*, *Glugeida*, 5068
Microsporidea, *Rozellomycota*, c. 10 species, type: *P.* 5069
typicalis Gurley, parasites of fishes, aquatic, worldwide, 5070
 see Canning and Hazard (1982: genus redefinition), San- 5071
 ders et al. (2010; infecting zebrafish), sequences are 5072
 available. 5073
Pleistosporidium Codreanu-Balcescu and Codreanu 1982, 5074
Pleistosporidiidae, *Microsporidea* families *incertae sedis*, 5075
Rozellomycota, one species, type: *P. hyperparasiticum* 5076
 (Codreanu-Balcescu and Codreanu) Codreanu-Balcescu 5077
 and Codreanu, parasites of gregarines, aquatic, Europe, 5078
 sequences are unavailable. 5079
Polydispyrenia Canning & Hazard 1982, *Caudosporidae*, 5080
Dissociodihaplophasida, *Microsporidea*, *Rozellomycota*, 5081
 two species, type: *P. simulii* (Lutz & Splendore) Canning 5082
 & Hazard, parasites of blackflies, aquatic, worldwide, see 5083
 Canning and Hazard (1982; taxonomy), Vossbrinck et al. 5084
 (2004; phylogeny), sequences are available. 5085
Potasporea Casal, Matos, Teles-Grilo & Azevedo 2008, 5086
Spragueidae, *Dissociodihaplophasida*, *Microsporidea*, 5087
Rozellomycota, two species, type: *P. morhaphis* Casal, 5088
 Matos, Teles-Grilo & Azevedo, parasites of fishes, aquatic, 5089
 South America, see Casal et al. (2008; taxonomy), Videira 5090
 et al. (2015; new species), sequences are available. 5091

- 5092 **Pseudoloma** Matthews, Brown, Larison, Bishop-Stewart,
5093 Rogers & Kent 2001, *Glugeidae*, *Glugeida*, *Microsporidea*,
5094 *Rozellomycota*, one species, type: *P. neurophilia* Mat-
5095 thews, Brown, Larison, Bishop-Stewart, Rogers & Kent,
5096 parasites of fishes, aquatic, worldwide, see Matthews et al.
5097 (2001; generic description), Whipps and Kent (2006; PCR
5098 detection), Sander and Kent (2011; sensitive assay), Cali
5099 et al. (2012; taxonomic revision), Sanders et al. (2016; host
5100 range), Ndikumana et al. (2017; genome analysis),
5101 sequences are available.
- 5102 **Pseudonosema** Canning, Refardt, Vossbrinck, Okamura &
5103 Curry 2002, *Neopereziiidae*, *Microsporidea* families *in-*
5104 *certae sedis*, *Rozellomycota*, one species, type: *P.*
5105 *cratellae* (Canning, Okamura & Curry) Canning,
5106 Refardt, Vossbrinck, Okamura & Curry, parasites of bry-
5107 ozoans, Europe, see Canning et al. (2002a, b; taxonomy),
5108 sequences are available.
- 5109 **Pseudopleistophora** Sprague 1977, *Pseudopleistophoridae*,
5110 *Dissociodihaplophasida*, *Microsporidea*, *Rozellomycota*,
5111 one species, type: *P. szollosi* Sprague, parasites of poly-
5112 chaetes, aquatic, North America, see Sprague (1977a, b;
5113 taxonomy), Sprague et al. (1992; taxonomic review),
5114 sequences are unavailable.
- 5115 **Pulicispora** Vedmed, Krylova & Issi 1991, *Duboscqiidae*,
5116 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one
5117 species, type: *P. xenopsyllae* Vedmed, Krylova & Issi,
5118 parasites of fleas, Eurasia, see Vedmed et al. (1991; tax-
5119 onomy), sequences are unavailable.
- 5120 **Pyrotheca** Hesse 1935, *Gurleyidae*, *Glugeida*, *Micro-*
5121 *sporidea*, *Rozellomycota*, eight species, type: *P. cyclo-*
5122 *pis* (Leblanc) Poisson, parasites of cyclops, aquatic,
5123 Europe, see Hyliš et al. (2007; notes), sequences are
5124 unavailable.
- 5125 **Rectispora** Larsson 1990, *Mrazekiidae*, *Dissociodihap-*
5126 *lophasida*, *Microsporidea*, *Rozellomycota*, one species,
5127 type: *R. reticulata* Larsson, parasites of oligochaetes,
5128 aquatic, Europe, see Larsson et al. (1990c; taxonomy),
5129 sequences are unavailable.
- 5130 **Resiomeria** Larsson 1986, *Thelohaniidae*, *Meiodihap-*
5131 *lophasida*, *Microsporidea*, *Rozellomycota*, one species,
5132 type: *R. odonatae* Larsson, parasites of dragonflies, aquatic,
5133 Europe, see Larsson (1986a, b; taxonomy), sequences are
5134 unavailable.
- 5135 **Ringueletium** Garcia 1990, *Caudosporidae*, *Dissociodi-*
5136 *haplophasida*, *Microsporidea*, *Rozellomycota*, one species,
5137 type: *R. pillosa* Garcia, parasites of blackflies, aquatic,
5138 Europe, see Garcia (1990; taxonomy), sequences are
5139 unavailable.
- 5140 **Schroedera** Morris & Adams 2002, *Neopereziiidae*, *Micro-*
5141 *sporidea* families *incertae sedis*, *Rozellomycota*, two
5142 species, type: *S. plumatellae* Morris & Adams 2002, par-
5143 asites of bryozoans, aquatic, Europe, see Morris and
5144 Adams (2002; taxonomy), sequences are available.
- Scipionospora** Bylén & Larsson 1996, *Caudosporidae*,
Dissociodihaplophasida, *Microsporidea*, *Rozellomycota*,
one species, type: *R. pillosa* Garcia, parasites of chirono-
mids, aquatic, Europe, see Bylén and Larsson (1996; tax-
onomy), sequences are unavailable.
- Senoma** Simakova, Pankova, Tokarev & Issi 2005, *Gur-*
leyidae, *Glugeida*, *Microsporidea*, *Rozellomycota*, one
species, type: *S. globulifera* (Issi & Pankova) Simakova,
Pankova, Tokarev & Issi, parasites of mosquitoes, aquatic,
Asia, see Simakova et al. (2005; taxonomy), sequences are
available.
- Sheriffia** Larsson 2014, *Microsporidea* genera *incertae*
sedis, *Rozellomycota*, one species, type: *S. brachynema*
(Richards and Sheffield) Larsson, parasites of molluscs,
aquatic, Europe, see Larsson (2014a, b; taxonomy),
sequences are unavailable.
- Simuliospora** Khodzhaeva, Krylova & Issi 1990, *Gol-*
bergiidae, *Dissociodihaplophasida*, *Microsporidea*, *Rozel-*
lomycota, two species, type: *S. uzbekistanica* Khodzhaeva,
Krylova & Issi, parasites in insects, Asia, sequences are
unavailable.
- Spherospora** Garcia 1991, *Thelohaniidae*, *Meiodihap-*
lophasida, *Microsporidea*, *Rozellomycota*, one species,
type: *S. andinae* Garcia, parasites of blackflies, aquatic,
South America, see Garcia (1991; taxonomy), sequences
are unavailable.
- Spiroglugea** Léger & Hesse 1924, *Microsporidea* genera
incertae sedis, *Rozellomycota*, one species, type: *S. octos-*
pora (Léger & Hesse) Léger & Hesse, parasites of biting
midges, aquatic, Europe, sequences are available.
- Sporanauta** Ardila-Garcia & Fast 2012, *Microsporidea*
genera *incertae sedis*, *Rozellomycota*, one species, type: *S.*
perivermis Ardila-Garcia & Fast, parasites of nematodes,
aquatic, North America, see Ardila-Garcia and Fast (2012;
taxonomy), sequences are available.
- Spraguea** Weissenberg 1976, *Spragueidae*, *Dissociodi-*
haplophasida, *Microsporidea*, *Rozellomycota*, two species,
type: *S. lophii* (Doflein) Weissenberg, parasites of fishes,
aquatic, worldwide, see Weissenberg (1976; generic
description), Sprague et al. (1992; taxonomic review),
Pomport-Castillon et al. (2000; phylogenetic reconstruc-
tion), Freeman et al. (2004; phylogeny), Campbell et al.
(2013; genome of *S. lophii*), Colmenero et al. (2015; *S.*
lophii in Mediterranean lophiids), Xiang et al. (2015;
comparative genomics), sequences are available.
- Steinhausia** Sprague, Ormières & Manier 1972, *Pseudo-*
pleistophoridae, *Dissociodihaplophasida*, *Microsporidea*,
Rozellomycota, four species, type: *S. mytilovum* (Field)
Sprague, Ormières & Manier, parasites of molluscs,
aquatic, worldwide, see Sprague et al. (1972; generic
description), Kalavati and Narasimhamurti (1977; new
species), Sprague et al. (1992; taxonomic review), Cun-
ningham and Daszak (1998; Extinction of land snail),

- 5198 Sagristà et al. (1998; ultrastructural data of *S. mytilovum*),
5199 sequences are unavailable.
- 5200 **Stempellia** Léger & Hesse 1910, *Microsporidea* genera
5201 *incertae sedis*, *Rozellomycota*, 19 species epithets are listed
5202 in Index Fungorum (2018), type: *S. mutabilis* Léger &
5203 Hesse, parasites of mosquitoes, aquatic, worldwide,
5204 sequences are unavailable.
- 5205 **Striatospora** Issi & Voronin 1986, *Striatosporidae*,
5206 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one
5207 species, type: *S. chironomi* Issi & Voronin, parasites of
5208 chironomids, aquatic, Europe, see Sokolova et al. (2018;
5209 Microsporidia from USSR in twentieth century, descrip-
5210 tion), sequences are unavailable.
- 5211 **Systemostrema** Hazard & Oldacre 1975, *Microsporidea*
5212 genera *incertae sedis*, *Rozellomycota*, five species, type: *S.*
5213 *tabani* Hazard & Oldacre, parasites of insects, aquatic,
5214 worldwide, see Hazard and Oldacre (1975; taxonomy),
5215 Sokolova et al. (2006; phylogeny), sequences are available.
- 5216 **Tabanispora** Bykova, Sokolova & Issi 1987, *Burenellidae*,
5217 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, two
5218 species, type: *T. bacillifera* Bykova, Sokolova & Issi,
5219 parasites of insects, Europe, see Sokolova et al. (2018;
5220 Microsporidia from USSR in twentieth Century), sequen-
5221 ces are unavailable.
- 5222 **Takaokaspora** Andreadis, Takaoka, Otsuka & Vossbrinck
5223 2013, *Microsporidea* genera *incertae sedis*, *Rozellomycota*,
5224 one species, type: *T. nipponicus* T.G. Andreadis, Takaoka,
5225 Otsuka & Vossbrinck, parasites of mosquitoes, aquatic,
5226 Asia, see Andreadis et al. (2013; taxonomy), sequences are
5227 available.
- 5228 **Tardivesicula** Larsson & Bylén 1992, *Duboscqiidae*,
5229 *Meiodihaplophasida*, *Microsporidea*, *Rozellomycota*, one
5230 species, type: *T. duplicata* Larsson & Bylén, parasites of
5231 caddisflies, aquatic, Europe, see Larsson and Bylén (1992;
5232 taxonomy), sequences are unavailable.
- 5233 **Telomyxa** Léger & Hesse 1910, *Telomyxidae*, *Micro-*
5234 *sporidea* families *incertae sedis*, *Rozellomycota*, four
5235 species, type: *T. glugeiformis* Léger & Hesse, parasites of
5236 mayflies, aquatic, Europe, sequences are unavailable.
- 5237 **Tetramicra** Matthews & Matthews 1980, *Spragueidae*,
5238 *Dissociodihaplophasida*, *Microsporidea*, *Rozellomycota*,
5239 one species, type: *T. brevifilum* Matthews & Matthews,
5240 parasites of fishes, aquatic, Europe, see Matthews and
5241 Matthews (1980; generic description), Sprague et al. (1992;
5242 taxonomic review), Leiro et al. (2002; PCR detection),
5243 Alonso et al. (2013; Real-time PCR assay), Scholz et al.
5244 (2017; phylogeny), sequences are available.
- 5245 **Thelohania** Henneguy 1892, *Thelohaniidae*, *Meiodihap-*
5246 *lophasida*, *Microsporidea*, *Rozellomycota*, c. 50 species,
5247 type: *T. giardi* Henneguy, parasites of arthropods, world-
5248 wide, see Vossbrinck and Debrunner-Vossbrinck (2005;
5249 phylogeny), sequences are available.
- Toxoglugea** Léger & Hesse 1924, *Thelohaniidae*, 5250
Meiodihaplophasida, *Microsporidea*, *Rozellomycota*, c. 15 5251
species, type: need typification, parasites of insects, aqua- 5252
tic, Europe, sequences are unavailable. 5253
- Toxospora** Voronin 1993, *Toxoglugeidae*, *Microsporidea* 5254
families *incertae sedis*, *Rozellomycota*, two species, type: 5255
T. volgae Voronin, parasites of chironomids, aquatic, 5256
Europe, see Voronin (1993; taxonomy), sequences are 5257
unavailable. 5258
- Trachipleistophora** Hollister, Canning, Weidner, Field, 5259
Kench & Marriott 1996, *Pleistophoridae*, *Glugeida*, *Micro-* 5260
sporidea, *Rozellomycota*, three species, type: *T. hominis* 5261
Hollister, Canning, Weidner, Field, Kench & Marriott, 5262
parasites of humans, worldwide, see Hollister et al. (1996; 5263
taxonomy), Weinder et al. (1999; mosquito vector com- 5264
petence), Heinz et al. (2012; genome dynamics and 5265
reductive evolution), sequences are available. 5266
- Trichoctosporaea** Larsson 1994, *Amblyosporidae*, *Meiodi-* 5267
haplophasida, *Microsporidea*, *Rozellomycota*, one species, 5268
type: *T. pygopellita* Larsson, parasites of mosquitoes and 5269
cyclops, aquatic, Eurasia, see Larsson (1994; taxonomy), 5270
Simakova et al. (2011; parasites of cyclops), Andreadis 5271
et al. (2012; phylogeny), sequences are available. 5272
- Trichoduboscqia** Léger 1926, *Duboscqiidae*, *Meiodihap-* 5273
lophasida, *Microsporidea*, *Rozellomycota*, one species, 5274
type: *P. epeori* Léger, parasites of mayflies, aquatic, Eur- 5275
ope, see Weiser et al. (2015; compare with *Agglomerata*), 5276
sequences are unavailable. 5277
- Trichonosema** Canning, Refardt, Vossbrinck, Okamura & 5278
Curry 2002, *Neopereziiidae*, *Microsporidea* families *in-* 5279
certae sedis, *Rozellomycota*, two species, type: *T. pecti-* 5280
natellae Canning, Refardt, Vossbrinck, Okamura & Curry, 5281
parasites of bryozoans, aquatic, Europe, see Canning et al. 5282
(2002a, b; taxonomy), sequences are available. 5283
- Trichotuzetia** Vávra, Larsson & Baker 1997, *Micro-* 5284
sporidea genera *incertae sedis*, one species, type: *T.* 5285
guttata Vávra, Larsson & Baker, parasites of cyclops, 5286
aquatic, Europe, see Vávra et al. (1997; taxonomy), 5287
sequences are available. 5288
- Tricornia** Pell & Canning 1992, *Amblyosporidae*, 5289
Meiodihaplophasida, *Microsporidea*, *Rozellomycota*, one 5290
species, type: *T. muhezae* Pell & Canning, parasites of 5291
mosquitoes, aquatic, Africa, see Pell and Canning (1992; 5292
taxonomy), sequences are unavailable. 5293
- Triwangia** Wang, Nai, Chih Wang, Solter, Hsu, Wang & 5294
Lo 2013, *Microsporidea* genera *incertae sedis*, *Rozel-* 5295
lomycota, one species, type: *T. caridinae* Wang, Nai, Chih 5296
Wang, Solter, Hsu, Wang & Lo, parasites of shrimps, 5297
aquatic, Asia, see Wang et al. (2013a, b, c, d; taxonomy), 5298
sequences are available. 5299
- Tubulinosema** Franzen, Fischer, Schröder, Schölmerich & 5300
Schneuwly 2005, *Tubulinosematidae*, *Microsporidea* fam- 5301
ilies *incertae sedis*, *Rozellomycota*, five species, type: *T.* 5302

- 5303 *ratisbonensis* Franzen, Fischer, Schröder, Schölmerich & 5355
 5304 Schneuwly, parasites of insects, worldwide, see Franzen 5356
 5305 et al. (2005; taxonomy), Vijendravarma et al. (2008; 5357
 5306 infection of *Drosophila melanogaster*), Bjørnson et al. 5358
 5307 (2011; new species), Choudhary et al. (2011: human 5359
 5308 infection), Meissner et al. (2012: human infection), Malysh
 5309 et al. (2013; new species), sequences are available.
- 5310 **Tuzetia** Maurand, Fize, Vernick & Michel 1971, *Tuzeti-* 5360
 5311 *idae*, *Glugeida*, *Microsporidea*, *Rozellomycota*, seven 5361
 5312 species, type: *Tuzetia infirma* (Kudo 1921) Maurand, Fize, 5362
 5313 Fenwick, and Michel, 1971 parasites of aquatic arthropods, 5363
 5314 worldwide, see Larsson (1983; taxonomy), Canning et al. 5364
 5315 (2002a, b: ultrastructure), Simakova et al. (2009b: new 5365
 5316 species), sequences are unavailable.
- 5317 **Unikaryon** Canning, Lai & Lie 1974, *Unikaryonidae*, 5366
 5318 *Glugeida*, *Microsporidea*, *Rozellomycota*, c. 18 species, 5367
 5319 type: *U. piriformis* Canning, Lai & Lie, parasites of 5368
 5320 invertebrates, worldwide, see Yaman et al. (2010; new 5369
 5321 species), sequences are available.
- 5322 **Vairimorpha** Pilley 1976, *Nosematidae*, *Dissociodihap-* 5370
 5323 *lophasida*, *Microsporidea*, *Rozellomycota*, 15 species, 5371
 5324 type: *V. necatrix* (Kramer) Pilley, parasites of insects, 5372
 5325 worldwide, see Fowler and Reeves (1974: spore dimor- 5373
 5326 phism), Fuxa and Brooks (1979: application in pest con- 5374
 5327 trol), Mitchell and Cali (1993: ultrastructure), Baker et al. 5375
 5328 (1994: relationships with *Nosema*), Down et al. (2008: host 5376
 5329 pathology), Wang et al. (2009; new species), Ironside et al. 5377
 5330 (2013: genetic diversity), Luo et al. (2014; morphological 5378
 5331 and molecular study), Baki and Bekircan (2018; new spe- 5379
 5332 cies), sequences are available.
- 5333 **Vavraia** Weiser 1977, *Pleistophoridae*, *Glugeida*, *Mi-* 5380
 5334 *crosporidea*, *Rozellomycota*, c. 10 species, type: *V. culicis* 5381
 5335 (Weiser) Weiser, parasites of insects, worldwide, see 5382
 5336 Weiser (1977; taxonomy), Bargielowski and Koella (2009; 5383
 5337 application), Lorenz and Koella (2011; mosquitoes biocon- 5384
 5338 trol), sequences are available.
- 5339 **Vittaforma** Silveira & Canning 1995, *Microsporidea* genera 5385
 5340 *incertae sedis*, *Rozellomycota*, one species, type: *V.* 5386
 5341 *corneae* (Shadduck, Meccoli, Davis & Font) Silveira & 5387
 5342 Canning, parasites of human, worldwide, Silveira and 5388
 5343 Canning (1995; taxonomy), Vossbrinck and Debrunner- 5389
 5344 Vossbrinck (2005: phylogeny), sequences are available.
- 5345 **Weiseria** Doby & Saguez 1964, *Caudosporidae*, *Disso-* 5390
 5346 *ciodihaplophasida*, *Microsporidea*, *Rozellomycota*, three 5391
 5347 species, type: *W. laurentii* Doby & Saguez, parasite of 5392
 5348 blackflies, worldwide, see Doby and Saguez (1964; tax- 5393
 5349 onomy), Vossbrinck and Debrunner-Vossbrinck (2005: 5394
 5350 phylogeny), sequences are available.
- 5351 **Wittmannia** Czaker 1997, *Microsporidea* families *incertae* 5395
 5352 *sedis*, *Rozellomycota*, *Rozellomycota*, one species, type: *W.* 5396
 5353 *antarctica* Czaker, parasites of mesozoans, Antarctica, see 5397
 5354 Czaker (1997; taxonomy), sequences are unavailable.
- Zelenkaia** Hylíš, Oborník, Nebesářová & Vávra 2013, 5398
Gurleyidae, *Glugeida*, *Microsporidea*, *Rozellomycota*, one 5399
 species, type: *Z. trichopterae* Hylíš, Oborník, Nebesářová 5400
 & Vávra, parasites of caddisflies, aquatic, Europe, Hylíš 5401
 et al. (2013; taxonomy), sequences are available. 5402
 5403
 5404
- Zoopagomycota** Gryganskyi et al. 5360
 Spatafora et al. (2016) introduced the phylum 5361
Zoopagomycota with *Zoopage* Drechsler (1935) as type 5362
 genus to accommodate three subphyla: *Entomoph-* 5363
thoromycotina Humber (Hibbett et al. 2007), *Kickellomy-* 5364
cotina Benny (Hibbett et al. 2007), and *Zoopagomycotina* 5365
 Benny (Hibbett et al. 2007). The phylum comprises early 5366
 diverging terrestrial fungi mainly associating with animals. 5367
 However, numerous mycoparasites are also included in this 5368
 group (Spatafora et al. 2016). 5369
- We accept *Zoopagomycota* as a distinct phylum which 5370
 comprises only two subphyla (we accept *Entomoph-* 5371
thoromycota as a distinct phylum agreeing with Tedersoo 5372
 et al. 2016), one class, five orders, ten families and 90 5373
 genera. 5374
- Notes for genera** 5375
- Acaulopage** Drechsler 1935, *Zoopagaceae*, *Zoopagales*, 5376
Zoopagomycetes, *Zoopagomycota*, 27 species, type: *A.* 5377
rhapidospora Drechsler, parasitic, aquatic, see Kirk et al. 5378
 (2008; genus accepted) but Kirk et al. (2013; not listed), 5379
 Hirotani-Akabane and Saikawa (2010; zygospore germi- 5380
 nation), Saikawa (2011; ultrastructural information), Sei- 5381
 fert et al. (2011; mentioned that the genus resembles 5382
 hyphomycetes), Michel et al. (2014, 2015; sequences, 5383
 isolation, prey pattern), Corsaro et al. (2018; DNA, phy- 5384
 logeny), cultures and sequences are available. 5385
- Amoebophilus** P.A. Dang. 1910, *Cochlonemataceae*, 5386
Zoopagales, *Zoopagomycetes*, *Zoopagomycota*, four spe- 5387
 cies, type: *A. penardii* P.A. Dang., parasitic on amoeboids, 5388
 Europe, North America, see Mrva (2011; infect *Mayorella* 5389
vespertoides), Saikawa (2011; accepted as in *Cochlone-* 5390
mataceae), Kirk et al. (2013; genus accepted), cultures and 5391
 sequences are unavailable. 5392
- Aplectosoma** Drechsler 1951, *Cochlonemataceae*, *Zoopa-* 5393
gales, *Zoopagomycetes*, *Zoopagomycota*, one species, type: 5394
A. microsporum Drechsler, amoebae endoparasites, USA, 5395
 see Saikawa (2011; accepted as in *Cochlonemataceae*), 5396
 Kirk et al. (2013; genus accepted), Benny et al. (2016b; 5397
 classification), cultures and sequences are unavailable. 5398
- Basidiolum** Cienk. 1861, *Zoopagomycotina* genera *incer-* 5399
tae sedis, *Kickellomycetes*, *Zoopagomycota*, one species, 5400
 type: *B. fimbriatum* Cienk., saprobes?, distribution 5401
 unknown, see Kirk et al. (2013; genus accepted), Benny 5402
 et al. (2016b; classification), cultures and sequences are 5403
 unavailable. 5404

- 5405 **Bdellospora** Drechsler 1935, *Cochlonemataceae*, *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, one species, type: 5406
5407 *B. helicoides* Drechsler, endoparasites, North America, see 5408
5409 Kirk et al. (2013; genus accepted), Benny et al. (2016b; 5410
5411 classification), cultures and sequences are unavailable. 5412
5413 **Brachymyces** G.L. Barron 1980, *Helicocephalidaceae*, 5414
5415 *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, one spe- 5416
5417 cies, type: *B. megasporus* G.L. Barron, from soil, Canada, 5418
5419 see Kirk et al. (2013; genus accepted), Benny et al. (2016b; 5420
5421 classification), cultures and sequences are unavailable. 5422
5423 **Cystopage** Drechsler 1941, *Zoopagaceae*, *Zoopagales*, 5424
5425 *Zoopagomycetes*, *Zoopagomycota*, nine species, type: *C.* 5426
5427 *lateralis* Drechsler, nematode trapping, worldwide, see 5428
5429 Kelly et al. (2009; Ireland), Kirk et al. (2013; genus 5430
5431 accepted), Ho et al. (2015; new species), cultures and 5432
5433 sequences are unavailable. 5434
5435 **Endocochlus** Drechsler 1935, *Cochlonemataceae*, *Zoopaga-* 5436
5437 *les*, *Zoopagomycetes*, *Zoopagomycota*, four species, 5438
5439 type: *E. microsporium* Drechsler, endoparasites, cosmopoli- 5440
5441 tan, see Saikawa (2011; accepted as in *Cochlonemataceae*), 5442
5443 Kirk et al. (2013; genus accepted), Benny et al. (2016b; 5444
5445 classification), cultures and sequences are unavailable. 5446
5447 **Helicocephalum** Thaxt. 1891, *Helicocephalidaceae*, 5448
5449 *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, six species, 5450
5451 type: *H. sarcophilum* Thaxt., parasites, cosmopolitan, see 5452
5453 Kirk et al. (2013; genus accepted), Tretter et al. (2014; 5454
5455 notes), Benny et al. (2016b; classification), cultures and 5456
5457 sequences are unavailable. 5458
5459 **Kuzuhaea** R.K. Benj. 1985, *Piptocephalidaceae*, *Zoopaga-* 5460
5461 *les*, *Zoopagomycetes*, *Zoopagomycota*, one species, type: 5462
5463 *K. moniliformis* R.K. Benj., from soil, cosmopolitan, see 5464
5465 Hoffmann et al. (2013; notes), Kirk et al. (2013; genus 5466
5467 accepted), Penton et al. (2013; diversity), Benny et al. 5468
5469 (2016b; classification), Corsaro et al. (2018, phylogeny), 5470
5471 cultures unavailable, sequences available. 5472
5473 **Lecophagus** M.W. Dick 1990, *Zoopagaceae*, *Zoopagales*, 5474
5475 *Zoopagomycetes*, *Zoopagomycota*, three species, type: *L.* 5476
5477 *fasciculatus* M.W. Dick, hyphomycetous, predator, 5478
5479 cosmopolitan, see Seifert et al. (2011; morphology), Kirk 5480
5481 et al. (2013; genus accepted), Arenz et al. (2014; Antarc- 5482
5483 tica), Magyar et al. (2016; new species), Fialkowska et al. 5484
5485 (2018; interactions with prey), cultures and sequences are 5486
5487 available. 5488
5489 **Massartia** De Wild. 1897, *Zoopagales* genera *incertae* 5490
5491 *sedis*, *Zoopagomycetes*, *Zoopagomycota*, one species, type: 5492
5493 *M. javanica* De Wild., cosmopolitan, see Kirk et al. (2013; 5494
5495 genus accepted), cultures and sequences are unavailable. 5496
5497 **Piptocephalis** de Bary 1865, *Piptocephalidaceae*, *Zoopaga-* 5498
5499 *les*, *Zoopagomycetes*, *Zoopagomycota*, c. 25 species, 5500
5501 type: *P. freseniana* de Bary, mycoparasites, worldwide, see 5502
5503 Ho and Kirk (2009; new species), Hou and Ho (2010; new 5504
5505 species), Hoffmann et al. (2013; notes), Kirk et al. (2013; 5506
5507 genus accepted), Benny et al. (2016b; classification), 5508
5509 Corsaro et al. (2018, phylogeny), cultures and sequences 5510
5511 are available, genome available: *P. cylindrospora* RSA 5512
5513 2659 unpublished genome at JGI portal (Grigoriev et al. 5514
5515 2014). 5516
5517 **Reticulocephalis** Benny, R.K. Benj. & P.M. Kirk 1992, 5518
5519 *Sigmoideomycetaceae*, *Zoopagales*, *Zoopagomycetes*, 5520
5521 *Zoopagomycota*, two species, type: *R. gyrosus* Benny, R.K. 5522
5523 Benj. & P.M. Kirk, from soil, cosmopolitan, see Hoffmann 5524
5525 et al. (2013; notes), Benny et al. (2016b; classification), 5526
5527 cultures and sequences are unavailable. 5528
5529 **Rhopalomyces** Corda 1839, *Helicocephalidaceae*, *Zoopaga-* 5530
5531 *les*, *Zoopagomycetes*, *Zoopagomycota*, eleven species, 5532
5533 type: *R. elegans* Corda, parasites, cosmopolitan, see Kirk 5534
5535 et al. (2013; genus accepted), Tretter et al. (2014; notes), 5536
5537 Benny et al. (2016b; classification), Corsaro et al. (2018, 5538
5539 phylogeny), cultures unavailable, sequences are available. 5540
5541 **Sigmoideomyces** Thaxt. 1891, *Sigmoideomycetaceae*, 5542
5543 *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, one spe- 5544
5545 cies, type: *S. dispiroides* Thaxt., saprobes, cosmopolitan, 5546
5547 see Kirk et al. (2013; genus accepted), Benny et al. (2016b; 5548
5549 classification), cultures and sequences are unavailable. 5550
5551 **Sphondylocephalum** Stalpers 1974, *Sigmoideomycetaceae*, 5552
5553 *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, one spe- 5554
5555 cies, type: *S. verticillatum* (Thaxt.) Stalpers, hyphomyce- 5556
5557 tous, coprophilous, North America, see Seifert et al. (2011; 5558
5559 morphology), Kirk et al. (2013; genus accepted), Suyama 5560
5561 and Degawa (2013; accepted as in *Sigmoideomycetaceae*), 5562
5563 Benny et al. (2016b; notes), cultures and sequences are 5564
5565 unavailable. 5566
5567 **Stylopaga** Drechsler 1935, *Zoopagaceae*, *Zoopagales*, 5568
5569 *Zoopagomycetes*, *Zoopagomycota*, 17 species, type: *S.* 5570
5571 *lepte* Drechsler, predator, cosmopolitan, see Kirk et al. 5572
5573 (2013; genus accepted), Michel et al. (2014; isolation, 5574
5575 characterization), Corsaro et al. (2018; DNA, phylogeny), 5576
5577 cultures and sequences are available. 5578
5579 **Syncephalis** Tiegh. & G. Le Monn. 1873, *Piptocephali-* 5580
5581 *daceae*, *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, c. 5582
5583 55 species, type: *S. cordata* Tiegh. & G. Le Monn., 5584
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5511 mycoparasites, worldwide, see Ho and Benny (2008; new
 5512 species), Santiago et al. (2011a, b; new species), Hoffmann
 5513 et al. (2013; notes), Kirk et al. (2013; genus accepted),
 5514 Benny et al. (2016a; classification, ecology), Melo et al.
 5515 (2016; neotropics), Lazarus et al. (2017, systematics) *S.*
 5516 *fuscata* S228 unpublished genome at JGI portal (Grigoriev
 5517 et al. 2014), *S. plumigaleata* NRRL S24 unpublished
 5518 genome at JGI portal (Grigoriev et al. 2014), *S. pseudop-*
 5519 *lumigaleata* Benny S71-1 unpublished genome at JGI
 5520 portal (Grigoriev et al. 2014).
 5521 **Tentaculophagus** Doweld 2014, *Zoopagaceae*, *Zoop-*
 5522 *agales*, *Zoopagomycetes*, *Zoopagomycota*, one species, type:
 5523 *T. karlingii* see Index Fungorum (2018), cultures and
 5524 **AQ5** sequences are unavailable.
 5525 **Thamnocephalis** Blakeslee 1905, *Sigmoideomycetaceae*,
 5526 *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, three spe-
 5527 cies, type: *T. quadrupedata* Blakeslee, saprobes, cos-
 5528 mopolitan, see Kirk et al. (2013; genus accepted), Ho and
 5529 Chiang (2014; Taiwan), Benny et al. (2016b; classifica-
 5530 tion), Corsaro et al (2018, phylogeny), cultures unavail-
 5531 able, *T. sphaerospora* RSA 1356 unpublished genome at
 5532 JGI portal (Grigoriev et al. 2014).
 5533 **Verrucocephalum** Degawa 2013, *Helicocephalidaceae*,
 5534 *Zoopagales*, *Zoopagomycetes*, *Zoopagomycota*, one spe-
 5535 cies, type: *H. latericorvinisporum* Degawa, from dung,
 5536 nematophagous, Asia, see Degawa (2014; taxonomy),
 5537 cultures and sequences are unavailable.
 5538 **Zoopage** Drechsler 1935, *Zoopagaceae*, *Zoopagales*, *Zoo-*
 5539 *pagomycetes*, *Zoopagomycota*, eleven species, type: *Z.*
 5540 *phanera* Drechsler, in amoeba, cosmopolitan, see Kirk
 5541 et al. (2013; genus accepted), Benny et al. (2016b; classi-
 5542 fication), cultures and sequences are unavailable.
 5543 **Zoophagus** Sommerst. 1911, *Zoopagaceae*, *Zoopagales*,
 5544 *Zoopagomycetes*, *Zoopagomycota*, four species, type: *Z.*
 5545 *insidians* Sommerst., on algae, cosmopolitan, see Kirk
 5546 et al. (2013; genus accepted), Benny et al. (2016b; classi-
 5547 **AQ6** fication), Corsaro et al (2018, phylogeny), a sequence is
 5548 available.

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References

- Abdel-Baki AA, Tamihi AF, Al-Qahtani HA, Al-Quraishy S, Mansour L (2015) *Glugea jazanensis* sp. nov. infecting *Lutjanus bohar* in the Red Sea: ultrastructure and phylogeny. *Dis Aquat Organ* 116:185–190
- Abe A, Asano K, Sone T (2010) A molecular phylogeny-based taxonomy of the genus *Rhizopus*. *Biosci Biochem Biotechnol* 74:1325–1331
- Abedinifar S, Karimi K, Khanahmadi M, Taherzadeh MJ (2009) Ethanol production by *Mucor indicus* and *Rhizopus oryzae* from rice straw by separate hydrolysis and fermentation. *Biomass Bioenergy* 33:828–833
- Adamčík S, Cai L, Chakraborty D, Chen XH et al (2015) Fungal biodiversity profiles 1–10. *Cryptogam Mycol* 36:121–166
- Adrianov AV, Rybakov AV (1991) *Kinorhynchospora japonica* gen. n., sp. n. (Microsporidia) from the intestine epithelium of *Kinorhynchus yushini* (Homalorhagida, Pycnophyidae) from the Sea of Japan. *Zool Z* 70(10):5–11
- Agboton BV, Hanna R, Onzo A, Vidal S et al (2013) Interactions between the predatory mite *Typhlodromalus aripo* and the entomopathogenic fungus *Neozygites tanajoae* and consequences for the suppression of their shared prey/host *Mononychellustanajoa*. *Exp Appl Acarol* 60:205–217
- Agboton BV, Hanna R, von Tiedemann A (2011) Molecular detection of establishment and geographical distribution of Brazilian isolates of *Neozygites tanajoae*, a fungus pathogenic to cassava green mite, in Benin (West Africa). *Exp Appl Acarol* 53:235–244
- Ahrendt SR, Medina EM, Chia-en AC, Stajich JE (2017) Exploring the binding properties and structural stability of an opsin in the chytrid *Spizellomyces punctatus* using comparative and molecular modeling. *PeerJ* 5:e3206
- Akar T, Arslan S, Akar ST (2013) Utilization of *Thamnidium elegans* fungal culture in environmental cleanup: a reactive dye biosorption study. *Ecol Eng* 58:363–370
- Akerstedt J (2002) An indirect ELISA for detection of *Encephalitozoon cuniculi* infection in farmed blue foxes (*Alopex lagopus*). *Acta Vet Scand* 43:211–220
- Akinwale PO, Lefevre E, Powell MJ, Findlay RH (2014) Unique odd-chain polyenoic phospholipid fatty acids present in chytrid fungi. *Lipids* 49(9):933–942
- Alarcón M, Thoen E, Poppe TT, Bornø G et al (2016) Co-infection of *Nucleospora cyclopteri* (Microsporidia) and *Kudoa islandica* (Myxozoa) in farmed lumpfish, *Cyclopterus lumpus* L., in Norway: a case report. *J Fish Dis* 39(4):411–418
- Alastruey-Izquierdo A, Cuesta I, Walther G, Cuenca-Estrella M et al (2010a) Antifungal susceptibility profile of human-pathogenic species of *Lichtheimia*. *Antimicrob Agents Chemother* 54:3058–3060
- Alastruey-Izquierdo A, Hoffmann K, de Hoog GS, Rodriguez-Tudela JL et al (2010b) Species recognition and clinical relevance of the zygomycetous genus *Lichtheimia* (syn. *Absidia* pro parte, *Mycocladus*). *J Clin Microbiol* 48:2154–2170
- Al-Maani AS, Paul G, Jardani A, Nayar M et al (2014) Gastrointestinal basidiobolomycosis: first case report from Oman and literature review. *Sultan Qaboos Uni Med J* 14(2):e241–e244
- Almoosa Z, Alsuhaibani M, AlDandan S, Alshahrani D (2017) Pediatric gastrointestinal basidiobolomycosis mimicking malignancy. *Med Mycol Case Rep* 18:31–33
- Alonso M, Lago FC, Gomez-Reino M, Fernandez J, Martin I, Vieites JM, Espineira M (2013) Fast real-time PCR assay for detection of *Tetramicra brevifilum* in cultured turbot. *Parasitology* 140:338–342

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- 5628 Alpat Ş, Alpat SK, Çadırcı BH, Yaşa İ et al (2008) A novel microbial biosensor based on *Circinella* sp. modified carbon paste electrode and its voltammetric application. *Sens Actuators B* 134:175–181
- 5629
- 5630
- 5631 Al-Quraishy S, Abdel-Baki AS, Al-Qahtani H, Dkhil M et al (2012) A new microsporidian parasite, *Heterosporis saurida* n. sp. (Microsporidia) infecting the lizardfish, *Saurida undosquamis* from the Arabian Gulf, Saudi Arabia: ultrastructure and phylogeny. *Parasitology* 139(4):454–462
- 5632
- 5633
- 5634 Aluoch AM, Obonyo MA, Okun DO et al (2015) Morphological diversity of *Ascobolus* and *Pilobolus* fungi from wild herbivore dung in Nairobi National Park, Kenya. *J Microbiol Res* 5:134–141. <https://doi.org/10.5923/j.microbiology.20150504.03>
- 5635
- 5636 Aluoch MA, Otiende MY, Obonyo MA et al (2017) First genetic identification of *Pilobolus* (Mucoromycotina, Mucorales) from Africa (Nairobi National Park, Kenya). *S Afr J Bot* 111:182–188. <https://doi.org/10.1016/j.sajb.2017.03.006>
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- 5688
- 5689
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- 5691
- 5692
- tablets in an allogeneic stem cell transplant recipient. *Int J Infect Dis* 55:24–26
- Ardila-Garcia AM, Fast NM (2012) Microsporidian infection in a free-living marine nematode. *Eukaryot Cell* 11(12):1544–1551
- Arenz BE, Blanchette RA, Farrell RL (2014) Fungal diversity in Antarctic soils. In: Cowan D (ed) *Antarctic terrestrial microbiology*. Springer, Berlin, pp 35–53
- Ariyawansa HA, Hyde KD, Jayasiri SC, Buyck B et al (2015) Fungal diversity notes 111–252-taxonomic and phylogenetic contributions to fungal taxa. *Fungal Divers* 75:1–248
- Asha S, Vidyavathi M (2009) *Cunninghamella*—a microbial model for drug metabolism studies—a review. *Biotechnol Adv* 27:16–29
- Azevedo C (1987a) Fine structure of the microsporidian *Abelspora portucalensis* gen. n., sp. n. (Microsporidia) parasite of the hepatopancreas of *Carcinus maenas* (Crustacea, Decapoda). *J Invertebr Pathol* 49(1):83–92
- Azevedo C (1987b) Fine structure of the microsporidian *Abelspora portucalensis* gen. n., sp. n. (Microsporidia) parasite of the hepatopancreas of *Carcinus maenas* (Crustacea, Decapoda). *J Invertebr Pathol* 49:83–92
- Azevedo C, Abdel-Baki AA, Rocha S, Al-Quraishy S, Casal G (2016) Ultrastructure and phylogeny of *Glugea arabica* n. sp. (Microsporidia), infecting the marine fish *Epinephelus polyphekadion* from the Red Sea. *Eur J Protistol* 52:11–21
- Azevedo C, Matos E (2003a) *Amazonspora hassar* n. gen. and n. sp. (Phylum Microsporidia, fam. Glugeidae), a parasite of the Amazonian teleost *Hassar orestis* (fam. Doradidae). *J Parasitol* 89(2):336–341
- Azevedo C, Matos E (2003b) *Amazonspora hassar* n. gen. and n. sp. (Phylum Microsporidia, fam. Glugeidae), a parasite of the Amazonian teleost *Hassar orestis* (fam. Doradidae). *J Parasitol* 89:336–341
- Aziz N, Pandey R, Barman I, Prasad R (2016) Leveraging the attributes of *Mucor hiemalis*-derived silver nanoparticles for a synergistic broad-spectrum antimicrobial platform. *Front Microbiol* 7:1984. <https://doi.org/10.3389/fmicb.2016.01984>
- Babu AG, Kim SW, Adhikari M, Yadav DR et al (2015) A new record of *Gongronella butleri* isolated in Korea. *Mycobiology* 43:166–169. <https://doi.org/10.5941/MYCO.2015.43.2.166>
- Baby S, Ramya TG, Geetha RK (2015) Onychomycosis by *Syncephalastrum Racemosum*: case report from Kerala, India. *Dermatol Rep* 7:5527. <https://doi.org/10.4081/dr.2017.5527>
- Baggio JS, Hau B, Amorim L (2017) Spatiotemporal analyses of rhizopus rot progress in peach fruit inoculated with *Rhizopus stolonifer*. *Plant Pathol* 66:1452–1462
- Baker MD, Vossbrinck CR, Maddox JV, Undeen AH (1994) Phylogenetic relationships among *Vairimorpha* and *Nosema* species (Microspora) based on ribosomal RNA sequence data. *J Invertebr Pathol* 64:100–106
- Baki H, Bekircan C (2018) A new microsporidium, *Vairimorpha subcoccinellae* n. sp. (Microsporidia: Burenellidae), isolated from *Subcoccinella vigintiquatuorpunctata* L. (Coleoptera: Coccinellidae). *J Invertebr Pathol* 151:182–190
- Balázs TK, Błaszczowski J, Chwat G, Góralaska A et al (2015) Spore-based study of arbuscular mycorrhizal fungi of semiarid sandy areas in Hungary, with *Diversispora jakucsiae* sp. nov. *Mycol Prog* 14:1021. <https://doi.org/10.1007/s11557-014-1021-z>
- Ballvora A, Flath K, Lübeck J, Strahwald J et al (2011) Multiple alleles for resistance and susceptibility modulate the defense response in the interaction of tetraploid potato (*Solanum tuberosum*) with *Synchytrium endobioticum* pathotypes 1, 2, 6 and 18. *Theor Appl Genet* 123:1281–1292
- Baquero E, Rubio M, Moura IN, Pieniazek NJ et al (2005) *Myosporidium merluccius* ng. n. sp. infecting muscle of commercial hake (*Merluccius* sp.) from fisheries near Namibia. *J Eukaryot Microbiol* 52(6):476–483

- 5759 Baradkar VP, Kumar S (2009) Cutaneous zygomycosis due to *Saksenaia vasiformis* in an immunocompetent host. *Indian J Dermatol* 54:382–384
- 5760 Baradkar VP, Mathur M, Panda M, Kumar S (2008) Sino-orbital infection by *Syncephalastrum racemosum* in chronic hepatorenal disease. *J Oral Maxillofac Pathol* 12:45–47
- 5761 Bard JD, Mangahis A, Hofstra TC, Bender JM (2014) First case report of bloodstream infection by *Rhizomucor pusillus* in a child with hemophagocytic lymphohistiocytosis. *Med Mycol Case Rep* 5:20–23
- 5762 Bargielowski I, Koella JC (2009) A possible mechanism for the suppression of *Plasmodium berghei* development in the mosquito *Anopheles gambiae* by the microsporidian *Vavraia culicis*. *PLoS ONE* 4(3):e4676
- 5763 Baszkowski J, Wubet T, Harikumar VS, Ryszka P et al (2010) *Glomus indicum*, a new arbuscular mycorrhizal fungus. *Botany* 88:132–143
- 5764 Bateman KS, Wiredu-Boakye D, Kerr R, Williams BA (2016) Single and multi-gene phylogeny of *Hepatospora* (Microsporidia)—a generalist pathogen of farmed and wild crustacean hosts. *Parasitology* 143(8):971–982
- 5765 Batista AC, Silva MCF, Batista JB, Nascimento AE et al (2013) Eco-friendly chitosan production by *Syncephalastrum racemosum* and application to the removal of acid orange 7 (AO7) from wastewaters. *Molecules* 18:7646–7660
- 5766 Batson BS (1983) A light and electron microscopical study of *Hirsutosporos austrosimulii* gen. n., sp. n., (Microsporidia: Nosematidae), a parasite of *Austrosimulium* sp. (Diptera: Simuliidae) in New Zealand. *Protistologica* 19:263–280
- 5767 Batta YA, Rahman M, Powis K, Baker G et al (2011) Formulation and application of the entomopathogenic fungus: *Zoophthora radicans* (Brefeld) Batko (Zygomycetes: Entomophthorales). *J Appl Microbiol* 110:831–839
- 5768 Becnel JJ, Jeyaprakash A, Hoy MA, Shapiro A (2002) Morphological and molecular characterization of a new microsporidian species from the predatory mite *Metaseiulus occidentalis* (Nesbitt) (Acari, Phytoseiidae). *J Invertebr Pathol* 79(3):163–172
- 5769 Becnel JJ, Scheffrahn RH, Vossbrinck C, Bahder B (2013) *Multilamina teevani* gen. et sp. nov., a microsporidian pathogen of the neotropical termite *Uncitermes teevani*. *J Invertebr Pathol* 114:100–105
- 5770 Becnel JJ, Sprague V, Fukuda T, Hazard EI (1989) Development of *Ethazardia aedis* (Kudo, 1930) ng, n. comb. (Microsporidia: Amblyosporidae) in the mosquito *Aedes aegypti* (L.) (Diptera: Culicidae). *J Protozool Res* 36(2):119–130
- 5771 Behnam S, Karimi K, Khanahmadi M, Salimian Z (2016) Optimization of xylanase production by *Mucor indicus*, *Mucor hiemalis*, and *Rhizopus oryzae* through solid state fermentation. *Biol J Microorgan* 4:1–10
- 5772 Bellanger AP, Reboux G, Botterel F, Candido C et al (2010) New evidence of the involvement of *Lichtheimia corymbifera* in farmer's lung disease. *Med Mycol* 48:981–987.
- 5773 Bench ME, White MM (2012) New species and first records of trichomycetes from immature aquatic insects in Idaho. *Mycologia* 104:295–312
- 5774 Benitez M-S, Osborne SL, Lehman RM (2017) Previous crop and rotation history effects on maize seedling health and associated rhizosphere microbiome. *Sci Rep* 7:15709. <https://doi.org/10.1038/s41598-017-15955-9>
- 5775 Benny GL, Ho HM, Lazarus KL, Smith ME (2016a) Five new species of the obligate mycoparasite *Syncephalium* (Zoopagales, Zoopagomycotina) from soil. *Mycologia* 108:1114–1129
- 5776 Benny GL, Humber RA, Voigt K (2014) Zygomycetous fungi: phylum entomophthoromycota and subphyla kickxellomycotina, mortierellomycotina, mucoromycotina, and zoopagomycotina. In: Mclaughlin DJ, Spatafora JW (eds) *Systematics and evolution*. Springer, Berlin, pp 209–250
- 5777 Benny GL, Smith ME, Kirk PM, Tretter ED et al (2016b) Challenges and future perspectives in the systematics of *Kickxellomycotina*, *Mortierellomycotina*, *Mucoromycotina*, and *Zoopagomycotina*. In: Li D-W (ed) *Biology of microfungi*. Springer, New York, pp 65–126
- 5778 Berger LRR, Stamford TCM, Stamford-Arnaud TM, de Alcântara SR et al (2014) Green conversion of agroindustrial wastes into chitin and chitosan by *Rhizopus arrhizus* and *Cunninghamella elegans* strains. *Int J Mol Sci* 15:9082–9102. <https://doi.org/10.3390/ijms15059082>
- 5779 Bertumen JB, Schell WA, Joyce M, Alley C et al (2016) Diagnostic difficulty identifying *Apophysomyces trapeziformis* septic arthritis in a patient with multiple myeloma. *JMM Case Rep* 3:1–4. <https://doi.org/10.1099/jmmcr.0.005075>
- 5780 Beyer DM, O'Donnell K, Paley K, Wach MP (2013) First report of *Syzygites megalocarpus* (Mucorales) web mold on the commercial portabella button mushroom *Agaricus bisporus* in North America. *Plant Dis* 97:142
- 5781 Bidartondo MI, Read DJ, Trappe JM, Merckx V et al (2011) The dawn of symbiosis between plants and fungi. *Biol Lett* 7:574–577. <https://doi.org/10.1098/rsbl.2010.1203>
- 5782 Bills RJ, Morton JB (2015) A combination of morphology and 28S rRNA gene sequences provide grouping and ranking criteria to merge eight into three *Ambispora* species (*Ambisporaceae*, *Glomeromycota*). *Mycorrhiza* 25:485–498
- 5783 Bjørnson S, Le J, Saito T, Wang H (2011) Ultrastructure and molecular characterization of a microsporidium, *Tubulinosema hippodamiae*, from the convergent lady beetle, *Hippodamia convergens* Guérin-Méneville. *J Invertebr Pathol* 106(2):280–288
- 5784 Blackwell WH, Letcher PM, Powell MJ (2012) Synopsis of *Obelidium* (Chytridiomycota). *Phytologia* 94:103–117
- 5785 Blackwell WH, Letcher PM, Powell MJ (2017) The taxa of *Dictyomorpha* (Chytridiomycota, in praesens tempus). *Phytologia* 99:74–82
- 5786 Blackwell WH, Letcher PM, Powell MJ, Vélez CG (2011) The occurrence of *Blyttomyces spinulosus* in Alabama and Argentina, and comments on the genus *Blyttomyces* (Chytridiomycota). *Phytologia* 93:304–315
- 5787 Błaszczowski J (2010) *Glomus majewskii*, a new species of arbuscular mycorrhizal fungi (Glomeromycota). *Polish Bot J* 55:265–270
- 5788 Błaszczowski J (2012) *Glomeromycota*. W. Szafer Institute of Botany, Krakow
- 5789 Błaszczowski J, Chwat G (2013) *Septoglomus deserticola* emended and new combinations in the emended definition of the family Diversisporaceae. *Acta Mycol* 48:89–103
- 5790 Błaszczowski J, Chwat G, Górska A (2015a) *Acaulospora ignota* and *Claroideoglomus hanlinii*, two new species of arbuscular mycorrhizal fungi (Glomeromycota) from Brazil and Cuba. *Mycol Prog* 14:18. <https://doi.org/10.1007/s11557-015-1042-2>
- 5791 Błaszczowski J, Chwat G, Górska A (2016) *Dominikia lithuanica* and *Kamienskia divaricata*: new species in the Glomeromycota. *Botany* 94:1075–1085
- 5792 Błaszczowski J, Chwat G, Górska A, Bobrowska-Chwat A (2015b) *Glomus tetrastratosum*, a new species of arbuscular mycorrhizal fungi (Glomeromycota). *Mycoscience* 56:280–286
- 5793 Błaszczowski J, Chwat G, Górska A, Ryszka P et al (2015c) Two new genera, *Dominikia* and *Kamienskia*, and *D. disticha* sp. nov. in Glomeromycota. *Nova Hedwig* 100:225–238
- 5794 Błaszczowski J, Chwat G, Górska A, Ryszka P et al (2014) *Septoglomus jasnowskiae* and *Septoglomus turnauae*, two new species of arbuscular mycorrhizal fungi (Glomeromycota). *Mycol Prog* 13:985. <https://doi.org/10.1007/s11557-014-0985-z>

- 5889 Błaszowski J, Chwat G, Kovács GM, Gáspár BK et al (2013) *Septoglossum fuscum* and *S. furcatum*, two new species of arbuscular mycorrhizal fungi (Glomeromycota). *Mycologia* 105:670–680
- 5891 Błaszowski J, Chwat G, Symanczik S, Góralska A (2015d) *Dominikia duoreactiva* sp. nov. and *Dominikia difficilevidera* sp. nov., two new species in the Glomeromycota. *Botany* 93:389–396
- 5897 Błaszowski J, Furrázola E, Chwat G, Góralska A et al (2015e) Three new arbuscular mycorrhizal *Diversispora* species in Glomeromycota. *Mycol Prog* 14:105. <https://doi.org/10.1007/s11557-015-1122-3>
- 5901 Błaszowski J, Kovács GM, Gáspár BK, Balázs TK et al (2012) The arbuscular mycorrhizal *Paraglossum majewskii* sp. nov. represents a distinct basal lineage in Glomeromycota. *Mycologia* 104:148–156
- 5902 Błaszowski J, Kozłowska A, Crossay T, Symanczik S et al (2017) A new family, Pervetustaceae with a new genus, *Pervetustus*, and *P. simplex* sp. nov. (Paraglomerales), and a new genus, *Innospora* with *I. majewskii* comb. nov. (Paraglomeraceae) in the Glomeromycotina. *Nova Hedwig* 105:397–410
- 5903 Błaszowski J, Kozłowska A, Niezgodna P, Goto BT, Dalpé Y (2018) A new genus, *Oehlia* with *Oehlia diaphana* comb. nov. and an emended description of *Rhizoglossum vesiculiferum* comb. nov. in the Glomeromycotina. *Nov Hedwig* 103:193–210
- 5904 Blooi M, Pasmans F, Longcore JE, Spitzen-van der Sluijs A et al (2013) Duplex real-time PCR for rapid simultaneous detection of *Batrachochytrium dendrobatidis* and *Batrachochytrium salamandrivorans* in Amphibian samples. *J Clin Microbiol* 51:4173–4177. <https://doi.org/10.1128/JCM.02313-13>
- 5905 Bojko J, Dunn AM, Stebbing PD, Ross SH et al (2015) *Cucumispora ornata* n. sp. (Fungi: Microsporidia) infecting invasive demon shrimp (*Dikerogammarus haemobaphes*) in the United Kingdom. *J Invertebr Pathol* 128:22–30
- 5906 Bonifaz A, Stchigel AM, Guarro J, Guevara E et al (2014) Primary cutaneous mucormycosis produced by the new species *Apophysomyces mexicanus*. *J Clin Microbiol* 52:4428–4431
- 5907 Borrás R, Roselló P, Chilet M, Bravo D et al (2010) Positive result of the *Aspergillus galactomannan* antigen assay using bronchoalveolar lavage fluid from a patient with an invasive infection due to *Lichtheimia ramosa*. *J Clin Microbiol* 48:3035–3036
- 5908 Bridge PD, Hughes KA, Denton JO (2008) Association of the coprophilous fungus *Pirella circinans* with an indigenous beetle on the sub-Antarctic Bird Island. *Polar Biol* 31:657–661
- 5909 Bronnvall AM, Larsson JR (2001) Ultrastructure and light microscopic cytology of *Agglomerata lacrima* n. sp. (Microspora, Duboscqidae), a microsporidian parasite of *Acanthocyclops vernalis* (Copepoda, Cyclopidae). *Eur J Protistol* 37(1):89–102
- 5910 Brooks WM, Becnel JJ, Kennedy GG (1988) Establishment of *Endoreticulalus* n.g. for *Pleistophora fidelis* (Hostounsky & Weiser 1975) (Microsporidia: Pleistophoridae) based on the ultrastructure of a microsporidium in the Colorado potato beetle, *Leptinotarsa decemlineata* (Say). *J Protozool* 35:481–488
- 5911 Brown AM, Kent ML, Adamson ML (2010) Description of five new *Loma* (Microsporidia) species in pacific fishes with redesignation of the type species *Loma morhua* Morrison & Sprague, 1981, based on morphological and molecular species-boundaries tests. *J Eukaryot Microbiol* 57:529–553
- 5912 Budziszewska J, Boulahdjel A, Wilk M, Wrzosek M (2010a) Soil zygomycetous fungi in Biebrza National Park (northeast Poland). *Pol Bot J* 55:391–407
- 5913 Budziszewska J, Wilk M, Wrzosek M (2010b) Taxonomic revision of the genus *Rhizomucor*. *IMC9: the biology of fungi: 2010; Edinburgh, UK.*
- 5914 Burjanadze M, Goginashvili N (2009) Occurrence of pathogens and nematodes in the spruce bark beetles, *Ips typographus* (Col, Scolytidae) in Borjomi Gorge. *Bull Georg Natl Acad Sci* 3(1):145–150
- 5915 Burmester A, Karimi S, Wetzel J, Wöstemeyer J (2013) Complementation of a stable Met2-1 mutant of the zygomycete *Absidia glauca* by the corresponding wild-type allele of the mycoparasite *Parasitiella parasitica*, transferred during infection. *Microbiology* 159:1639–1648
- 5916 Bylén EK, Larsson JR (1994) Ultrastructural study and description of *Pernicivesicula gracilis* gen. et sp. nov. (Microspora, Perezidae), a rod-shaped microsporidium of midge larvae, *Pentaneurella* sp. (Diptera, Chironomidae), in Sweden. *Eur J Protistol* 30(2):139–150
- 5917 Bylén EK, Larsson JR (1996) Ultrastructural study and description of *Mrazekia tetraspora* Léger & Hesse, 1922 and transfer to a new genus *Scipionospora* ng (Microspora, Caudosporidae). *Eur J Protistol* 32(1):104–115
- 5918 Cai B-P, Guo L-D, Chen J-Y, Zhang QX (2013) *Glomus mume* and *Kuklospora spinosa*: two new species of Glomeromycota from China. *Mycotaxon* 124:263–268
- 5919 Cali A, Becnel JJ, Takvorian PM (2017) Microsporidia. In: Archibald JM, Simpson AGB, Slamovits CH (eds) *Handbook of the Protists*. Springer, New York, pp 1569–1618
- 5920 Cali A, Kent M, Sanders J, Pau C, Takvorian PM (2012) Development, ultrastructural pathology, and taxonomic revision of the Microsporidian genus, *Pseudoloma* and its type species *Pseudoloma neurophilia*, in skeletal muscle and nervous tissue of experimentally infected zebrafish *Danio rerio*. *J Eukaryot Microbiol* 59:40–48
- 5921 Cali A, Neafie R, Weiss LM, Ghosh K et al (2010) Human vocal cord infection with the microsporidium *Anncaliia algerae*. *J Eukaryot Microbiol* 57(6):562–567
- 5922 Callaghan TM, Podmirsej SM, Hohlweck D, Edwards JE (2015) *Biwchfawromyces eastonii* gen. nov., sp. nov.: a new anaerobic fungus (Neocallimastigomycota) isolated from buffalo faeces. *MycKeys* 9:11–28
- 5923 Calo S, Nicolás FE, Lee SC, Vila A et al (2017) A non-canonical RNA degradation pathway suppresses RNAi-dependent epimutations in the human fungal pathogen *Mucor circinelloides*. *PLoS Genet* 13:e1006686
- 5924 Camino LP, Idnurm A, Cerdá-Olmedo E (2015) Diversity, ecology, and evolution in *Phycomyces*. *Fungal Biol* 119:1007–1021
- 5925 Campbell SE, Williams TA, Yousof A, Soanes DM, Paszkiewicz KH, Williams BA (2013) The genome of *Spraguea lophii* and the basis of host-microsporidian interactions. *PLoS Genet* 9(8):e1003676
- 5926 Canet A, Benaiges MD, Valero F, Adlercreutz P (2017) Exploring substrate specificities of a recombinant *Rhizopus oryzae* lipase in biodiesel synthesis. *New Biotechnol* 39:59–67
- 5927 Canning EU, Curry A, Overstreet RM (2002a) Ultrastructure of *Tuzetia weidneri* sp. n. (Microspora: Tuzetiidae) in skeletal muscle of *Litopenaeus setiferus* and *Farfantepenaeus aztecus* (Crustacea: Decapoda) and new data on *Perezia nelsoni* (Microsporidia: Perezidae) in *L. setiferus*. *Acta Protozool* 41:63–77
- 5928 Canning EU, Feist SW, Longshaw M, Okamura B, Anderson CL, Tse MT, Curry A (2005) *Microgemma vivaresi* n. sp. (Microsporidia, Tetramicridae), infecting liver and skeletal muscle of sea scorpions, *Taurulus bubalis* (Euphrasen 1786) (Osteichthyes, Cottidae), an inshore, littoral fish. *J Eukaryot Microbiol* 52:123–131
- 5929 Canning EU, Hazard EI (1982) Genus *Pleistophora* Gurley, 1893: an assemblage of at least three genera 1. *J Protozool Res* 29(1):39–49
- 5930 Canning EU, Killick-Kendrick R, Killick-Kendrick M (1991) A new microsporidian parasite, *Flabelliforma montana* ng, n. sp.,

- 6020 infecting *Phlebotomus ariasi* (Diptera, Psychodidae) in France. J Invertebr Pathol 57(1):71–81
- 6021 Canning EU, Refardt D, Vossbrinck CR, Okamura B et al (2002b) New diplokaryotic microsporidia (Phylum Microsporidia) from freshwater bryozoans (Bryozoa, Phylactolaemata). Eur J Protistol 38(3):247
- 6022 Canning EU, Refardt D, Vossbrinck CR, Okamura B et al (2004) Correction for genus *Bryonosema* (Microsporidia, Pseudonosematidae). Eur J Protistol 40(1):69
- 6023 Casal G, Matos E, Garcia P, Al-Quarishy S, Azevedo C (2012) Ultrastructural and molecular studies of *Microgemma carolinus* n. sp. (Microsporidia), a parasite of the fish *Trachinotus carolinus* (Carangidae) in Southern Brazil. Parasitology 139:1720–1728
- 6024 Casal G, Matos E, Teles-Grilo ML, Azevedo C (2008) A new microsporidian parasite, *Potaspora morhaphis* n. gen., n. sp. (Microsporidia) infecting the Teleostean fish, *Potamorhaphis guianensis* from the River Amazon. Morphological, ultrastructural and molecular characterization. Parasitology 135(9):1053–1064
- 6025 Casal G, Matos E, Teles-Grilo ML, Azevedo C (2009) Morphological and genetical description of *Loma psittaca* sp. n. isolated from the Amazonian fish species *Colomesus psittacus*. Parasitol Res 105:1261–1271
- 6026 Cassone BJ, Carter FM, Michel AP, Stewart LR et al (2014) Genetic insights into *Graminella nigrifrons* competence for maize fine streak virus infection and transmission. PLoS ONE 9:e113529. <https://doi.org/10.1371/journal.pone.0113529>
- 6027 Cavalheiro GF, Sanguine IS, Santos FR, Costa AC et al (2017) Catalytic properties of amylolytic enzymes produced by *Gongronella butleri* using agroindustrial residues on solid-state fermentation. BioMed Res Int. <https://doi.org/10.1155/2017/7507523>
- 6028 ~~Chakrabarti A, Singh R (2014) Mucormycosis in India: unique features. Mycoses 57:85–90~~
- 6029 Chander J, Singla N, Kaur M, Punia RS et al (2017) *Saksenaea erythrospora*, an emerging mucoralean fungus causing severe necrotizing skin and soft tissue infections—a study from a tertiary care hospital in north India. Infect Dis 49:170–177. <https://doi.org/10.1080/23744235.2016.1239027>
- 6030 Chaudhary S, Polaino S, Shakya VPS, Idnurm A (2013) A new genetic linkage map of the zygomycete fungus *Phycomyces blakesleeanus*. PLoS ONE 8:e58931. <https://doi.org/10.1371/journal.pone.0058931>
- 6031 Chen L, Li R, You Y, Zhang K et al (2017) A novel spore wall protein from *Antonospora locustae* (Microsporidia: Nosematidae) contributes to sporulation. J Eukaryot Microbiol 64(6):779–791
- 6032 Chen WJ, Kuo TL, Wu ST (1998) Development of a new microsporidian parasite, *Intrapredatorus barri* ng, n. sp. (Microsporidia: Amblyosporidae) from the predacious mosquito *Culex fuscans* Wiedemann (Diptera: Culicidae). Parasitol Int 47(3):183–193
- 6033 Chen Y, Cassone BJ, Bai X, Redinbaugh MG et al (2012) Transcriptome of the plant virus vector *Graminella nigrifrons*, and the molecular interactions of maize fine streak rhabdovirus transmission. PLoS ONE 7(7):e40613. <https://doi.org/10.1371/journal.pone.0040613>
- 6034 Chen Y, Liu S, Bonning BC (2015) Genome sequence of a novel iflavivirus from the leafhopper *Graminella nigrifrons*. Genome Announc 3:e00323-15. <https://doi.org/10.1128/genomeA.00323-15>
- 6035 Cheney SA, Lafranchi-Tristem NJ, Canning EU (2000) Phylogenetic relationships of pleistophora-like microsporidia based on small subunit ribosomal DNA sequences and implications for the source of trachipleistophora hominis infections. J Eukaryot Microbiol 47:280–287
- 6036 Chibucos MC, Etienne KA, Orvis J, Lee H et al (2015) The genome sequence of four isolates from the family Lichtheimiaceae. Pathog Dis 73:ftv024. <https://doi.org/10.1093/femspd/ftv024>
- 6037 Chibucos MC, Soliman S, Gebremariam T, Lee H et al (2016) An integrated genomic and transcriptomic survey of mucormycosis-causing fungi. Nat Commun. <https://doi.org/10.1038/ncomms12218>
- 6038 Chiranjeevi U, Kalusalingam A, Kamarajan K (2017) Anti-oxidant activity of *Linderina* madayiparensis extracts. Int J ChemTechnol Res 10:178–184
- 6039 Choudhari SM, Ananthanarayan L, Singhal RS (2008) Use of metabolic stimulators and inhibitors for enhanced production of β -carotene and lycopene by *Blakeslea trispora* NRRL 2895 and 2896. Bioresour Technol 99:3166–3173
- 6040 Choudhary MM, Metcalfe MG, Arrambide K, Bern C et al (2011) *Tubulinosema* sp. *microsporidian* myositis in immunosuppressed patient. Emerg Infect Dis 17(9):1727
- 6041 Chuang CC, Ho HM (2009) Notes on zygomycetes of Taiwan (VII): two Kickxellalean species, *Linderina macrospore* and *Ramicandelaber brevisporus* new to Taiwan. Fungal Sci 24:23–28
- 6042 Chuang SC, Ho HM (2011) The merosporangiferous fungi from Taiwan (VIII): two new records of *Coemansia* (Kickxellales, Kickxellomycotina). Taiwanica 56:295–300
- 6043 Chuang SC, Ho HM, Benny GL, Lee CF (2013) Two new *Ramicandelaber* species from Taiwan. Mycologia 105:320–334
- 6044 Chuang SC, Ho HM, Reynolds N, Smith ME et al (2018) Preliminary phylogeny of *Coemansia* (Kickxellales), with descriptions of four new species from Taiwan. Mycologia 109:815–831. <https://doi.org/10.1080/00275514.2017.1401892>
- 6045 Clum A, Tindall BJ, Sikorski J, Ivanova N et al (2009) Complete genome sequence of *Pirellula staleyi* type strain (ATCC 27377 T). Stand Genom Sci 1:308–316. <https://doi.org/10.4056/signs.51657>
- 6046 Codreanu R (1966) On the occurrence of spore or sporont appendages in the Microsporidia and their taxonomic significance. Proc First Int Congress Parasitol 1:602–603
- 6047 Codreanu R, Balcescu-Codreanu D (1974) On the morphology and ultrastructure of the microsporidian *Thelohania octospora* Hennequy, 1892, parasitic in the prawn *Palaemon serratus* (Pennant) 1777 from the Atlantic French coast; need for a revision of its taxonomic status. In: Proceedings of the 3rd International Congress of Parasitol, Miinchen, Facta Publications, Vienna, vol 1, pp. 15–16
- 6048 Codreanu-Bălcescu D, Codreanu R, Traciuc E (1981) Ultrastructural data on a microsporidian infesting the ovaries of an araneid. J Invertebr Pathol 37(1):28–33
- 6049 Colmenero AI, Barría C, Feist SW, Tuset VM (2015) Observations on the occurrence of *Spraguea lophii* in Mediterranean lophiids. Parasitol Res 114:1977–1983
- 6050 Cooley JR, Marshall DC, Hill KB (2018) A specialized fungal parasite (*Massospora cicadina*) hijacks the sexual signals of periodical cicadas (Hemiptera: Cicadidae: Magicicada). Sci Rep. <https://doi.org/10.1038/s41598-018-19813-0>
- 6051 Corradi N, Haag KL, Pombert JF, Ebert D et al (2009) Draft genome sequence of the *Daphnia* pathogen *Octosporaea bayeri*: insights into the gene content of a large microsporidian genome and a model for host-parasite interactions. Genome Biol 10(10):R106
- 6052 Corradi N, Pombert JF, Farinelli L, Didier ES, Keeling PJ (2010) The complete sequence of the smallest known nuclear genome from the microsporidian *Encephalitozoon intestinalis*. Nat Commun 1:77
- 6053 Corrochano LM, Kuo A, Marcet-Houben M, Polaino S et al (2016) Expansion of signal transduction pathways in fungi by extensive genome duplication. Curr Biol 26:1577–1584

- 6150 Corsaro D, Köhler M, Wylezich C, Venditti D et al (2018) New
6151 insights from molecular phylogenetics of amoebophilic fungi
6152 (Zoopagomycota, Zoopagales). *Parasitol Res* 117:157–167
- 6153 Crossay T, Cilia A, Cavaloc Y, Amir H et al (2018) Four new species
6154 of arbuscular mycorrhizal fungi (Glomeromycota) associated
6155 with endemic plants from ultramafic soils of New Caledonia.
6156 *Mycol Prog*. <https://doi.org/10.1007/s11557-018-1386-5>
- 6157 Crous PW, Wingfield MJ, Burgess TI, Carnegie AJ et al (2017)
6158 Fungal Planet description sheets: 625–715. *Persoonia*
6159 39:270–467
- 6160 Cruz-Lachica I, Marquez-Zequera I, Garcia-Estrada RS, Carrillo-
6161 Fasio JA et al (2016) First report of *Gilbertella persicaria*
6162 causing papaya fruit rot. *Plant Dis* 100:227. <https://doi.org/10.1094/PDIS-05-15-0607-PDN>
- 6163 Cunningham A, Daszak P (1998) Extinction of a species of land snail
6164 due to infection with a microsporidian parasite. *Conserv Biol*
6165 12:1139–1141
- 6166 Czaker R (1997) *Wittmannia antarctica* ng, n. sp. (Nosematidae), a
6167 new hyperparasite in the Antarctic dicyemid mesozoan kan-
6168 tharella Antarctica. *J Eukaryot Microbiol* 44(5):438–446
- 6169 Dagar SS, Kumar S, Griffith GW, Edwards JE et al (2015) A new
6170 anaerobic fungus (*Oontomyces ankari* gen. nov., sp. nov.) from
6171 the digestive tract of the Indian camel (*Camelus dromedarius*).
6172 *Fungal Biol* 119:731–737
- 6173 Das SK, Dickinson C, Lafir F, Brougham DF et al (2012) Synthesis,
6174 characterization and catalytic activity of gold nanoparticles
6175 biosynthesized with *Rhizopus oryzae* protein extract. *Green*
6176 *Chem* 14:1322–1334
- 6177 Dave VP, Sharma S, Yogi R, Reddy S (2014) *Apophysomyces*
6178 *elegans*: a novel cause of endogenous endophthalmitis in an
6179 immunocompetent individual. *Int Ophthalmol* 34:1285–1289
- 6180 Davis WJ, Antonetti J, Letcher PM, Powell MJ (2016a) Phylogenetic
6181 diversity of chytridiomycetes in a temporary forest pond
6182 surveyed using culture-based methods. *Southeast Nat*
6183 15:534–548
- 6184 Davis WJ, Letcher PM, Longcore JE, Powell MJ (2015) *Fayoehytri-*
6185 *omyces*, a new genus within Chytridiales. *Mycologia*
6186 107:432–439
- 6187 Davis WJ, Letcher PM, Powell MJ (2013) Chytrid diversity of
6188 Tuscaloosa County, Alabama. *Southeast Nat* 12:666–683
- 6189 Davis WJ, Letcher PM, Powell MJ (2016b) *Borealophlyctis nick-*
6190 *ersoniae*, a new species in Rhizophlyctidales. *Mycologia*
6191 108:744–752
- 6192 De Andrade Z, Furrázola E, Cuenca G (2017) *Scutellospora*
6193 *tepuiensis* sp. nov. from the highland tepuis of Venezuela.
6194 *Mycotaxon* 132:9–18
- 6195 De Azevedo Santiago ALCM, dos Santos PJP, Maia LC (2013)
6196 Mucorales from the semiarid of Pernambuco, Brazil. *Braz J*
6197 *Microbiol* 44:299–305. <https://doi.org/10.1590/S1517-83822013005000027>
- 6200 De Godoi FSP, Rafael JA (2013) A new species of *Dicranophora*
6201 *Macquart* (Diptera, Stratiomyidae) from Bahia State, Brazil and
6202 a key to species of the genus. *Zootaxa* 3641:83–91
- 6203 de Mello CMA, da Silva GA, de Assis DM, de Pontes JS et al (2013)
6204 *Paraglomus pernambucanum* sp. nov. and *Paraglomus boli-*
6205 *vianum* comb. nov., and biogeographic distribution of *Paraglo-*
6206 *mus* and *Pacispora*. *J Appl Bot Food Qual* 86:113–125
- 6207 de Pontes JS, Santos VM, Pereira CD, da Silva AG et al (2017)
6208 *Acaulospora spinulifera*, a new arbuscular mycorrhizal fungal
6209 species from the Brazilian Cerrado and Atlantic rain forest. *Nova*
6210 *Hedwig* 105:1219–1229
- 6211 de Santiago ALCM, Cavalcanti MA, Trufem SFB (2009) The first
6212 record of *Dimargaris bacillispora* (Dimargaritales) in South
6213 America. *Mycotaxon* 108:201–204
- 6214 de Souza JI, Marano AV, Pires-Zottarelli CL, Chambergo FS et al
6215 (2014) A new species of *Backusella* (Mucorales) from a Cerrado
6216 reserve in Southeast Brazil. *Mycol Progress* 13(4):981. <https://doi.org/10.1007/s11557-014-0981-3>
- 6217 De Souza JI, Pires-Zottarelli CL, Dos Santos JF, Costa JP et al (2012)
6218 *Isonucor* (Mucoromycotina): a new genus from a Cerrado
6219 reserve in state of São Paulo, Brazil. *Mycologia* 104:232–241
- 6220 Degawa Y (2009) Secondary spore formation in *Orcheshellaria*
6221 *mauguioi* (Asellariales, Trichomyces) and its taxonomic and
6222 ecological implications. *Mycoscience* 50:247. <https://doi.org/10.1007/s10267-008-0477-6>
- 6223 Degawa Y (2014) *Verrucocephalum*, a new nematophilic genus in
6224 the Helicocephalidaceae (Zoopagales). *Mycoscience* 55:144–148
- 6225 Desirò A, Duckett JG, Pressel S, Villarreal JC et al (2013) Fungal
6226 symbioses in hornworts: a chequered history. *Proc R Soc B*
6227 280(1759):20130207. <https://doi.org/10.1098/rspb.2013.0207>
- 6228 Desirò A, Faccio A, Kaech A, Bidartondo MI et al (2015) Endogone,
6229 one of the oldest plant-associated fungi, host unique Mollicutes-
6230 related endobacteria. *New Phytol* 205:1464–1472
- 6231 Desirò A, Rimington WR, Jacob A, Pol NV, Smith ME, Trappe JM,
6232 Bidartondo MI, Bonito G (2017) Multigene phylogeny of
6233 Endogonales, an early diverging lineage of fungi associated
6234 with plants. *IMA Fungus* 8(2):245–264
- 6235 de Souza CAF, Lima DX, Gurgel LMS, de Azevedo Santiago ALCM
6236 (2017) Coprophilous mucorales (ex Zygomycota) from three
6237 areas in the semi-arid of Pernambuco, Brazil. *Braz J Microbiol*
6238 48:79–86. <https://doi.org/10.1016/j.bjm.2016.09.008>
- 6239 Diamant A, Goren M, Yokeş MB, Galil BS, Klopman Y, Huchon D,
6240 Szipenberg A, Karhan SU (2010) *Dasyatispora levantinae* gen. et
6241 sp. nov., a new microsporidian parasite from the common
6242 stingray *Dasyatis pastinaca* in the eastern Mediterranean. *Dis*
6243 *Aquat Organ* 91(2):137–150
- 6244 Diamant A, Rothman SB, Goren M, Galil BS, Yokes MB, Szipenberg
6245 A, Huchon D (2014) Biology of a new xenoma-forming
6246 gonadotropic microsporidium in the invasive blotchin dragonet
6247 *Callionymus filamentosus*. *Dis Aquat Organ* 109(1):35–54
- 6248 Didier ES, Vossbrinck CR, Baker MD, Rogers LB, Bertucci DC,
6249 Shaddock JA (1995) Identification and characterization of three
6250 *Encephalitozoon cuniculi* strains. *Parasitology* 111:411–421
- 6251 Dillon MJ, Bowkett AE, Bungard MJ, Beckman KM et al (2017)
6252 Tracking the amphibian pathogens *Batrachochytrium dendrobati-*
6253 *dis* and *Batrachochytrium salamandrivorans* using a highly
6254 specific monoclonal antibody and lateral-flow technology.
6255 *Microbial Biotechnol* 10:381–394. <https://doi.org/10.1111/1751-7915.12464>
- 6256 Ding Z, Pan J, Huang H, Jiang G et al (2018) An integrated metabolic
6257 consequence of *Hepatospora eriocheir* infection in the Chinese
6258 mitten crab *Eriocheir sinensis*. *Fish Shellfish Immunol*
6259 72:443–451
- 6260 Ding ZF, Chen JQ, Lin J, Zhu XS et al (2017) Development of in situ
6261 hybridization and real-time PCR assays for the detection of
6262 *Hepatospora eriocheir*, a microsporidian pathogen in the Chi-
6263 nese mitten crab *Eriocheir sinensis*. *J Fish Dis* 40(7):919–927
- 6264 Doby JM, Saguez F (1964) *Weiseria*, new genus of Microsporidia and
6265 *Weiseria laurenti* n. sp., parasite of larvae of *Prosimulium*
6266 *Inflatum* Davies, 1957 (Diptera: Paraneuracera). *Comp Rendus*
6267 *Hebd seances Acad Sci* 259:3614–3617
- 6268 Dolatabadi S, Hoog GS, Meis JF, Walther G (2014) Species
6269 boundaries and nomenclature of *Rhizopus arrhizus* (syn. *R.*
6270 *oryzae*). *Mycoses* 57:108–127
- 6271 Dong S, Shen Z, Xu L, Zhu F (2010a) Sequence and phylogenetic
6272 analysis of SSU rRNA gene of five microsporidia. *Curr*
6273 *Microbiol* 60(1):30–37
- 6274 Dong S, Shen Z, Xu L, Zhu F (2010b) Sequence and phylogenetic
6275 analysis of SSU rRNA gene of five microsporidia. *Curr*
6276 *Microbiol* 60:30–37
- 6277 Dorin J, D'Aveni M, Debourgogne A, Cuenin M et al (2017) Update
6278 on *Actinomuor elegans*, a mucormycete infrequently detected in
6279 6280 6281

- 6282 human specimens: how combined microbiological tools contribute efficiently to a more accurate medical care. *Int J Med Microbiol* 307:435–442
- 6283
- 6284
- 6285 ~~Dourou M, Mizzerakis P, Papanikolaou S, Aggelis G (2017) Storage~~
- 6286 ~~lipid and polysaccharide metabolism in *Yarrowia lipolytica* and~~
- 6287 ~~*Umbelopsis isabellina*. *Appl Microbiol Biotechnol*~~
- 6288 ~~101:7213–7226. <https://doi.org/10.1007/s00253-017-8455-6>~~
- 6289 Doweld A (2001) *Prosyllabus tracheophytorum tentamen systematis plantarum vasculares (Tracheophyta)*, vol 80. Geos, Moscow, pp 33–110
- 6290
- 6291
- 6292 Doweld AB (2013a) Nomenclatural novelties [*Aciascus*, *Carpenterophlyctis*, *Conostomatium*, *Glomerogloea*, *Lecythiomyces*, *Spiromastigoides*, *Trissocladyces*]. <http://www.indexfungorum.org/names/NamesRecord.asp?RecordID=550471>
- 6293
- 6294 Doweld AB (2013b) Nomenclatural novelties [*Batrachochytriaceae* fam. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.44.pdf>
- 6295
- 6296 Doweld AB (2013c) Nomenclatural novelties [*Olpidiales* ord. nov., *Olpidiomyces* class. nov., *Olpidiomyces* phyl. nov., *Olpidiomyces* subphyl. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.42.pdf>
- 6297
- 6298 Doweld AB (2013d) Nomenclatural novelties [*Rozellomycota* phyl. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.43.pdf>
- 6299
- 6300 Doweld AB (2014a) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.103.pdf>
- 6301
- 6302 Doweld AB (2014b) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.76.pdf>
- 6303
- 6304 Doweld AB (2014c) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.58.pdf>
- 6305
- 6306 Doweld AB (2014d) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.94.pdf>
- 6307
- 6308 Doweld AB (2014e) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.91.pdf>
- 6309
- 6310 Doweld AB (2014f) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.74.pdf>
- 6311
- 6312 Doweld AB (2014g) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.49.pdf>
- 6313
- 6314 Doweld AB (2014h) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.61.pdf>
- 6315
- 6316 Doweld AB (2014i) Nomenclatural novelties [*Algochytrops polysiphoniae* gen. et comb. nov.]. <http://www.indexfungorum.org/names/NamesRecord.asp?RecordID=550471>
- 6317
- 6318 Doweld AB (2014j) Nomenclatural novelties [*Leiolpidium* gen. nov.]. <http://www.indexfungorum.org/names/NamesRecord.asp?RecordID=550478>
- 6319
- 6320 Doweld AB (2014k) Nomenclatural novelties [*Nematoceromyces* gen. nov.]. <http://www.indexfungorum.org/names/NamesRecord.asp?RecordID=550335>
- 6321
- 6322 Doweld AB (2014l) Nomenclatural novelties [*Olpidiaster brassicae* comb. nov., *O. virulentus* sp. nov., *Olpidiasteraceae* fam. nov.]. <http://www.indexfungorum.org/names/NamesRecord.asp?RecordID=550486>
- 6323
- 6324 Doweld AB (2014m) Nomenclatural novelties [*Perolpidium saccatum*, *P. utriculiforme* gen. et comb. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.130.pdf>
- 6325
- 6326 Doweld AB (2014n) Nomenclatural novelties [*Polyphagus arnaudovii*, *P. asymmetricus*, *P. sinicus* spp. nov.]. <http://www.indexfungorum.org/names/NamesRecord.asp?RecordID=550465>
- 6327
- 6328 Doweld AB (2014o) Nomenclatural novelties [*Rhizosiphon akintovorax* sp. nov., *Rhizosiphonaceae* fam. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.116.pdf>
- 6329
- 6330 Doweld AB (2014p) Nomenclatural novelties [*Riethophlyctis vaucheriae* gen. et sp. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.124.pdf>
- 6331
- 6332
- 6333
- 6334
- 6335 Doweld AB (2014q) Nomenclatural novelties [*Schizolpidium majus* gen. et comb. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.127.pdf>
- 6336
- 6337 Doweld AB (2014r) Nomenclatural novelties [*Sorokinocystis mirabilis* nom. et comb. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.113.pdf>
- 6338
- 6339 Doweld AB (2014s) Nomenclatural novelties [*Zygothlyctis planktonica* gen. et sp. nov.]. <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.114.pdf>
- 6340
- 6341 Down RE, Bell HA, Bryning G, Kirkbride-Smith AE, Edwards JP, Weaver RJ (2008) Infection by the microsporidium *Vairimorpha necatrix* (Microspora: Microsporidia) elevates juvenile hormone titres in larvae of the tomato moth, *Lacanobia oleracea* (Lepidoptera: Noctuidae). *J Invertebr Pathol* 97(3):223–229
- 6342
- 6343 Dube AK, Kumar MS (2017) Biotransformation of bromhexine by *Cunninghamella elegans*, *C. echinulata* and *C. blakesleeana*. *Braz J Microbiol* 48:259–267. <https://doi.org/10.1016/j.bjm.2016.11.003>
- 6344
- 6345 Edgington S, Thompson E, Moore D, Hughes KA et al (2014) Investigating the insecticidal potential of *Geomyces* (Myxotrichaceae: Helotiales) and *Mortierella* (Mortierellaceae: Mortierellales) isolated from Antarctica. *SpringerPlus* 3:289. <https://doi.org/10.1186/2193-1801-3-289>
- 6346
- 6347 Ellenberger S, Burmester A, Wöstemeyer J (2014) Complete mitochondrial DNA sequence of the mucoralean fusion parasite *Parasitella parasitica*. *Genome Announc* 2:e00912-14. <https://doi.org/10.1128/genomeA.00912-14>
- 6348
- 6349 ~~Ellenberger S, Burmester A, Wöstemeyer J (2018) The fate of~~
- 6350 ~~mitochondria after infection of the Mucoralean fungus *Absidia*~~
- 6351 ~~*glauca* by the fusion parasite *Parasitella parasitica*: comparison~~
- 6352 ~~of mitochondrial genomes in zygomycetes. *Mitochondrial DNA*~~
- 6353 ~~Part A 29:113–120~~
- 6354
- 6355 Ellerbeck M, Schüßler A, Brucker D, Dafinger C et al (2013) Characterization of three ammonium transporters of the glomeromycotan fungus *Geosiphon pyriformis*. *Eukaryot Cell* 12:1554–1562
- 6356
- 6357 Estrada B, Palenzuela J, Barea J, Ruiz-Lozano JM et al (2011) *Diversispora clara* (Glomeromycetes)—a new species from saline dunes in the Natural Park Cobo de Gata (Spain). *Mycotaxon* 118:73–81
- 6358
- 6359 Etienne KA, Chibucos MC, Su Q, Orvis J et al (2014) Draft genome sequence of *Mortierella alpina* isolate CDC-B6842. *Genome Announc* 2:e01180-13. <https://doi.org/10.1128/genomeA.01180-13>
- 6360
- 6361 Etienne KA, Gillece J, Hilsabeck R, Schupp JM et al (2012) Whole genome sequence typing to investigate the *Apophysomyces* outbreak following a tornado in Joplin, Missouri 2011. *PLoS ONE* 7(11):e49989
- 6362
- 6363 Fakas S, Makri A, Mavromati M, Tselepi M et al (2009a) Fatty acid composition in lipid fractions lengthwise the mycelium of *Mortierella isabellina* and lipid production by solid state fermentation. *Bioresour Technol* 100:6118–6120
- 6364
- 6365 Fakas S, Papanikolaou S, Batsos A, Galiotou-Panayotou M et al (2009b) Evaluating renewable carbon sources as substrates for single cell oil production by *Cunninghamella echinulata* and *Mortierella isabellina*. *Biomass Bioenergy* 33:573–580
- 6366
- 6367 Faye N, Toguebaye BS, Bouix G (1991) *Microfilum lutjani* n. sp. (Protozoa Microsporida), a gill parasite of the golden African snapper *Lutjanus fulgens* (Valenciennes, 1830) (*Teleost lutjanidae*): developmental cycle and infrastructure. *J Protozool Res* 38(1):30–40
- 6368
- 6369 Faye N, Toguebaye BS, Bouix G (1996) Ultrastructure and development of *Neonosemoides tilapiae* (Sakiti and Bouix, 1987) n. sp. (Protozoa, Microspora) from African cichlid fish. *Eur J Protistol* 32(3):320–326
- 6370
- 6371
- 6372
- 6373
- 6374
- 6375
- 6376
- 6377
- 6378
- 6379
- 6380
- 6381
- 6382
- 6383
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- 6400
- 6401
- 6402
- 6403
- 6404
- 6405
- 6406
- 6407
- 6408
- 6409
- 6410
- 6411
- 6412

- 6413 Fiałkowska E, Pajdak-Stós A (2018) Temperature-dependence of
6414 predator-prey dynamics in interactions between the predatory
6415 fungus *Lecophagus* sp. and its prey *L. inermis* Rotifers.
6416 *Microbial Ecol* 75:400–406
- 6417 Fisher MC, Garner TW, Walker SF (2009) Global emergence of
6418 *Batrachochytrium dendrobatidis* and amphibian chytridiomycosis
6419 in space, time, and host. *Ann Rev Microbiol* 63:291–310
- 6420 Foissner I, Foissner W (1995) *Ciliatosporidium platyophryae* nov.
6421 gen., nov. spec. (*Microspora incerta* sedis), a parasite of
6422 *Platyophrya terricola* (Ciliophora, Colpodea). *Eur J Protistol*
6423 31(3):248–259
- 6424 Fokin SI, Di-Giuseppe G, Erra F, Dini F (2008) *Euplotespora*
6425 *binucleata* n. gen., n. sp. (Protozoa: Microsporidia), a parasite
6426 infecting the hypotrichous ciliate *Euplotes woodruffi*, with
6427 observations on microsporidian infections in Ciliophora.
6428 *J Eukaryot Microbiol* 55(3):214–228
- 6429 Foltz JR, Plant KP, Overturf K, Clemens K et al (2009) Detection of
6430 *Nucleospora salmonis* in steelhead trout, *Oncorhynchus mykiss*
6431 (Walbaum), using quantitative polymerase chain reaction
6432 (qPCR). *J Fish Dis* 32(6):551–555
- 6433 Foos KM, May NL, Beach DL, Pomper M et al (2011) Phylogeny of
6434 Pilobolaceae. *Mycologia* 103:36–44
- 6435 Fowler JL, Reeves EL (1974) Spore dimorphism in a microsporidian
6436 isolate. *J Protozool* 21:538–542
- 6437 Franzen C, Fischer S, Schroeder J, Scholmerich J et al (2005)
6438 Morphological and molecular investigations of *Tubulinosema*
6439 *ratishbonensis* gen. nov., sp. nov. (Microsporidia: *Tubulinose-*
6440 *matidae* fam. nov.), a parasite infecting a laboratory colony of
6441 *Drosophila melanogaster* (Diptera: Drosophilidae). *J Eukaryot*
6442 *Microbiol* 52(2):141–152
- 6443 Freeman KR, Martin AP, Karki D, Lynch RC et al (2009) Evidence
6444 that chytrids dominate fungal communities in high-elevation
6445 soils. *Proc Natl Acad Sci USA* 106:18315–18320. <https://doi.org/10.1073/pnas.0907303106>
- 6446 Freeman MA, Kasper JM, Kristmundsson Á (2013) *Nucleospora*
6447 *cyclopteri* n. sp., an intranuclear microsporidian infecting wild
6448 lumpfish, *Cyclopterus lumpus* L., in Icelandic waters. *Parasit*
6449 *Vectors* 6(1):49
- 6450 Freeman MA, Kristmundsson Á (2013) Ultrastructure of *Nucleospora*
6451 *cyclopteri*, an intranuclear microsporidian infecting the Atlantic
6452 lumpfish (*Cyclopterus lumpus* L.). *Bul Eur Ass Fish Pathol*
6453 33:194–198
- 6454 Freeman MA, Sommerville C (2009) *Desmozoon lepeophtherii* n.
6455 gen., n. sp., (Microsporidia: Enterocytozoonidae) infecting the
6456 salmon louse *Lepeophtheirus salmonis* (Copepoda: Caligidae).
6457 *Parasit Vectors* 2(1):58
- 6458 Freeman MA, Sommerville C (2011) Original observations of
6459 *Desmozoon lepeophtherii*, a microsporidian hyperparasite infecting
6460 the salmon louse *Lepeophtheirus salmonis*, and its subsequent
6461 detection by other researchers. *Parasit Vectors* 4(1):231
- 6462 Freeman MA, Yokoyama H, Ogawa K (2004) A microsporidian
6463 parasite of the genus *Spraguea* in the nervous tissues of the
6464 Japanese anglerfish *Lophius litulon*. *Folia Parasitol* 51:167–176
- 6465 Frenken T, Alacid E, Berger SA, Bourne EC et al (2017) Integrating
6466 chytrid fungal parasites into plankton ecology. Research gaps
6467 and needs. *Environ Microbiol* 19:3802–3822. <https://doi.org/10.1111/1462-2920.13827>
- 6468 Fu SB, Yang JS, Cui JL, Sun DA (2013) Biotransformation of ursolic
6469 acid by *Syncephalastrum racemosum* CGMCC 3.2500 and anti-
6470 HCV activity. *Fitoterapia* 86:123–128. <https://doi.org/10.1016/j.fitote.2013.02.007>
- 6471 Furrzola E, Goto BT, Alves da Silva G, Torres-Arias Y et al (2013)
6472 *Acaulospora herrerae*, a new pitted species in the Glom-
6473 eromycetes from Cuba and Brazil. *Nova Hedwig* 97:401–413
- 6474 Furrzola E, Torres-Arias Y, Ferrer RL, Herrera RA et al (2011)
6475 *Glomus crenatum* (*Glomeromycetes*), a new ornamented species
6476 from Cuba. *Mycotaxon* 116:143–149
- 6477 Furuya K (2009) Spore-forming microsporidian encephalitozoon:
6478 current understanding of infection and prevention in Japan. *Jpn J*
6479 *Infect Dis* 62:413–422
- 6480 Fuxa JR, Brooks WM (1979) Effects of *Vairimorpha necatrix* in
6481 sprays and com meal on *Heliothis* species on tobacco, soybeans,
6482 and sorghum. *J Econ Entomol* 72:462–467
- 6483 Gade L, Hurst S, Balajee SA, Lockhart SR et al (2016) Detection of
6484 mucormycetes and other pathogenic fungi in formalin fixed
6485 paraffin embedded and fresh tissues using the extended region of
6486 28S rDNA. *Med Mycol* 55:385–395
- 6487 Gamper HA, Walker C, Schüßler A (2009) *Diversispora celata* sp.
6488 nov.: molecular ecology and phylotaxonomy of an inconspicuous
6489 arbuscular mycorrhizal fungus. *New Phytol* 182:495–506
- 6490 Ganjali Dashti M, Abdeshahian P, Wan Yusoff WM, Kalil MS et al
6491 (2014) Repeated batch fermentation biotechnology for the
6492 biosynthesis of lipid and gamma-linolenic acid by *Cunning-*
6493 *hamella bainieri* 2A1. *BioMed Res Int*. <https://doi.org/10.1155/2014/831783>
- 6494 Garcia A, Adedoyin G, Heitman J, Lee SC (2017) Construction of a
6495 recyclable genetic marker and serial gene deletions in the human
6496 pathogenic mucorales *Mucor circinelloides*. G3: genes. *Genom*
6497 *Genet* 7:2047–2054
- 6498 Garcia JJ (1990) A new microsporidian pathogenic to larvae of
6499 blackflies (Diptera: Simuliidae): *Ringueletium pillosa* gen. sp.
6500 nov. (Microspora: Caudosporidae). *Neotropica* 36(96):111–122
- 6501 Garcia JJ (1991) Estudios sobre el ciclo de vida y ultraestructura de
6502 *Sphaerospora andinae* gen. et sp. nov. (Microspora. Thelohani-
6503 dae), un nuevo microsporidio de simúlidos neotropicales.
6504 *Neotropica* 37:15–23
- 6505 Garcia NFL, da Silva Santos FR, Gonçalves FA, da Paz MF et al
6506 (2015) Production of β -glucosidase on solid-state fermentation
6507 by *Lichtheimia ramosa* in agroindustrial residues: characteriza-
6508 tion and catalytic properties of the enzymatic extract. *Electron J*
6509 *Biotechnol* 18:314–319
- 6510 Garcia-Hermoso D, Hoinard D, Gantier JC, Grenouillet F et al (2009)
6511 Molecular and phenotypic evaluation of *Lichtheimia corymbi-*
6512 *ifera* (formerly *Absidia corymbifera*) complex isolates associated
6513 with human mucormycosis: rehabilitation of *L. ramosa*. *J Clin*
6514 *Microbiol* 47:3862–3870. <https://doi.org/10.1128/JCM.02094-08>
- 6515 García-Martínez J, López-Medrano F, Alhambra A, Del Palacio A
6516 (2008) *Rhinocerebral zygomycosis* caused by *Saksenae vasi-*
6517 *formis* in a diabetic patient. *Mycoses* 51:549–553
- 6518 Ge C, Chen H, Mei T, Tang X et al (2018) Application of a ω -3
6519 Desaturase with an arachidonic acid Preference to eicosapen-
6520 taenoic acid Production in *Mortierella alpina*. *Front Bioeng*
6521 *Biotechnol* 5:89. <https://doi.org/10.3389/fbioe.2017.00089>
- 6522 Gebremariam T, Liu M, Luo G, Bruno V et al (2014) CotH3 mediates
6523 fungal invasion of host cells during mucormycosis. *J Clin Invest*
6524 124:237–250. <https://doi.org/10.1172/JCI71349>
- 6525 Gerphagnon M, Latour D, Colombet J, Sime-Ngando T (2013) A
6526 double staining method using SYTOX green and calcofluor
6527 white for studying fungal parasites of phytoplankton. *Appl*
6528 *Environ Microbiol* 79:3943–3951
- 6529 Ghizelini AM, Mendonça-Hagler LCS, Macrae A (2012) Microbial
6530 diversity in Brazilian mangrove sediments—a mini review. *Braz*
6531 *J Microbiol* 43:1242–1254. <https://doi.org/10.1590/S1517-83822012000400002>
- 6532 Gleason FH, Jephcott TG, Kuepper FC, Gerphagnon M et al (2015)
6533 Potential roles for recently discovered chytrid parasites in the
6534 dynamics of harmful algal blooms. *Fungal Biol Rev* 29:20–33
- 6535 Gleason FH, Marano AV, Digby AL, Al-Shugairan N et al (2011)
6536 Patterns of utilization of different carbon sources by Chytrid-
6537 iomycota. *Hydrobiologia* 659:55–64

- 6543 Gomes MZ, Lewis RE, Kontoyiannis DP (2011) Mucormycosis
6544 caused by unusual mucormycetes, non-*Rhizopus*-, *Mucor*, and
6545 *Lichtheimia* species. Clin Microbiol Rev 24:411–445. <https://doi.org/10.1128/CMR.00056-10>
- 6546 González MC, Murueta-Figueroa N, Medina-Ortiz C, Hanlin RT
6547 (2010) New record of *Circinella muscae* from a hydrocarbon
6548 polluted sand beach of Tabasco, Mexico. Mycotaxon
6549 113:111–117
- 6550 González-Tortuero E, Rusek J, Maayan I, Petrusek A et al (2016)
6551 Genetic diversity of two *Daphnia*-infecting microsporidian
6552 parasites, based on sequence variation in the internal transcribed
6553 spacer region. Parasit Vectors 9:293
- 6554 Goto BT, Jardim JG, Silva GA, Furrázola E et al (2012a) *Glomus*
6555 *trufemii* (Glomeromycetes), a new sporocarpic species from
6556 Brazilian sand dunes. Mycotaxon 120:1–9
- 6557 Goto BT, Maia LC, Oehl F (2008) *Ambispora brasiliensis*, a new
6558 ornamented species in the arbuscular mycorrhiza-forming
6559 Glomeromycetes. Mycotaxon 105:11–18
- 6560 Goto BT, Pereira CMR, Nobre CP, Zatorre NP et al (2013)
6561 *Acaulospora endographis* (Glomeromycetes), a new fungus with
6562 a complex spore wall. Mycotaxon 123:403–408
- 6563 Goto BT, Silva GA, Assis D, Silva DK et al (2012b) Intraornatospo-
6564 raceae (Gigasporales), a new family with two new genera and
6565 two new species. Mycotaxon 119:117–132
- 6566 Greaves M (2014) *Pilobolus* in Britain. Field Mycol 15:62–64
- 6567 Griffith GW, Baker S, Fliegerova K, Ligenstoffer A et al (2010)
6568 Anaerobic fungi: neocallimastigomycota. IMA Fungus
6569 1(2):181–185
- 6570 Grigoriev IV, Nikitin R, Haridas S, Kuo A et al (2014) MycoCosm
6571 portal: gearing up for 1000 fungal genomes. Nucl Acids Res
6572 42:D699–D704. <https://doi.org/10.1093/nar/gkt1183>
- 6573 Gruninger RJ, Puniya AK, Callaghan TM, Edwards JE et al (2014)
6574 Anaerobic fungi (phylum Neocallimastigomycota): advances in
6575 understanding their taxonomy, life cycle, ecology, role and
6576 biotechnological potential. FEMS Microbiol Ecol 90:1–7
- 6577 Grushevaya IV, Ignatieva AN, Malysh SM, Senderskiy IV, Zubarev
6578 IV, Kononchuk AG (2018) Spore dimorphism in *Nosema*
6579 *pyrausta* (Microsporidia, Nosematidae): from morphological
6580 evidence to molecular genetic verification. Acta Protozool
6581 57(1):49–52
- 6582 Gryganskyi AP, Golan J, Dolatabadi S, Mondo S et al (2018)
6583 Phylogenetic and phylogenomic definition of *Rhizopus* species.
6584 G3. <https://doi.org/10.1534/g3.118.200235>
- 6585 Gryganskyi AP, Humber RA, Smith ME, Hodge K et al (2013a)
6586 Phylogenetic lineages in Entomophthoromycota. Persoonia
6587 30:94–105
- 6588 Gryganskyi AP, Humber RA, Smith ME, Miadlikovska J et al (2012)
6589 Molecular phylogeny of the Entomophthoromycota. Mol Phy-
6590 logeny Evol 65(2):682–694
- 6591 Gryganskyi AP, Humber RA, Stajich JE, Mullens B et al (2013b)
6592 Sequential utilization of hosts from different fly families by
6593 genetically distinct, sympatric populations within the *Entomoph-*
6594 *thora muscae* species complex. PLoS ONE 8:e71168. <https://doi.org/10.1371/journal.pone.0071168>
- 6595 Gryganskyi AP, Lee SC, Litvintseva AP, Smith ME et al (2010)
6596 Structure, function, and phylogeny of the mating locus in the
6597 *Rhizopus oryzae* complex. PLoS ONE 5:e15273
- 6598 Gryganskyi AP, Mullens BA, Gajdeczka MT, Rehner SA et al (2017)
6599 Hijacked: co-option of host behavior by entomophthoralean
6600 fungi. PLoS Pathogens 13(5):e1006274
- 6601 Gsell AS, de Senerpont Domis LN, Verhoeven KJ, Van Donk E et al
6602 (2013) Chytrid epidemics may increase genetic diversity of a
6603 diatom spring-bloom. ISME J 7(10):2057. <https://doi.org/10.1038/ismej.2013.73>
- 6604 Guarro J, Chander J, Alvarez E, Stchigel AM et al (2011) *Apophysomyces variabilis* infections in humans. Emerg Infect Dis 17:134–135
- 6605 Gunnarsson GS, Blindheim S, Karlsbakk E, Plarre H et al (2017)
6606 *Desmozoon lepeophtherii* (microsporidian) infections and pan-
6607 creas disease (PD) outbreaks in farmed Atlantic salmon (*Salmo*
6608 *salar* L.). Aquaculture 468:141–148
- 6609 Guo LW, Wu YX, Mao ZC, Ho HH et al (2012) Storage rot of dragon
6610 fruit caused by *Gilbertella persicaria*. Plant Dis 96:1826–1836
- 6611 Guzmán-Franco AW, Atkins SD, Alderson PG, Pell JK (2008)
6612 Development of species-specific diagnostic primers for *Zooph-*
6613 *thora radicans* and *Pandora blunckii*; two co-occurring fungal
6614 pathogens of the diamondback moth, *Plutella xylostella*. Mycol
6615 Res 112:1227–1240
- 6616 Haag KL, Larsson JI, Refardt D, Ebert D (2011) Cytological and
6617 molecular description of *Hamiltosporidium ivaerminnensis* gen.
6618 et sp. nov., a microsporidian parasite of *Daphnia magna*, and
6619 establishment of *Hamiltosporidium magnivora* comb. nov.
6620 Parasitology 138(4):447–462
- 6621 Hajek AE, Gryganskyi A, Bittner T, Liebherr JK et al (2016)
6622 Phylogenetic placement of two species known only from resting
6623 spores: *Zoophthora independentia* sp. nov. and *Z. porteri* comb
6624 nov. (Entomophthorales: Entomophthoraceae). J Invertebr
6625 Pathol 140:68–74
- 6626 Hajek AE, Solter LF, Maddox JV, Huang W-F, Estep AS, Krawczyk
6627 G, Weber DC, Hoelmer KA, Sanscrainte ND, Becnel JJ (2018)
6628 *Nosema maddoxi* sp. nov. (Microsporidia, Nosematidae), a
6629 widespread pathogen of the green stink bug *Chinavia hilaris*
6630 (Say) and the brown marmorated stink bug *Halyomorpha halys*
6631 (Stål). J Euk Microbiol 65(3):315–330
- 6632 Hanafy RA, Elshahed MS, Ligenstoffer AS, Griffith GW et al (2017)
6633 *Pecoramyces ruminantium*, gen. nov., sp. nov., an anaerobic gut
6634 fungus from the feces of cattle and sheep. Mycologia
6635 109:231–243
- 6636 Hao G, Chen H, Du K, Huang X et al (2014a) Increased fatty acid
6637 unsaturation and production of arachidonic acid by homologous
6638 over-expression of the mitochondrial malic enzyme in *Mortier-*
6639 *ella alpina*. Biotechnol Lett 36:1827–1834. <https://doi.org/10.1007/s10529-014-1546-x>
- 6640 Hao G, Chen H, Gu Z, Zhang H et al (2015) Metabolic engineering of
6641 *Mortierella alpina* for arachidonic acid production with glycerol
6642 as carbon source. Microbial Cell Fact 14:205. <https://doi.org/10.1186/s12934-015-0392-4>
- 6643 Hao G, Chen H, Wang L, Gu Z et al (2014b) Role of malic enzyme
6644 during fatty acid synthesis in the oleaginous fungus *Mortierella*
6645 *alpina*. Appl Environ Microbiol 80:2672–2678. <https://doi.org/10.1128/AEM.00140-14>
- 6646 Hapsari MP, White MM, Hyde KD (2009) Freshwater trichomycetes
6647 from northern Thailand. Cryptog Mycol 30:405–425
- 6648 Hazard EI, Oldacre SW (1975) Revision of microsporidia (Protozoa)
6649 close to *Thelohania*, with descriptions of one new family, eight
6650 new genera and thirteen new species. US Dept Agric Technol
6651 Bull 1530:1–104
- 6652 He SH, Dai YC (2012) Taxonomy and phylogeny of *Hymenochaete*
6653 and allied genera of Hymenochaetaceae (Basidiomycota) in
6654 China. Fungal Divers 56:77–83
- 6655 Heady SE, Nault LR (2017) Acoustic signals of *Graminella nigrifrons*
6656 (Homoptera: Cicadellidae). The Great Lakes Entomologist 24: 2.
6657 <https://scholar.valpo.edu/tgle/vol24/iss1/2>
- 6658 Healy RA, Celio GJ, Kumar TKA, Roberson RW et al (2014)
6659 Ultrastructure of mitosis and spindle pole bodies in the
6660 zygomycetous fungus *Coemansia reversa* using conventional
6661 fixation and freeze substitution. Microsc Microanal
6662 20:1292–1293
- 6663 Heilveil JS, Kohler SL, Solter LF (2001) Studies on the life cycle and
6664 transmission of *Cougourdella* sp, a microsporidian parasite of

- 6673 *Glossosoma nigrrior* (Trichoptera: Glossosomatidae). Great
6674 Lakes Entomol 34(1):9–15
- 6675 Heinz E, Williams TA, Nakjang S, Noël CJ et al (2012) The genome
6676 of the obligate intracellular parasite *Trachipleistophora hominis*:
6677 new insights into microsporidian genome dynamics and reductive
6678 evolution. PLoS Pathog 8(10):e1002979
- 6679 Henske JK, Gilmore SP, Knop D, Cunningham FJ, et al (2018) Index
6680 Fungorum 353:1 (2018) <http://www.indexfungorum.org/Publications/Index%20Fungorum%20no.353.pdf>
- 6681 Herivaux A, De Bernonville TD, Roux C, Clastre M et al (2017) The
6682 identification of phytohormone receptor homologs in early
6683 diverging fungi suggests a role for plant sensing in land
6684 colonization by fungi. MBio 8:e01739-16
- 6685 Hermet A, Méheust D, Mounier J, Barbier G et al (2012) Molecular
6687 systematics in the genus *Mucor* with special regards to species
6688 encountered in cheese. Fungal Biol 116:692–705. <https://doi.org/10.1016/j.funbio.2012.04.002>
- 6689 Hernandez-Lauzardo AN, Bautista-Baños S, Velazquez-Del Valle
6690 MG, Méndez-Montevalvo MG et al (2008) Antifungal effects of
6691 chitosan with different molecular weights on in vitro develop-
6692 ment of *Rhizopus stolonifer* (Ehrenb.: Fr.) Vuill. Carbohydr
6693 Polym 73:541–547
- 6694 Hibbett DS, Binder M, Bischoff JF, Blackwell M et al (2007) A
6696 higher-level phylogenetic classification of the fungi. Mycol Res
6697 111:509–547
- 6698 Hillman ET, Lu H, Yao T, Nakatsu CH (2017) Microbial ecology
6699 along the gastrointestinal tract. Microbes Environ 32:300–313
- 6700 Hirose D, Degawa Y, Inaba S, Tokumasu S (2012) The anamorphic
6701 genus *Calcarisporiella* is a new member of the Mucoromy-
6702 cotina. Mycoscience 53:256–260
- 6703 Hirose D, Degawa Y, Yamamoto K, Yamada A (2014) *Sphaeroceas*
6704 *pubescens* is a member of the Mucoromycotina closely related to
6705 fungi associated with liverworts and hornworts. Mycoscience
6706 55:221–226
- 6707 Hirotani-Akabane E, Saikawa M (2010) Germination and morphology
6708 of zygospores in two Cochlonema and one Acaulopage species.
6709 Mycologia 102:39–43
- 6710 Ho HM, Benny GL (2008) A new species of *Syncephalis* from
6711 Taiwan. Botanical Stud 49:45–48
- 6712 Ho HM, Chiang HJ (2014) Notes on zygomycetes of Taiwan (XII): a
6713 zoopagalean species” *Thamnocephalis Sphaerospora*” New to
6714 Taiwan. Fungal Sci 29:13–17
- 6715 Ho HM, Chuang SC (2010) Notes on zygomycetes of Taiwan (IX):
6716 two new records of *Dispira* (Dimargaritales, Zygomycetes) in
6717 Taiwan. Fungal Sci 25:13–18
- 6718 Ho HM, Chuang SC, Hsien CY (2008) Notes on zygomycetes of
6719 Taiwan (VI): *Chaetocladium brefeldii* new to Taiwan. Fungal
6720 Sci 23:21–25
- 6721 Ho HM, Kirk PM (2009) *Piptocephalis formosana*, a new species
6722 from Taiwan. Botanical Stud 50:69–72
- 6723 Ho YH, Ho HM, Saikawa M (2015) Two new species of *Cystopage*,
6724 *C. ovispora* and *C. irregularispora*, obtained in Taiwan.
6725 Mycoscience 56:396–401
- 6726 Hoffman RM, Marshall MM, Polchert DM, Jost BH (2003) Identifi-
6727 cation and characterization of two subpopulations of *Encephal-*
6728 *itozoon intestinalis*. Appl Environ Microbiol 69:4966–4970
- 6729 Hoffman Y, Aflalo C, Zarka A, Gutman J et al (2008) Isolation and
6730 characterization of a novel chytrid species (phylum Blastocla-
6731 diomycota), parasitic on the green alga *Haematococcus*. Mycol
6732 Res 112:70–81
- 6733 Hoffmann K (2010) Identification of the genus *Absidia* (Mucorales,
6734 Zygomycetes): a comprehensive taxonomic revision. In: Gher-
6735 bawy Y, Voigt K (eds) Molecular identification of fungi.
6736 Springer, Berlin, pp 439–460
- Hoffmann K, Pawlowska J, Walther G, Wrzosek M et al (2013) The
family structure of the Mucorales: a synoptic revision based on
comprehensive multigene-genealogies. Persoonia 30:57–76
- Hoffmann K, Voigt K (2009) *Absidia parricida* plays a dominant role
in biotrophic fusion parasitism among mucoralean fungi (Zy-
gomycetes): *Lentamyces*, a new genus for *A. parricida* and *A.*
zychae. Plant Biol 4:537–554
- Hoffmann K, Walther G, Voigt K (2009a) *Mycocladius* vs
Lichtheimia: a correction (Lichtheimiaceae fam. nov., Mucor-
ales, Mucoromycotina). Mycol Res 113:277–278
- Hoffmann K, Walther G, Voigt K (2009b) *Mycocladius* vs.
Lichtheimia: a correction (Lichtheimiaceae fam. nov., Mucor-
ales, Mucoromycotina). Mycol Res 113:275–278
- Hollister WS, Canning EU, Weidner E, Field AS (1996) Development
and ultrastructure of *Trachipleistophora hominis* ng, n. sp. after
in vitro isolation from an AIDS patient and inoculation into
athymic mice. Parasitology 112(1):143–154
- Hopper JV, Mills NJ (2016) Pathogenicity, prevalence and intensity
of a microsporidian infection by *Nosema fumiferanae postvittana*
in the light brown apple moth, *Epiphyas postvittana*, in
California. J Invertebr Pathol 134:27–34
- Hospenthal DR, Chung KK, Lairet K, Thompson EH et al (2011)
Saksenaeya erythrospora infection following combat trauma.
J Clin Microbiol 49:3707–3709
- Hou YH, Ho HM (2010) The merosporangiferous fungi from Taiwan
(VII): two new records of piptocephalis. Fungal Sci 25:19–24
- Huang WK, Cui JK, Liu SM, Kong LA et al (2016) Testing various
biocontrol agents against the root-knot nematode (*Meloidogyne*
incognita) in cucumber plants identifies a combination of
Syncephalastrum racemosum and *Paecilomyces lilacinus* as
being most effective. Biol Control 92:31–37
- Huang W-K, Sun J-H, Cui J-K, Wang G-F et al (2014) Efficacy
evaluation of fungus *Syncephalastrum racemosum* and *Nemati-*
cide Avermectin against the root-knot nematode *Meloidogyne*
incognita on Cucumber. PLoS ONE 9:e89717. <https://doi.org/10.1371/journal.pone.0089717>
- Humber RA (2012) Entomophthoromycota: a new phylum and
reclassification for entomophthoroid fungi. Mycotaxon
120:477–492
- Humber RA (2016) Entomophthoromycota: a new overview of some
of the oldest terrestrial fungi. In: Li DW (ed) Biology of
microfungi. Springer, Cham, pp 127–145
- Hussain A, Rizwan-ul-Haq M, Al-Ayedh H, Al-Jabr MA (2014)
Mycosinsecticides: potential and future perspective. Recent Pat
Food Nutr Agric 6:45–53
- Hyde KD, Jones EBG, Liu JK, Ariyawansa H et al (2013) Families of
dothideomycetes. Fungal Divers 63:1–313
- Hyde KD, Maharachchikumbura SS, Hongsanan S, Samarakoon MC
(2017a) The ranking of fungi: a tribute to David L. Hawksworth
on his 70th birthday. Fungal Divers 84:1–23
- Hyde KD, McKenzie EHC, Koko TW (2011) Towards incorporating
anamorphic fungi in a natural classification—checklist and notes
for 2010. Mycosphere 2:1–88
- Hyde KD, Nilsson RH, Alias SA, Ariyawansa HA et al (2014) One
stop shop: backbones trees for important phytopathogenic
genera: I. Fungal Divers 67:21–125. <https://doi.org/10.1007/s13225-014-0298-1>
- Hyde KD, Norphanphoun C, Abreu VP, Bazzicalupo A (2017b)
Fungal diversity notes 603–708: taxonomic and phylogenetic
notes on genera and species. Fungal Divers 87:1–235
- Hylíš M, Oborník M, Nebesářová J, Vávra J (2007) Aquatic
tetrasporoblastic microsporidia from caddis flies (Insecta, Tri-
choptera): characterisation, phylogeny and taxonomic re-evalu-
ation of the genera *Episeptum* Larsson, 1986, *Pyrotheca* Hesse,
1935 and *Cougourdella* Hesse, 1935. Eur J Protistol 43(3):205–224

- 6803 Hylíš M, Oborník M, Nebesářová J, Vávra J (2013) Description and
6804 phylogeny of *Zelenkaia trichopterae* gen. et sp. nov. (Mi-
6805 crosporidia), an aquatic microsporidian parasite of caddisflies
6806 (Trichoptera) forming spore doublets. J Invertebr Pathol
6807 114(1):11–21
- 6808 Index Fungorum (2018) [http://www.indexfungorum.org/Names/
6809 Names](http://www.indexfungorum.org/Names/Names)
- 6810 Ironside JE (2013) Diversity and recombination of dispersed riboso-
6811 mal DNA and protein coding genes in Microsporidia. PloS ONE
6812 8:e55878
- 6813 ~~Issi IV (1986) Microsporidia as a phylum of parasitic protozoa.
6814 Protozoology 10:6–136 (Russian)~~
- 6815 Issi IV, Kadyrova MK, Pushkar EN, Khodzhaeva LF, Krylova SV
6816 (1990) Microsporidia of black flies (Definitions and short
6817 descriptions of the forms of Microsporidia of the world's fauna).
6818 Tashkent, "FAN" Publishing Co., Uzbekistan. (In Russian)
- 6819 Issi IV, Radischcheva DF, Dolzhenko VT (1983) Microsporidia of
6820 flies of genus *Delia* (Diptera, Muscidae), harmful to farm crops.
6821 Bull VIZR 55:3–9
- 6822 Issi IV, Tokarev YS, Seliverstova EV, Voronin VN (2012) Taxonomy
6823 of *Neoperezia chironomi* and *Neoperezia semenovaiae* comb.
6824 nov. (Microsporidia, Aquasporidia): lessons from ultrastructure
6825 and ribosomal DNA sequence data. Eur J Protistol 48(1):17–29
- 6826 Issi IV, Tokarev YS, Voronin VN, Seliverstova EV et al (2010)
6827 Ultrastructure and molecular phylogeny of *Mrazekia macrocy-
6828 clopis* sp. n. (Microsporidia, Mrazekiidae), a microsporidian
6829 parasite of *Macrocyclus albidus* (Jur.) (Crustacea, Copepoda).
6830 Acta Protozool 49(1):75
- 6831 Iwano H, Ishihara R (1991) Dimorphic development of *Nosema
6832 bombycis* spore in gut epithelium of larva of the silkworm
6833 *Bombyx mori*. J Seric Sci Jpn 60:249–256
- 6834 Jacobs K, Botha A (2008) *Mucor renisporus* sp. nov., a new
6835 coprophilous species from Southern Africa. Fungal Divers
6836 29:27–35
- 6837 Jamali S (2015) First report of the *Helicocephalum sarcophilum*
6838 (Zoopagomycotina) in Iran. Mycol Iran 2:77
- 6839 James TY, Berbee ML (2012) No jacket required—new fungal lineage
6840 defies dress code. Bioessays 34:94–102
- 6841 James TY, Hoffman Y, Zarka A, Boussiba S (2011) *Paraphysoderma
6842 sedebokerense*, gen. et sp. nov., an aplanosporic relative of
6843 *Physoderma* (Blastocladiomycota). Mycotaxon 118:177–180
- 6844 James TY, Letcher PM, Longcore JE, Mozley-Standridge SE et al
6845 (2006) A molecular phylogeny of the flagellated fungi (Chytrid-
6846 iomycota) and description of a new phylum (Blastocladiomy-
6847 cota). Mycologia 98:860–871
- 6848 James TY, Porter TM, Martin WW (2014) 7 Blastocladiomycota. In:
6849 McLaughlin DJ, Spadafora JW (eds) Systematics and evolution.
6850 Springer, Berlin, pp 177–207
- 6851 Janicki T, Krupiński M, Długoński J (2016) Degradation and toxicity
6852 reduction of the endocrine disruptors nonylphenol, 4-tert-
6853 octylphenol and 4-cumylphenol by the non-ligninolytic fungus
6854 *Umbelopsis isabellina*. Bioresour Technol 200:223–229
- 6855 Jayachandra T, Venugopal C, Appaiah KA (2011) Utilization of
6856 phytotoxic agro waste—coffee cherry husk through pretreatment
6857 by the ascomycetes fungi Mycotypha for biomethanation.
6858 Energy Sustain Dev 15:104–108
- 6859 Jensen AB, Eilenberg J, López Lastra C (2009) Differential diver-
6860 gences of obligately insect-pathogenic *Entomophthora* species
6861 from fly and aphid hosts. FEMS Microbiol Lett 300:180–187
- 6862 Jephcott TG, Alves-de-Souza C, Gleason FH, Van Ogtrop FF et al
6863 (2016) Ecological impacts of parasitic chytrids, syndiniales
6864 and perkinsids on populations of marine photosynthetic dinoflagel-
6865 lates. Fungal Ecol 19:47–58
- 6866 Jiang X, Yu H, Xiangf M, Liu X et al (2011) *Echinoclamydosporium
6867 variabile*, a new genus and species of Zygomycota from soil
6868 nematodes. Fungal Divers 46:43–51
- John D, Irodi A, Michael JS (2016) Concurrent infections of
6869 *Conidiobolus* Coronatus with disseminated tuberculosis present-
6870 ing as bilateral orbital cellulitis. J Clin Diagn Res 10(4):ND01–
6871 ND02. <https://doi.org/10.7860/jcdr/2016/16790.7535>
- 6872 Jones ME, Armien AG, Rothermel BB, Pessier AP (2012a) Granu-
6873 lomatous myositis associated with a novel alveolate pathogen in
6874 an adult southern leopard frog (*Lithobates sphenoccephalus*). Dis
6875 Aquat Org 102:163–167
- 6876 Jones SR, Prosperi-Porta G, Kim E (2012b) The diversity of
6877 microsporidia in parasitic copepods (Caligidae: Siphonostoma-
6878 toida) in the Northeast Pacific ocean with description of
6879 *Facilispora margolis* ng, n. sp. and a new family Facilisporidae
6880 n. fam. J Eukaryot Microbiol 59(3):206–217
- 6881 Joshi CV, Pathan EK, Puneekar NS, Tupe SG et al (2013) A
6882 biochemical correlate of dimorphism in a zygomycete *Ben-
6883 jaminiella poitrassii*: characterization of purified NAD-dependent
6884 glutamate dehydrogenase, a target for antifungal agents. Antonie
6885 Van Leeuwenhoek 104:25–36
- 6886 Jouvenaz DP, Hazard EI (1978) New family, genus, and species of
6887 Microsporida (Protozoa: Microsporida) from the tropical fire ant,
6888 *Solenopsis geminata* (Fabricius) (Insecta: Formicidae). J Proto-
6889 zool Res 25(1):24–29
- 6890 Justo A, Hibbett DS (2011) Phylogenetic classification of *Trametes*
6891 (Basidiomycota, Polyporales) based on a five-marker dataset.
6892 Taxon 60:1567–1583
- 6893 Justo A, Vizzini A, Minnis AM, Menolli N Jr et al (2011) Phylogeny
6894 of the Pluteaceae (Agaricales, Basidiomycota): taxonomy and
6895 character evolution. Fungal Biol 115(1):1–20
- 6896 Kaerger K, Schwartze VU, Dolatabadi S, Nyilasi I et al (2015)
6897 Adaptation to thermotolerance in *Rhizopus coincides* with
6898 virulence as revealed by avian and invertebrate infection models,
6899 phylogeny, physiological and metabolic flexibility. Virulence
6900 6:395–403
- 6901 Kagiwada S, Kayano Y, Hoshi H, Kawanishi T et al (2010) First
6902 report of Choanephora rot of ice plant (*Mesembryanthemum
6903 crystallinum*) caused by *Choanephora cucurbitarum* in Japan.
6904 J Gen Plant Pathol 76:345–347
- 6905 Kalavati C, Narasimhamurti CC (1977) *Steinhausia spraguei* n. sp. a
6906 microsporidian parasite of the excretory cells found in the fluid
6907 from renal appendages of *Sepia elliptica*. Riv Parassitol
6908 38:271–275
- 6909 Kandel P, White MM (2012) A new species of *Ephemerellomyces*
6910 from North America highlights its morphological plasticity and
6911 possible intergeneric similarities with other Harpellales. Fungal
6912 Biol 116:171–184
- 6913 Kang D, Jiang X, Wan H (2014) *Mucor irregularis* infection around
6914 the inner canthus cured by Amphotericin B: a case report and
6915 review of published literatures. Mycopathologia 178:129–133
- 6916 Kaonongbua W, Morton JB, Bever JD (2010) Taxonomic revision
6917 transferring species in *Kuklospora* to *Acaulospora* (Glomeromy-
6918 cota) and a description of *Acaulospora colliculosa* sp. nov. from
6919 field collected spores. Mycologia 102:1497–1509
- 6920 ~~Karamanlioglu M, Houlden A, Robson GD (2014) Isolation and
6921 characterisation of fungal communities associated with degra-
6922 dation and growth on the surface of poly (lactic) acid (PLA) in
6923 soil and compost. Int Biodeterior Biodegrad 95:301–310~~
- 6924 Karimi K, Arzanlou M, Ahari A, Ghazi MM (2015) Phenotypic and
6925 molecular characterization of the causal agent of chafer beetle
6926 mortality in the wheat fields of the Kurdistan province, Iran.
6927 J Plant Protect Res 55:227–234. [https://doi.org/10.1515/jppr-
6928 2015-0031](https://doi.org/10.1515/jppr-2015-0031)
- 6929 Karimi K, Zamani A (2013) *Mucor indicus*: biology and industrial
6930 application perspectives: a review. Biotechnol Adv 31:466–481.
6931 <https://doi.org/10.1016/j.biotechadv.2013.01.009>
- 6932 Karpov SA, Kobseva AA, Mamkaeva MA, Mamkaeva KA et al
6933 (2014) *Gromochytrium mamkaevae* gen. & sp. nov. and two new
6934

- 6935 orders: Gromochytriales and Mesochytriales (Chytridiomycetes).
6936 Persoonia 32:115–126
- 6937 Karpov SA, Letcher PM, Mamkaeva MA, Mamkaeva KA (2010)
6938 Phylogenetic position of the genus *Mesochytrium* (Chytridiomycota)
6939 based on zoospore ultrastructure and sequences from the
6940 18S and 28S rRNA gene. Nova Hedwig 90:81–94
- 6941 Karpov SA, López-García P, Mamkaeva MA et al (2018) The chytrid-
6942 like parasites of algae *Amoeboradix gromovi* gen. et sp. nov. and
6943 *Sanchytrium tribonematis* belong to a new fungal lineage. Protist
6944 169:122–140
- 6945 Karpov SA, Mamanazarova KS, Popova OV, Aleoshin VV et al
6946 (2017a) Monoblepharidomycetes diversity includes new parasitic
6947 and saprotrophic species with highly intronized rDNA. Fungal Biol
6948 121:729–741
- 6949 Karpov SA, Mamkaeva MA, Moreira D, López-García P (2016)
6950 Molecular phylogeny of *Aphelidium tribonemae* reveals its sister
6951 relationship with *A. aff. melosirae* (Aphelida, Opisthosporidia).
6952 Protistology 10:97–103
- 6953 Karpov SA, Tcvetkova VS, Mamkaeva MA, Torruella G, Timpano H,
6954 Moreira D, Mamanazarova KS, López-García P (2017b) Morphological
6955 and genetic diversity of Opisthosporidia: new aphelid
6956 *Paraphelidium tribonemae* gen. et sp. nov. J Eukaryot Microbiol
6957 64(2):204–212
- 6958 Karpov SA, Torruella G, Moreira D, Mamkaeva MA, López-García P
6959 (2017c) Molecular phylogeny of *Paraphelidium letcheri* sp. nov.
6960 (Aphelida, Opisthosporidia). J Eukaryot Microbiol
6961 64(5):573–578
- 6962 Karthikeyan V, Gopalakrishnan A (2014) A novel report of
6963 phytopathogenic fungi *Gilbertella persicaria* infection on *Penaeus monodon*.
6964 Aquaculture 430:224–229
- 6965 Keller S, Weiser J, Wegensteiner R (2009) *Tarichium hylobii* sp. nov.,
6966 a pathogen of *Hylobius abietis*. Sydowia 61:249–254
- 6967 Kelly P, Good B, Hanrahan JP, Fitzpatrick R et al (2009) Screening
6968 for the presence of nematophagous fungi collected from Irish
6969 sheep pastures. Vet Parasitol 165:345–349
- 6970 Kendrick B (2000) The fifth kingdom, 3rd edn. Focus Publishing,
6971 Newbury, MA
- 6972 Kennedy KJ, Daveson K, Slavin MA, van Hal SJ et al (2016)
6973 Mucormycosis in Australia: contemporary epidemiology and
6974 outcomes. Clin Microbiol Infect 22:775–781
- 6975 Kereselidze M, Pilarska D, Hajek AE, Jensen AB et al (2011) First
6976 record of *Entomophaga maimaiga* (Entomophthorales: Entomophthoraceae)
6977 in Georgia. Biocontrol Sci Technol 21:1375–1380
- 6978 Khade SW (2009) Arbuscular mycorrhizal fungi in wild banana II: a
6979 new species (*Glomus goensis* Khade sp. nov.). Mycorrhiza
6980 News 20:21–22
- 6981 Khodzhaeva LF, Issi IV (1989) A new genus of microsporidians
6982 *Cristulospora* gen. n. (Amblyosporidae) with 3 new species from
6983 blood-sucking mosquitoes in Uzbekistan. Parazitologiya
6984 23(2):140–145
- 6985 Kia SH, Schulz M, Ayah E, Schouten A et al (2014) Abutilon
6986 theophrasti's defense against the allelochemical benzoxazolin-2
6987 (3H)-one: support by *Actinomucor elegans*. J Chem Ecol
6988 40:1286–1298
- 6989 Kilochitskii PJ (1997) Two new microsporidian genera: *Aedispora*
6990 gen. n. (Culicosporida, Culicosporidae) and *Krishtalia* gen. n.
6991 (Culicosporida, Golbergiidae) of the blood sucking mosquitoes
6992 from the Ukraine. Vestn Zool 31:15–23
- 6993 Kimura M, Yaguchi T, Sutton DA, Fothergill AW et al (2011)
6994 Disseminated human conidiobolomycosis due to *Conidiobolus lampraegus*.
6995 J Clin Microbiol 49:752–756. <https://doi.org/10.1128/JCM.01484-10>
- 6996 Kirk P, Cannon PF, Minter DW, Stalpers JA (2008) Ainsworth &
6997 Bisby's dictionary of the fungi, 10th edn. CAB International,
6998 Wallingford
- 6999 Kirk PM (2012) Nomenclatural novelties [*Anaeromyces polycephalus*,
7000 *Caecomyces hurleyensis*, *Callimastix frontalis*, *Piromyces cryptodigmaticus*]. Index Fungorum 1: 1
- 7001 Kirk PM, Stalpers JA, Braun U, Crous PW et al (2013) A
7002 withoutprejudice list of generic names of fungi for protection
7003 under the international code of nomenclature for algae, fungi,
7004 and plants. IMA Fungus 4:381–443
- 7005 Kito H, Abe A, Sujaya IN, Oda Y et al (2009) Molecular
7006 characterization of the relationships among *Amylomyces rouxii*,
7007 *Rhizopus oryzae*, and *Rhizopus delemar*. Biosci Biochem
7008 Biotechnol 73:861–864
- 7009 Krings M, Taylor TN, Martin H (2016) An enigmatic fossil fungus
7010 from the 410 Ma Rhynie chert that resembles *Macrochytrium*
7011 (Chytridiomycota) and *Blastocladiella* (Blastocladiomycota).
7012 Mycologia 108:303–312
- 7013 Kroll KW, Eisfeld AK, Lozanski G, Bloomfield CD et al (2016)
7014 MuCor: mutation aggregation and correlation. Bioinformatics
7015 32(10):1557–1558
- 7016 Krüger M, Krüger C, Walker C, Stockinger H et al (2012)
7017 Phylogenetic reference data for systematics and phylotaxonomy
7018 of arbuscular mycorrhizal fungi from phylum to species level.
7019 New Phytol 193:970–984
- 7020 Krüger M, Walker C, Schübler A (2011) *Acaulospora brasiliensis*
7021 comb. nov. and *Acaulospora alpina* (Glomeromycota) from
7022 upland Scotland: morphology, molecular phylogeny and DNA-
7023 based detection in roots. Mycorrhiza 21:577–587
- 7024 Kubo H (2011) Cloning and expression analysis of putative glycer-
7025 aldehyde-3-phosphate dehydrogenase genes in *Pilobolus crys-*
7026 tallinus. Mycoscience 52:99–106
- 7027 Kubo H (2012) Asexual reproductive organ-specific expression of the
7028 glyceraldehyde-3-phosphate dehydrogenase 2 gene of *Pilobolus*
7029 *crystallinus*. Mycoscience 53:147–151
- 7030 Kumar Verma R, Shivaprakash MR, Shanker A, Panda NK (2012)
7031 Subcutaneous zygomycosis of the cervicotemporal region: due to
7032 *Basidiobolus ranaram*. Med Mycol Case Rep 1:59–62. <https://doi.org/10.1016/j.mmcr.2012.07.004>
- 7033 Kurihara Y, Sukarno N, Ilyas M, Yuniarti E et al (2008) Indonesian
7034 Kickxellales: two species of *Coemansia* and *Linderina*. Myco-
7035 science 49:250. <https://doi.org/10.1007/s10267-008-0417-5>
- 7036 Kwon-Chung KJ (2012) Taxonomy of fungi causing mucormycosis
7037 and entomophthoromycosis (zygomycosis) and nomenclature of
7038 the disease: molecular mycologic perspectives. Clin Infect Dis
7039 54:8–15
- 7040 Kyei-Poku G, Gauthier D, Van Frankenhuyzen K (2008) Molecular
7041 data and phylogeny of *Nosema* infecting Lepidoptera forest
7042 defoliators in the genera *Choristoneura* and *Malacosoma*.
7043 J Eukaryot Microbiol 55:51–58
- 7044 Kyei-Poku G, Gauthier D, van-Frankenhuyzen K (2012) Complete
7045 rRNA sequence, arrangement of tandem repeated units and
7046 phylogeny of *Nosema fumiferanae* from spruce budworm,
7047 *Choristoneura fumiferana* (Clemens). J Eukaryot Microbiol
7048 59(1):93–96
- 7049 Kyei-Poku G, Sokolova J (2017) The microsporidium *Nosema*
7050 *disstriae* (Thomson 1959): fine structure and phylogenetic
7051 position within the *N. bombycis* clade. J Invertebr Pathol
7052 143:90–103
- 7053 Laisutisan K, Prasertsri S, Chuchird N, Limsuwan C (2009)
7054 Ultrastructure of the microsporidian *Thelohania (Agmasoma)*
7055 *penaei* in the pacific white shrimp (*Litopenaeus vannamei*).
7056 Kasetsart Univ Fish Res Bull 33(2):41–48
- 7057 Lange CE, Azzaro FG (2008) New case of long-term persistence of
7058 *Paranosema locustae* (Microsporidia) in melanoplina grasshop-
7059 pers (Orthoptera: Acrididae: Melanoplinae) of Argentina. J In-
7060 vertebr Pathol 99(3):357–359
- 7061 Lange CE, Becnel JJ, Razafindratiana E, Przybyszewski J, Razafin-
7062 rafara H (1996) *Johenrea locustae* n.g., n.sp. (Microspora:

- 7067 Glugeidae): a pathogen of migratory locusts (Orthoptera: Acrididae: Oedipodinae) from Madagascar. *J Invertebr Pathol* 68:28–40
- 7068
- 7069
- 7070 Lange CE, Macvean CM, Henry JE, Streett DA (1995) *Heterovesicula cowani* ng, n. sp. (Heterovesiculidae n. fam.), a microsporidian parasite of Mormon crickets, *Anabrus simplex* Haldeman, 1852 (Orthoptera: Tettigoniidae). *J Eukaryot Microbiol* 42(5):552–558
- 7071
- 7072
- 7073
- 7074
- 7075 Larsson JIR (1980) Insect pathological investigations on Swedish Thysanura. II. A new microsporidian parasite of *Petrobius brevistylis* (Microcoryphia, Machilidae); description of the species and creation of two new genera and a new family. *Protistologica* 16:85–101
- 7076
- 7077
- 7078
- 7079
- 7080 Larsson JIR (1983) A revisionary study of the taxon *Tuzetia* Maurand, Fize, Fenwick and Michel, 1971, and related forms (Microspora, Tuzetiidae). *Protistologica* 19:323–355
- 7081
- 7082
- 7083 Larsson JIR (1986a) Ultrastructural investigation of two microsporidia with rod-shaped spores, with descriptions of *Cylindrospora fasciculata* sp. nov. and *Resiomeria odonataegen* et sp. nov. (Microspora, thelohaniidae). *Protistologica* 22(4):379–398
- 7084
- 7085
- 7086
- 7087 Larsson JIR (1990a) *Rectispora reticulata* gen. et sp. nov. (Microspora, Bacillidiidae), a new microsporidian parasite of *Pomatothrix hammoniensis* (Michaelson, 1901) (Oligochaeta, Tubificidae). *Eur J Protistol* 26(1):55–64
- 7088
- 7089
- 7090
- 7091
- 7092
- 7093
- 7094
- 7095
- 7096
- 7097
- 7098
- 7099
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- 7121
- 7122
- 7123
- 7124
- 7125
- 7126
- 7127
- 7128
- 7129
- 7130
- 7131
- 7132
- Larsson JIR (1990b) Description of a new microsporidium of the water mite *Limnochares aquatica* and establishment of the new genus *Napamichum* (Microspora, Thelohaniidae). *J Invertebr Pathol* 55(2):152–161
- Larsson JIR (1990c) On the cytology and taxonomic position of *Nudispora biformis* ng, n. sp. (Microspora, Thelohaniidae), a microsporidian parasite of the dragon fly *Coenagrion hastulatum* in Sweden. *J Protozool Res* 37(4):310–318
- Larsson JIR (1994) *Trichoctosporea pygopellita* gen. et sp. nov. (Microspora, Thelohaniidae), a microsporidian parasite of the mosquito *Aedes vexans* (Diptera, Culicidae). *Arch Protistenkd* 144(2):147–161
- Larsson JIR (2014a) The primitive microsporidia. In: Weiss LM, Becnel JJ (eds) *Microsporidia pathogens of opportunity*. Wiley-Blackwell Press, Ames, pp 605–634
- Larsson JIR, Bylén EK (1992) *Tardivesicula duplicata* gen. et sp. nov. (Microspora, Dubosqiidae), a microsporidian parasite of the caddis fly *Limnephilus centralis* (Trichoptera, Limnephilidae) in Sweden. *Eur J Protistol* 28(1):25–36
- Larsson JIR, Ebert D, Vávra J (1996a) Ultrastructural study of *Glugea cladocera* Pfeiffer, 1895, and transfer to the genus *Agglomerata* (Microspora, Dubosqiidae). *Eur J Protistol* 32(4):412–422
- Larsson JIR, Ebert D, Vávra J (1997a) Ultrastructural study and description of *Ordospora colligata* gen. et sp. nov. (Microspora, Ordosporidae fam. nov.), a new microsporidian parasite of *Daphnia magna* (Crustacea, Cladocera). *Eur J Protistol* 33(4):432–443
- Larsson JIR, Ebert D, Vávra J, Voronin VN (1996b) Redescription of *Pleistophora intestinalis* Chatton 1907, a microsporidian parasite of *Daphnia magna* and *Daphnia pulex*, with establishment of the new genus *Glugoides* (Microspora, Glugeidae). *Eur J Protistol* 32:251–261
- Larsson JIR, Voronin VN (2000) Light and electron microscopic study of *Agglomerata volgensae* n. sp. (Microspora: Dubosqiidae), a new microsporidian parasite of *Daphnia magna* (Crustacea: Daphniidae). *Eur J Protistol* 36(1):89–99
- Larsson JIR, Yan ND (1988) The ultrastructural cytology and taxonomy of *Dubosqia sidaejirovec*, 1942 (Microspora, Dubosqiidae), with establishment of the new genus *Agglomerata* gen nov. *Arch Protistenkd* 135(1–4):271–288
- Larsson JIR (2014b) The primitive microsporidia. *Microsporidia* 9:605–634
- Larsson R (1981) A new microsporidium *Berwaldia singularis* gen. et sp. nov. from *Daphnia pulex* and a survey of microsporidia described from *Cladocera*. *Parasitology* 83(2):325–342
- Larsson R (1985) On the cytology, development and systematic position of the *Thelohania asterias* Weiser, 1963, with creation of the new genus *Bohuslavia* (Microspora, Thelohaniidae). *Protistologica* 21(2):235–246
- Larsson R (1986b) Ultracytology of a tetrasporoblastic Microsporidium of the Caddis fly *Holocentropus picicornis* (Trichoptera, Polycentropodidae), with description of *Eptseptuni inversum* gen. et sp. nov. (Microspora, Gurleyidae). *Arch Protistenkd* 131(3–4):257–279
- Larsson R, Steiner MY, Bjornson S (1997b) *Intexta acarivora* gen. et sp. n. (Microspora: Chytridiopsidae): ultrastructural study and description of a new microsporidian parasite of the forage mite *Tyrophagus putrescentiae* (Acari: Acaridae). *Acta Protozool* 36:295–304
- Lazarus KL, Benny GL, Ho HM, Smith ME (2017) Phylogenetic systematics of *Syncephalis* (Zoopagales, Zoopagomycotina), a genus of ubiquitous mycoparasites. *Mycologia* 109:333–349
- Lechevalier P, Hermoso DG, Carol A, Bonacorsi S et al (2008) Molecular diagnosis of *Saksenaea vasiformis* cutaneous infection after scorpion sting in an immunocompetent adolescent. *J Clin Microbiol* 46:3169–3172
- Leiro J, Iglesias R, Parama A, Aragort W, Sanmartin ML (2002) PCR detection of *Tetramicra brevifilum* (Microspora) infection in turbot (*Scophthalmus maximus* L.) musculature. *Parasitology* 124:145–151
- Leiro J, Parama A, Ortega M, Santamarina MT (1999) Redescription of *Glugea caulleryi*, a microsporidian parasite of the greater sand-eel, *Hyperoplus lanceolatus* (Le Sauvage), (Teleostei: Ammodytidae), as *Microgemma caulleryi* comb. nov. *J Fish Dis* 22:101–110
- Lepelletier F, Karpov SA, Alacid E, Le Panse S et al (2014) *Dinomyces arenysensis* gen. et sp. nov. (Rhizophydiales, Dinomycetaceae fam. nov.), a chytrid infecting marine dinoflagellates. *Protist* 165:230–244
- Letcher PM (2014) Nomenclatural novelties [*Irineochytrium annulatum* comb. nov.]. <http://www.indexfungorum.org/names/NameRecord.asp?RecordID=550671>
- Letcher PM, Lee PA, Lopez S, Burnett M et al (2016) An ultrastructural study of *Paraphysoderma sedebokerense* (Blastocladiomycota), an epibiotic parasite of microalgae. *Fungal Biol* 120:324–337
- Letcher PM, Longcore JE, Powell MJ (2014) *Dendrochytridium crassum* gen. et sp. nov., a taxon in Chytridiales with unique zoospore ultrastructure. *Mycologia* 106:145–153
- Letcher PM, Powell MJ (2017) Three new genera of soil-inhabiting chytrids in Spizellomycetaceae (Chytridiomycota). *Nova Hedwig* 105(3–4):3–4. https://doi.org/10.1127/nova_hedwigia/2017/0458
- Letcher PM, Powell MJ, Barr DJ, Churchill PF et al (2008a) Rhizophlyctidales—a new order in Chytridiomycota. *Mycol Res* 112:1031–1048
- Letcher PM, Powell MJ, Davis WJ (2015a) A new family and four new genera in Rhizophydiales (Chytridiomycota). *Mycologia* 107:808–830
- Letcher PM, Powell MJ, Lee PA, Lopez S, Burnett M (2017) Molecular phylogeny and ultrastructure of *Aphelidium desmodesmi*, a new species in Aphelida (Opisthosporidia). *J Eukaryot Microbiol* 64(5):655–667
- Letcher PM, Powell MJ, Lopez S, Lee PA et al (2015b) A new isolate of *Amoebophilidium protococcarum*, and *Amoebophilidium occidentale*, a new species in phylum Aphelida (Opisthosporidia). *Mycologia* 107:522–531

- 7198 Letcher PM, Powell MJ, Picard KT (2012a) Zoospore ultrastructure
7199 and phylogenetic position of *Phlyctochytrium aureliae* Ajello is
7200 revealed (Chytridiaceae, Chytridiales, Chytridiomycota).
7201 Mycologia 104:410–418
- 7202 Letcher PM, Powell MJ, Viusent MC (2008b) Rediscovery of an
7203 unusual chytridiaceous fungus new to the order Rhizophydiales.
7204 Mycologia 100:325–334
- 7205 Letcher PM, Vélez CG, Barrantes ME, Powell MJ et al (2008c)
7206 Ultrastructural and molecular analyses of Rhizophydiales
7207 (Chytridiomycota) isolates from North America and Argentina.
7208 Mycol Res 112:759–782
- 7209 Letcher PM, Vélez CG, Schultz S, Powell MJ (2012b) New taxa are
7210 delineated in Alphamycetaceae (Rhizophydiales, Chytridiomy-
7211 cota). Nova Hedwig 94:9–29
- 7212 Leung S-Y, Huang Y, Lau SKP, Woo PCY (2014) Complete
7213 mitochondrial genome sequence of *Lichtheimia ramosa* (syn.
7214 *Lichtheimia hongkongensis*). Genome Announc 2:e00644-44.
7215 <https://doi.org/10.1128/genomeA.00644-14>
- 7216 Levaditi C, Nicolau S, Schoen R (1923) L'etiologie de l'encephalite.
7217 C r hebdomadaire Acad Sci Paris 177:985
- 7218 Li GJ, Hyde KD, Zhao RL, Hongsanan S et al (2016) Fungal diversity
7219 notes 253–366: taxonomic and phylogenetic contributions to
7220 fungal taxa. Fungal Divers 78:1–237
- 7221 Li L, Yang ZY, Yang XQ, Zhang GH et al (2008) Debittering effect
7222 of *Actinomucor elegans* peptidases on soybean protein hydro-
7223 lysates. J Ind Microbiol Biotechnol 35:41–47
- 7224 Li SL, Lin Q, Li XR, Xu H et al (2012) Biodiversity of the oleaginous
7225 microorganisms in Tibetan Plateau. Braz J Microbiol
7226 43:627–634
- 7227 Li Y, Li J, Zhao H (2018) The preparation of chitosan from corn cob
7228 hydrolyzate by *Actinomucor elegans*. In: Liu H, Song C, Ram A
7229 (eds) Advances in applied biotechnology. ICAB 2016. Lecture
7230 Notes in Electrical Engineering, vol 444. Springer, Singapore
- 7231 Lichtwardt RW (2011) *Dacrydiomyces*, a new genus of Harpellales
7232 in Chironomidae larvae. Mycologia 103:912–914
- 7233 Lichtwardt RW (2012) Trichomycete gut fungi from tropical regions
7234 of the world. Biodivers Conserv 21:2397–2402
- 7235 Lichtwardt RW, Williams MC, White MM (2011a) *Klastostachys*, a
7236 new genus of Harpellales in Chironomidae larvae. Mycologia
7237 103:915–917
- 7238 Lichtwardt RW, Williams MC, White MM (2011b) Typification of
7239 *Smittium*, an important genus in the taxonomy of Harpellales.
7240 Mycologia 103:918–920
- 7241 Ligginstoffer AS, Youssef NH, Couger MB, Elshahed MS (2010)
7242 Phylogenetic diversity and community structure of anaerobic gut
7243 fungi (phylum Neocallimastigomycota) in ruminant and non-
7244 ruminant herbivores. ISME J 10:1225–1235. <https://doi.org/10.1038/ismej.2010.49>
- 7245 Lihme M, Jensen AB, Rosendahl S (2009) Local scale population
7246 genetic structure of *Entomophthora muscae* epidemics. Fungal
7247 Ecol 2:81–86
- 7248 Lilje O, Lilje E (2008) Fluctuation in *Rhizophyidium* sp. (AUS 6)
7249 zoospore production and biomass during colony formation. Aust
7250 Mycol 27:20–32
- 7251 Lima DX, Souza-Motta CM, Wagner L, Voigt K et al (2017)
7252 *Circinella simplex*—a misapplied name of *Mucor circinatus* sp.
7253 nov. Phytotaxa 329:269–276
- 7254 Lima DX, Voigt K, De Souza CA, De Oliveira RJ et al (2016)
7255 Description of *Backusella constricta* sp. nov. (Mucorales, ex
7256 Zygomycota) from the Brazilian Atlantic rainforest, including a
7257 key to species of Backusella. Phytotaxa 289:59–68
- 7258 Lima LL, Kozovits AR, Magna DAA, Silva GA et al (2014)
7259 *Cetraspora auronigra*, a new glomeromycete species from Ouro
7260 Preto (Minas Gerais, Brazil). Sydowia 66:299–308
- 7261 Linde J, Schwartze V, Binder U, Lass-Flörl C et al (2014) De novo
7262 whole-genome sequence and genome annotation of *Lichtheimia*
7263 *ramosa*. Genome Announc 2(5):e00888-14
- 7264 Liu H, Ma J, Wang M, Wang W et al (2016) Food waste fermentation
7265 to fumaric acid by *Rhizopus arrhizus* RH7-13. Appl Biochem
7266 Biotechnol 180:1524–1533
- 7267 Liu XY, Zheng RY (2015) New taxa of *Ambomucor* (Mucorales,
7268 Mucoromycotina) from China. Mycotaxon 130:165–171
- 7269 Lom J, Dyková I (2005) Microsporidian xenomas in fish seen in wider
7270 perspective. Folia Parasitol 52(1/2):69
- 7271 Longcore JE, Letcher PM, James TY (2011) *Homolaphylyctis*
7272 *polyrhiza* gen. et sp. nov., a species in the Rhizophydiales
7273 (Chytridiomycetes) with multiple rhizoidal axes. Mycotaxon
7274 118:433–440
- 7275 Longcore JE, Simmons DR (2012) The Polychytriales ord. nov.
7276 contains chitinophilic members of the rhizophlyctoid alliance.
7277 Mycologia 104:276–294
- 7278 Longcore JE, Simmons DR, Letcher PM (2016) *Synchytrium*
7279 *microbalum* sp. nov. is a saprobic species in a lineage of
7280 parasites. Fungal Biol 120:1156–1164
- 7281 Lorenz LM, Koella JC (2011) The microsporidian parasite *Vavraia*
7282 *culicis* as a potential late life-acting control agent of malaria.
7283 Evol Appl 4(6):783–790
- 7284 Loubès C, Akbarieh M (1978) Etude ultrastructurale de la microspori-
7285 die *Baculea daphniae* ng. n. sp., parasite de l'épithélium
7286 intestinal de *Daphnia pulex* Leydig, 1860 (Crustacé, Cladocère).
7287 Protistologica 14:23–38
- 7288 Lovy J, Kostka M, Dyková I, Arsenault G, Pecková H, Wright GM,
7289 Spéare DJ (2009) Phylogeny and morphology of *Glugea*
7290 *hertwigi* from rainbow smelt *Osmerus mordax* found in Prince
7291 Edward Island, Canada. Dis Aquat Organ 86:235–243
- 7292 Lu XL, Liu ZH, Shen YN, She XD et al (2009) Primary cutaneous
7293 zygomycosis caused by *Rhizomucor variabilis*: a new endemic
7294 zygomycosis? A case report and review of 6 cases reported from
7295 China. Clin Infect Dis 49:e39–e43. <https://doi.org/10.1086/600817>
- 7296 Lu XL, Najafzadeh MJ, Dolatabadi S, Ran YP et al (2013) Taxonomy
7297 and epidemiology of *Mucor irregularis*, agent of chronic
7298 cutaneous mucormycosis. Persoonia 30:48–56. <https://doi.org/10.3767/003158513X665539>
- 7299 Lücking R, Hodkinson BP, Leavitt SD (2017) The 2016 classification
7300 of lichenized fungi in the Ascomycota and Basidiomycota ap-
7301 proaching one thousand genera. Bryologist 119:361–416
- 7302 Lukášová K, Holuša JA (2013) New data on the host specificity of
7303 *Larssoniella duplicati*. Period Biol 115(3):455–457
- 7304 Lumbsch HT, Huhndorf SM (2010) Outline of ascomycota 2009.
7305 Myconet 14:1–64
- 7306 Luo B, Liu H, Pan G, Li T et al (2014) Morphological and molecular
7307 studies of *Vairimorpha necatrix* BM, a new strain of the
7308 microsporidium *V. necatrix* (microsporidia, burenellidae)
7309 recorded in the silkworm, *Bombyx mori*. Exp Parasitol
7310 143:74–82
- 7311 Luo XA, Zhu YM, Liu TT, Wang XP et al (2017) Identification and
7312 characterization of a novel diacylglycerol acyltransferase gene
7313 from *Mortierella alpina*. Biotechnol Lett 39:883–888
- 7314 Ma LJ, Ibrahim AS, Skory C, Grabherr MG et al (2009) Genomic
7315 analysis of the basal lineage fungus *Rhizopus oryzae* reveals a
7316 whole-genome duplication. PLoS Genet 5(7):e1000549
- 7317 Mackey PE, Cappe KG, Mani R, Rothenburg L et al (2015)
7318 Disseminated *Conidiobolus incongruus* in a dog: a case report
7319 and literature review. Med Mycol Case Rep 8:24–28. <https://doi.org/10.1016/j.mmcr.2015.02.005>
- 7320 Madden AA, Stchigel AM, Guarro J, Sutton D et al (2012) *Mucor*
7321 *nidicola* sp. nov., a fungal species isolated from an invasive
7322 paper wasp nest. Int J Syst Evol Microbiol 62:1710–1714.
7323 <https://doi.org/10.1099/ijs.0.033050-0>

- 7328 Magyar D, Merényi Z, Bratek Z, Baral HO et al (2016) *Lecophagus*
7329 *vermicola* sp. nov., a nematophagous hyphomycete with an
7330 unusual hunting strategy. Mycol Prog 15:1137–1144
- 7331 Mahmud A, Lee R, Munfus-McCray D, Kwiatkowski N et al (2012)
7332 *Actinomyces elegans* as an emerging cause of mucormycosis.
7333 J Clin Microbiol 50:1092–1095
- 7334 Maier MA, Peterson TD (2016) Enumeration of parasitic chytrid
7335 zoospores in the Columbia River via quantitative PCR. Appl
7336 Environ Microbiol 82:3857–3867
- 7337 Malysh JM, Tokarev YS, Sitnicova NV, Martemyanov VV et al
7338 (2013) *Tubulinosema loxostegi* sp. n. (Microsporidia: Tubuli-
7339 nosematidae) from the beet webworm *Loxostege sticticalis* L.
7340 (Lepidoptera: Crambidae) in Western Siberia. Acta Protozool
7341 4:299–308
- 7342 Mane SR, Pathan EK, Kale D, Ghormade V et al (2017) Optimization
7343 for the production of mycelial biomass from *Benjaminiella*
7344 *poitrasii* to isolate highly deacetylated chitosan. J Polym Mater
7345 34:145–156
- 7346 Mangaraj S, Sethy G, Patro MK, Padhi S (2014) A rare case of
7347 subcutaneous mucormycosis due to *Syncephalastrum racemosum*:
7348 case report and review of literature. Indian J Med Microbiol
7349 32:448–451
- 7350 Mansour L, Prensier G, Jemaa SB, Hassine OKB, Méténier G,
7351 Vivarès CP, Cornillot E (2005) Description of a xenoma-
7352 inducing microsporidian, *Microgemma tincae* n. sp., parasite of
7353 the teleost fish *Symphodus tinca* from Tunisian coasts. Dis Aquat
7354 Org 65:217–226
- 7355 Mantzouridou F, Naziri E, Tsimidou MZ (2008) Industrial glycerol as
7356 a supplementary carbon source in the production of β -carotene
7357 by *Blakeslea trispora*. J Agric Food Chem 56:2668–2675
- 7358 Marano AV, Barrera MD, Steciow MM, Gleason FH et al (2011)
7359 Diversity of zoospore true fungi and heterotrophic straminipiles
7360 in Las Cañas stream (Buenos Aires, Argentina): assemblages
7361 colonizing baits. Fundam Appl Limnol 178:203–218
- 7362 Marinho F, Silva GA, Ferreira AC, Veras JS et al (2014) *Bulbospora*
7363 *minima*, a new genus and a new species in the Glomeromycetes
7364 from semi-arid Northeast Brazil. Sydowia 66:313–323
- 7365 Martel A, Spitzen-van der Sluijs A, Blooi M, Bert W et al (2013)
7366 *Batrachochytrium salamandrivorans* sp. nov. causes lethal
7367 chytridiomycosis in amphibians. Proc Natl Acad Sci
7368 110:15325–15329
- 7369 Martin N, Guez MAU, Sette LD, Da Silva R et al (2010) Pectinase
7370 production by a Brazilian thermophilic fungus *Thermomucor*
7371 *indicae-seudaticae* N31 in solid-state and submerged fermenta-
7372 tion. Microbiology 79:306–313. [https://doi.org/10.1134/
7373 S0026261710030057](https://doi.org/10.1134/S0026261710030057)
- 7374 Martinez A, Rivas F, Perojil A, Parra A et al (2013) Biotransforma-
7375 tion of oleanolic and maslinic acids by *Rhizomucor miehei*.
7376 Phytochem 94:229–237
- 7377 Mascarin GM, da Silveira Duarte V, Brandão MM, Delalibera Í Jr
7378 (2012) Natural occurrence of *Zoopthora radicans* (Entomoph-
7379 thorales: Entomophthoraceae) on *Thaumastocoris peregrinus*
7380 (Heteroptera: Thaumastocoridae), an invasive pest recently
7381 found in Brazil. J Invertebr Pathol 110:401–404
- 7382 Mathur C, Prakash R, Ali A, Kaur J et al (2010) Emulsification and
7383 hydrolysis of oil by *Syncephalastrum racemosum*. Defence Sci J
7384 60:251–254
- 7385 Mathuram AJ, Mohanraj P, Mathews MS (2013) Rhino-orbital-
7386 cerebral infection by *Syncephalastrum racemosum*. J Assoc
7387 Physicians India 45:339–340
- 7388 Matthews CG, Richards RH, Shinn AP, Cox DI (2013) Gill pathology
7389 in Scottish farmed Atlantic salmon, *Salmo salar* L., associated
7390 with the microsporidian *Desmozoon lepeophtherii* Freeman et
7391 Sommerville, 2009. J Fish Dis 36(10):861–869
- 7392 Matthews JL, Brown AMV, Larison K, Bishop-Stewart JK, Rogers P,
7393 Kent ML (2001) *Pseudoloma neurophilia* n.g., n.sp., a new
7394 genus and species of *Microsporidia* from the central nervous
7395 system of the zebrafish (*Danio rerio*). J Eukaryot Microbiol
7396 48:229–235
- 7397 Matthews RA, Matthews ABF (1980) Cell and tissue reactions of
7398 turbot *Scophthalmus maximus* (L.) to *Tetramicra brevifilum* gen.
7399 n., sp. n. (Microspora). J Fish Dis 3:495–515
- 7400 Maurand I, Fize A, Fenwick B, Michel R (1971) Etude au microscope
7401 électronique de *Nosema infirmum* Kudo, 1921, microsporidie
7402 parasite d'un copepode cyclopoide; creation du genre nouveau
7403 *Tuzetia* a propos de cette espece. Protistologica 7:221–225
- 7404 Medina J, Cornejo P, Borie F, Meier S et al (2014) *Corymbiglomus*
7405 *pacificum*, a new glomeromycete from a saline lakeshore in
7406 Chile. Mycotaxon 127:173–183
- 7407 Meeuwse P, Tramper J, Rinzema A (2011) Modeling lipid accumu-
7408 lation in oleaginous fungi in chemostat cultures: I. Development
7409 and validation of a chemostat model for *Umbelopsis isabellina*.
7410 Bioprocess Biosyst Eng 34:939–949
- 7411 Meissner EG, Bennett JE, Qvarnstrom Y, da Silva A, Chu EY, Tsokos
7412 M, Gea-Banacloche J (2012) Disseminated microsporidiosis in
7413 an immunosuppressed patient. Emerg Infect Dis 18:1155–1158
- 7414 Melo RF, Maia LC, Santiago AL (2016) The discovery of *Syncephalis*
7415 *obliqua* (Zoopagomycotina, Zoopagales) in the Neotropics.
7416 Mycotaxon 130:1165–1169
- 7417 Mendoza L, Vilela R, Voelz K, Ibrahim AS et al (2015) Human
7418 fungal pathogens of Mucorales and Entomophthorales. Cold
7419 Spring Harb Perspect Med 5:a019562
- 7420 Menotti J, Cassinat B, Sarfati C, Liguory O, Derouin F, Molina JM
7421 (2003) Development of a real-time PCR assay for quantitative
7422 detection of *Encephalitozoon intestinalis* DNA. J Clin Microbiol
7423 41:1410–1413
- 7424 Merheb-Dini C, Gomes E, Boscolo M, da Silva R et al (2010)
7425 Production and characterization of a milk-clotting protease in the
7426 crude enzymatic extract from the newly isolated *Thermomucor*
7427 *indicae-seudaticae* N31: (Milk-clotting protease from the newly
7428 isolated *Thermomucor indicae-seudaticae* N31). Food Chem
7429 120:87–93. <https://doi.org/10.1016/j.foodchem.2009.09.075>
- 7430 Michel R, Scheid P, Köhler M, Walochnik J (2015) *Acaulopage*
7431 *tetraceros* Drechsler 1935 (Zoopagales): cultivation, prey pattern
7432 and molecular characterization. J Endocytobiosis Cell Res
7433 26:76–82
- 7434 Michel R, Walochnik J, Scheid P (2014) Article for the “free-living
7435 amoebae special issue”: isolation and characterisation of various
7436 amoebophilic fungi and evaluation of their prey spectrum.
7437 Exp Parasitol 145:131–136
- 7438 Mikhailov KV, Simdyanov TG, Aleoshin VV (2016) Genomic survey
7439 of a hyperparasitic microsporidian *Amphiamblys* sp. (Metch-
7440 nikovellidae). Genome Biol Evol 9(3):454–467
- 7441 Millanes AM, Diederich P, Ekman S, Wedin M (2011) Phylogeny and
7442 character evolution in the jelly fungi (Tremellomycetes, Basidi-
7443 omycota, Fungi). Mol Phylogenet Evol 61:12–28
- 7444 Min B, Park J-H, Park H, Shin H-D et al (2017) Genome analysis of a
7445 zygomycete fungus *Choanephora cucurbitarum* elucidates
7446 necrotrophic features including bacterial genes related to plant
7447 colonization. Sci Rep. <https://doi.org/10.1038/srep40432>
- 7448 Misra JK (2012) Systematics of *Stachylina* and *Smittium*—the two
7449 largest genera of Harpellales, Zygomycota. In: Deshmukh SK,
7450 Misra JK, Tewari JP (eds) Systematics and evolution of fungi.
7451 CRC Press, New York, pp 124–167
- 7452 Misra JK, Papp T, Csernetics A, Vágvolgyi C (2014) A new species
7453 of *Legeriomyces* and other Harpellales reported for the first time
7454 in larval insects from Hungary. Mycoscience 55:268–274
- 7455 Misra JK, Tiwari VK (2008) A new species of *Gauthieromyces* and
7456 range extensions for other Harpellales to India. Mycologia
7457 100:94–98
- 7458 Mitchell MJ, Cali A (1993) Ultrastructural study of the development
7459 of *Vairimorpha necatrix* (Kramer, 1965) (Protozoa, 7459

- 7460 Microsporidia) in larvae of the corn earworm, *Heliothis zea* (Boddie) (Lepidoptera, Noctuidae) with emphasis on sporogony. *J Eukaryot Microbiol* 40:701–710
- 7462 Monaghan SR, Rumney RL, Vo NT, Bols NC et al (2011) *In vitro* growth of microsporidia *Anncaliia algerae* in cell lines from warm water fish. *In Vitro Cell Dev Biol Anim* 47(2):104–113
- 7464 Monchy S, Sanciú G, Jobard M, Rasconi S et al (2011) Exploring and quantifying fungal diversity in freshwater lake ecosystems using rDNA cloning/sequencing and SSU tag pyrosequencing. *Environ Microbiol* 13:1433–1453
- 7470 Mondo SJ, Dannebaum RO, Kuo RC, Louie KB et al (2017) Widespread adenine N6-methylation of active genes in fungi. *Nat Genet* 49:964–968. <https://doi.org/10.1038/ng.3859>
- 7471 Morgenstern I, Powlowski J, Ishmael N, Darmond C et al (2012) A molecular phylogeny of thermophilic fungi. *Fungal Biol* 116:489–502
- 7475 Morin-Sardin S, Nodet P, Coton E, Jany JL et al (2017) *Mucor*: a janus-faced fungal genus with human health impact and industrial applications. *Fungal Biol Rev* 31:12–32. <https://doi.org/10.1016/j.fbr.2016.11.002>
- 7477 Morris DJ, Adams A (2002) Development of *Schroedera plumatellae* gen. n., sp. n. (Microsporidia) in *Plumatella fungosa* (Bryozoa: Phylactolaemata). *Acta Protozool* 41(4):383–396
- 7481 Morris DJ, Freeman MA (2010) Hyperparasitism has wide-ranging implications for studies on the invertebrate phase of myxosporean (Myxozoa) life cycles. *Int J Parasitol* 40(3):357–369
- 7485 Morrison CM, Sprague V (1981) Electron microscopical study of a new genus and new species of microsporidia in the gills of Atlantic cod *Gadus morhua* L. *J Fish Dis* 4:15–32
- 7488 Morton JB, Msiska Z (2010) Phylogenies from genetic and morphological characters do not support a revision of Gigasporaceae (Glomeromycota) into four families and five genera. *Mycorrhiza* 20:483–496
- 7492 Moss DM, Croppo GP, Wallace S, Visvesvara GS (1999) Flow cytometric analysis of microsporidia belonging to the genus *Encephalitozoon*. *J Clin Microbiol* 37:371–375
- 7494 Mou LY, Xin XL, Chen L, Dong PP et al (2014) Biotransformation of resibufogenin by *Actinomucor elegans*. *J Asian Nat Prod Res* 16:623–628
- 7498 Mozley-Standridge SE, Letcher PM, Longcore JE, Porter D et al (2009) Cladochytriales—a new order in Chytridiomycota. *Mycol Res* 113:498–507
- 7501 Mrva M (2011) *Mayorella vespertioides* Page, 1983 (Amoebozoa)—a new host for the ectoparasitic fungus *Amoebophilus simplex* (Zygomycota). *Biologia* 66:645–647
- 7504 Myšková E, Ditrich O, Sak B, Kváč M, Cymbalak T (2014) Detection of ancient DNA of *Encephalitozoon intestinalis* (Microsporidia) in archaeological material. *J Parasitol* 100:356–359
- 7506 Ndikumana S, Pelin A, Williot A, Sanders JL, Kent M, Corradi N (2017) Genome analysis of *Pseudoloma neurophilia*: a microsporidian parasite of Zebrafish (*Danio rerio*). *J Eukaryot Microbiol* 64:18–30
- 7511 Nelder MP, McCreddie JW, Beard CE (2009) Predicting occurrence of the fungal symbiote *Harpella* colonizing black fly larvae in coastal streams of Alabama and Mississippi, USA. *J Invertebr Pathol* 102:1–5
- 7515 Němejc K, Sak B, Květoňová D, Hanzal V, Janiszewski P, Forejtek P, Rajský D, Kotková M, Ravaszová P, McEvoy J, Kváč M (2013) Prevalence and diversity of *Encephalitozoon* spp. and *Enterocytozoon bieneusi* in wild boars (*Sus scrofa*) in Central Europe. *Parasitol Res* 113:761–767
- 7520 Neves ML, Silva MF, Souza-Motta CM, Spier MR et al (2011) *Lichtheimia blakesleeana* as a new potential producer of phytase and xylanase. *Molecules* 16:4807–4817
- 7523 Ni X, Backus EA, Maddox JV (1995) A new microsporidium, *Nosema empoascae* n. sp., from *Empoasca fabae* (Harris) (Homoptera: Auchenorrhyncha: Cicadellidae). *J Invertebr Pathol* 66:52–59
- 7527 Nie Y, Yu CZ, Liu XY, Huang B (2012) A new species of *Conidiobolus* (Ancylistaceae) from Anhui, China. *Mycotaxon* 120:427–435
- 7529 Nováková A, Vaughan MJ (2016) *Dimargaris bacillispora*—novel records from cave environment and its isolation in culture. *Czech Mycol* 68:167–182
- 7531 Nwe N, Furuike T, Tamura H (2009) The mechanical and biological properties of chitosan scaffolds for tissue regeneration templates are significantly enhanced by chitosan from *Gongronella butleri*. *Materials* 2:374–398
- 7537 Nyilasi I, Papp T, Csermets Á, Krizsán K et al (2008) High-affinity iron permease (FTR1) gene sequence-based molecular identification of clinically important Zygomycetes. *Clin Microbiol Infect* 14:393–397
- 7541 Nylund S, Andersen L, Sævreid I, Plarre H et al (2011) Diseases of farmed Atlantic salmon *Salmo salar* associated with infections by the microsporidian *Paranucléospora theridion*. *Dis Aquat Organ* 94(1):41–57
- 7545 Nylund S, Nylund A, Watanabe K, Arnesen CE et al (2010) *Paranucléospora theridion* n. gen., n. sp. (Microsporidia, Enterocytozoonidae) with a life cycle in the salmon louse (*Lepeophtheirus salmonis*, Copepoda) and Atlantic salmon (*Salmo salar*). *J Eukaryot Microbiol* 57(2):95–114
- 7550 Obidiegwu JE, Sanetomo R, Flath K, Tacke E et al (2015) Genomic architecture of potato resistance to *Synchytrium endobioticum* disentangled using SSR markers and the 8.3 k SolCAP SNP genotyping array. *BMC Genet* 16:38–54
- 7554 Oehl F, Alves a Silva G, Goto BT, Costa Maia L et al (2011a) Glomeromycota: two new classes and a new order. *Mycotaxon* 116:365–379
- 7556 Oehl F, Castillo C, Schneider D, Saele V et al (2012a) *Ambispora reticulata*, a new species in the Glomeromycota from mountainous areas in Switzerland and Chile. *J Appl Bot Food Qual* 85:129–133
- 7558 Oehl F, da Silva DKA, Maia LC, de Sousa NMF et al (2011b) *Orbispora* gen. nov., ancestral in the Scutellosporaceae (Glomeromycetes). *Mycotaxon* 116:161–169
- 7562 Oehl F, da Silva GA, Goto BT, Sieverding E (2011c) Glomeromycota: three new genera and glomoid species reorganized. *Mycotaxon* 116:75–120
- 7566 Oehl F, da Silva GA, Goto BT, Sieverding E (2011d) New recombinations in Glomeromycota. *Mycotaxon* 117:429–434
- 7569 Oehl F, da Silva GA, Sánchez-Castro I, Goto B et al (2011e) Revision of Glomeromycetes with entrophosporoid and glomoid spore formation with three new genera. *Mycotaxon* 117:297–316
- 7572 Oehl F, de Souza FA, Sieverding E (2008) Revision of *Scutellospora* and description of five new genera and three new families in the arbuscular mycorrhiza-forming Glomeromycetes. *Mycotaxon* 106:311–360
- 7576 Oehl F, Jansa J, de Souza FA, da Silva GA (2011f) *Cetraspora helvetica*, a new ornamented species in the Glomeromycetes from Swiss agricultural fields. *Mycotaxon* 114:71–84
- 7579 Oehl F, Palenzuela J, Sanchez-Castro I, Hountondji F et al (2012b) *Acaulospora minuta*, a new arbuscular mycorrhizal fungal species from sub-Saharan savannas of West Africa. *J Appl Bot Food Qual* 84:213–218
- 7582 Oehl F, Palenzuela J, Sánchez-Castro I, Kuss P et al (2012c) *Acaulospora nivalis*, a new fungus in the Glomeromycetes, characteristic for high alpine and nival altitudes of the Swiss Alps. *Nova Hedwig* 95:105–122
- 7585 Oehl F, Sánchez-Castro I, de Sousa NMF, Silva G et al (2015a) *Dominikia bernensis*, a new arbuscular mycorrhizal fungus from a Swiss no-till farming site, and *D. aurea*, *D. compressa* and *D.*

- 7591 *indica*, three new combinations in *Dominikia*. Nova Hedwig 101:65–76
- 7592 Oehl F, Sánchez-Castro I, Palenzuela J, da Silva GA (2015b)
- 7593 *Palaeospora spainii*, a new arbuscular mycorrhizal fungus from
- 7594 Swiss agricultural soils. Nova Hedwig 101:89–102
- 7595 Oehl F, Santos VM, Palenzuela J (2016) *Paraglomus turpe*, a new
- 7596 arbuscular mycorrhizal fungal species from Central European
- 7597 agricultural soils. Nova Hedwig 103:491–499
- 7598 Oehl F, Sieverding E, Palenzuela J, Ineichen K et al (2011g)
- 7599 Advances in Glomeromycota taxonomy and classification. IMA
- 7600 Fungus 2:191–199
- 7601 Oehl F, Tchabi A, Silva GA, Sánchez-Castro I et al (2014)
- 7602 *Acaulospora spinosissima*, a new arbuscular mycorrhizal fungus
- 7603 from the Southern Guinea Savanna in Benin. Sydowia 66:29–42
- 7604 Ogawa Y, Sugiyama M, Hirose D, Kusama-Eguchi K et al (2011)
- 7605 Polyphyly of intraspecific groups of *Umbelopsis ramanniana* and
- 7606 their genetic and morphological variation. Mycoscience
- 7607 52:91–98
- 7608 Oman SJ, White MM (2012) Extended studies of *Baltomyces styra*
- 7609 in Idaho and expanded distribution of this isopod gut fungus in
- 7610 USA. Mycologia 104:313–320
- 7611 Ortiz-Santana B, Lindner DL, Miettinen O, Justo A, Hibbett DS
- 7612 (2013) A phylogenetic overview of the antrodia clade (Basid-
- 7613 iomycota, Polyporales). Mycologia 105:1391–1411
- 7614 Ovcharenko M, Bacela K, Wilkinson T, Ironside JE et al (2010)
- 7615 *Cucumispora dikerogammari* n. gen. (Fungi: Microsporidia)
- 7616 infecting the invasive amphipod *Dikerogammarus villosus*: a
- 7617 potential emerging disease in European rivers. Parasitology
- 7618 137(2):191–204
- 7619 Ovcharenko M, Świątek P, Ironside J, Skalski T (2013) *Orthosomella*
- 7620 *lipae* sp. n. (Microsporidia) a parasite of the weevil, *Liophloeus*
- 7621 *lentus* Germar, 1824 (Coleoptera: Curculionidae). J Invertebr
- 7622 Pathol 112(1):33–40
- 7623 Ovcharenko M, Wita I (2001) Ultrastructural study of *Agglomerata*
- 7624 *connexa* sp. nov. (Microspora, Duboscqiiidae), a new
- 7625 microsporidian parasite of *Daphnia longispina* (Cladocera,
- 7626 Daphniidae). Acta Parasitol 46(2):94–102
- 7627 Overstreet RM, Weidner E (1974) Differentiation of microsporidian
- 7628 spore-tails in *Inodosporus spraguei* gen. et sp. n. Z Parasitenkd
- 7629 44(3):169–186
- 7630 Palenzuela J, Azcón-Aguilar C, Barea JM, da Silva GA et al (2014)
- 7631 *Acaulospora viridis*, a new species in the Glomeromycetes from
- 7632 two mountain ranges in Andalucía (Spain). Nova Hedwig
- 7633 99:71–82
- 7634 Palenzuela J, Azcon-Aguilar C, Barea J-M, da Silva GA et al (2015)
- 7635 *Acaulospora baetica*, a new arbuscular mycorrhizal fungal
- 7636 species from two mountain ranges in Andalucía (Spain). Nova
- 7637 Hedwig 101:463–474
- 7638 Palenzuela J, Azcón-Aguilar C, Barea JM, da Silva GA et al (2013a)
- 7639 *Acaulospora pustulata* and *Acaulospora tortuosa*, two new
- 7640 species in the Glomeromycota from Sierra Nevada National Park
- 7641 (Southern Spain). Nova Hedwig 97:305–319
- 7642 Palenzuela J, Azcón-Aguilar C, Barea JM, da Silva GA et al (2013b)
- 7643 *Septoglomus altomontanum*, a new arbuscular mycorrhizal
- 7644 fungus from mountainous and alpine areas in Andalucía
- 7645 (southern Spain). IMA Fungus 4:243–249
- 7646 Palenzuela J, Barea JM, Ferrol N, Oehl F (2011) *Ambispora*
- 7647 *granatensis*, a new arbuscular mycorrhizal fungus, associated
- 7648 with *Asparagus officinalis* in Andalucía (Spain). Mycologia
- 7649 103:333–340
- 7650 Palenzuela J, Ferrol N, Boller T, Azcon-Aguilar C et al (2008)
- 7651 *Otospora bareai*, a new fungal species in the Glomeromycetes
- 7652 from a dolomitic shrub land in Sierra de Baza National Park
- 7653 (Granada, Spain). Mycologia 100:296–305
- 7654 Panek J, El Alaoui H, Mone A, Urbach S et al (2014) Hijacking of
- 7655 host cellular functions by an intracellular parasite, the
- 7656 microsporidian *Anncaliia algerae*. PLoS ONE 9(6):e100791
- 7657 Papanikolaou S, Diamantopoulou P, Chatzifragkou A, Philippoussis
- 7658 A et al (2010) Suitability of low-cost sugars as substrates for
- 7659 lipid production by the fungus *Thamnidium elegans*. Energy
- 7660 Fuels 24:4078–4086
- 7661 Paperna I, Lainson R (1995a) *Alloglugea bufonis* nov. gen., nov. sp.
- 7662 (Microsporea: Glugeidae), a microsporidian of *Bufo marinus*
- 7663 tadpoles and metamorphosing toads (Amphibia: Anura) from
- 7664 Amazonian Brazil. Dis Aquat Organ 23(1):7–16
- 7665 Paperna I, Lainson R (1995b) *Alloglugea bufonis* nov. gen., nov. sp.
- 7666 (Microsporea: Glugeidae), a microsporidian of *Bufo marinus*
- 7667 tadpoles and metamorphosing toads (Amphibia: Anura) from
- 7668 Amazonian Brazil. Dis Aquat Organ 23:7–16
- 7669 Paquette C, Slater SE, McMahon MD, Quddus MR (2016)
- 7670 *Cokeromyces recurvatus* in a cervical papanicolaou test: a case
- 7671 report of a rare fungus with a brief review of the literature. Diagn
- 7672 Cytopathol 44:419–421. <https://doi.org/10.1002/dc.23432>
- 7673 Paskerova GG, Frolova EV, Kováčiková M, Panfilkina TS et al
- 7674 (2016) *Metchnikovella dogieli* sp. n. (Microsporidia: Metchn-
- 7675 nikovellida), a parasite of archigregarines *Selenidium* sp from
- 7676 polychaetes *Pygospio elegans*. Protistology 10(4):148–157
- 7677 Pastor FJ, Ruíz-Cendoya M, Pujol I, Mayayo E et al (2010) In vitro
- 7678 and in vivo antifungal susceptibilities of the mucoralean fungus
- 7679 *Cunninghamella*. Antimicrob Agents Chemother 54:4550–4555.
- 7680 <https://doi.org/10.1128/AAC.00786-10>
- 7681 Pathan EK, Ghormade V, Deshpande MV (2017) Selection of
- 7682 reference genes for quantitative real-time RT-PCR assays in
- 7683 different morphological forms of dimorphic zygomycetous
- 7684 fungus *Benjaminiella poitrasii*. PLoS ONE 12:e0179454.
- 7685 <https://doi.org/10.1371/journal.pone.0179454>
- 7686 Pawlowska P, Aleksandrak-Piekarczyk T, Banach A, Kiersztyn B
- 7687 et al (2016) Preliminary studies on the evolution of carbon
- 7688 assimilation abilities within Mucorales. Fungal Biol
- 7689 120:752–763. <https://doi.org/10.1016/j.funbio.2016.02.004>
- 7690 Pekkarinen M, Lom J, Nilssen F (2002) *Ovipleistophora* gen. n., a new
- 7691 genus for *Pleistophora mirandellae*-like microsporidia. Dis
- 7692 Aquat Organ 48(2):133–142
- 7693 Pell JK, Canning EU (1992) Ultrastructure of *Tricornia muhezae* ng,
- 7694 n. sp. (Microspora, Thelohaniidae), a parasite of *Mansonia*
- 7695 *africana* (Diptera: Culicidae) from Tanzania. J Protozool Res
- 7696 39(1):242–247
- 7697 Pell JK, Canning EU (1993) Ultrastructure and life cycle of
- 7698 *Merocinta davidii* gen et sp. nov, a dimorphic microsporidian
- 7699 parasite of *Mansonia africana* (Diptera: Culicidae) from Tanza-
- 7700 nia. J Invertebr Pathol 61(3):267–274
- 7701 Penton CR, StLouis D, Cole JR, Luo Y et al (2013) Fungal diversity
- 7702 in permafrost and tallgrass prairie soils under experimental
- 7703 warming conditions. Appl Environ Microbiol 79:7063–7072.
- 7704 <https://doi.org/10.1128/AEM.01702-13>
- 7705 Percival NJ, Harvey MC (2011) *Harpella forficella* (Scopoli) (Lep.:
- 7706 Oecophoridae) new to the UK. Br J Entomol Nat Hist 24:220
- 7707 Pereira CMR, Goto BT, da Silva DKA, Ferreira AC et al (2016a)
- 7708 *Acaulospora reducta* sp. nov. and *A. excavata*—two glom-
- 7709 eromycotan fungi with pitted spores from Brazil. Mycotaxon
- 7710 130:983–995
- 7711 Pereira CMR, Maia LC, Sánchez-castro I, Palenzuela J et al (2016b)
- 7712 *Acaulospora papillosa*, a new mycorrhizal fungus from NE
- 7713 Brazil, and *Acaulospora rugosa* from Norway. Phytotaxa
- 7714 260:14–24
- 7715 Petkovits T, Nagy LG, Hoffmann K, Wagner L et al (2011) Data
- 7716 partitions, Bayesian analysis and phylogeny of the zygomycet-
- 7717 ous fungal family Mortierellaceae, inferred from nuclear
- 7718 ribosomal DNA sequences. PLoS ONE 6:e27507. <https://doi.org/10.1371/journal.pone.0027507>
- 7719
- 7720

- Phelps NB, Goodwin AE (2008) Vertical transmission of *Ovipleistophora ovariae* (Microspora) within the eggs of the golden shiner. *J Aquat Anim Health* 20(1):45–53
- Phelps NBD, Mor SK, Armien AG, Pelican KM et al (2015) Description of the microsporidian parasite, *Heterosporis sutherlandae* n. sp., infecting fish in the Great Lakes Region, USA. Pombert J-F, ed. *PLoS ONE* 10(8):e0132027
- Picard KT, Letcher PM, Powell MJ (2009) *Rhizidium phycophilum*, a new species in Chytridiales. *Mycologia* 101:696–706
- Pierce SD, Foos KM (2011) Phylogenetic species identification of *Pilobolus* associated with horses in India and Ohio. *Proc Indiana Acad Sci* 120(1–2):62–70
- Pilarska DK, Radek R, Huang WF, Takov DI, Linde A, Solter LF (2015) Review of the genus *Endoreticulatus* (Microsporidia, Encephalitozoonidae) with description of a new species isolated from the grasshopper *Poecilimon thoracicus* (Orthoptera: Tettigoniidae) and transfer of *Microsporidium ititii* Malone to the genus. *J Invertebr Pathol* 124:23–30
- Pinho DB, Pereira OL, Soares DJ (2014) First report of *Gilbertella persicaria* as the cause of soft rot of fruit of *Syzygium cumini*. *Australas Plant Dis Notes* 9:143–147
- Plowes RM, Becnel JJ, LeBrun EG, Oi DH, Valles SM, Jones NT, Gilbert LE (2015) *Myrmecomorba nylanderiae* gen. et sp. nov., a microsporidian parasite of the tawny crazy ant *Nylanderia fulva*. *J Invertebr Pathol* 129:45–49
- Poddubnaya LG, Tokarev YS, Issi IV (2006) A new microsporidium *Paratuzetia kupermani* gen. et sp. n. (Microsporidia), a hyperparasite of the proceroid of the cestode *Khawia armeniaca* Chol. 1915 (Cestoda, Caryophyllidea). *Protistology* 4(3):269–277
- Poley JD, Sutherland BJ, Fast MD, Koop BF et al (2017) Effects of the vertically transmitted microsporidian *Facilispora margolisi* and the parasiticide emamectin benzoate on salmon lice (*Lepeophtheirus salmonis*). *BMC Genomics* 18(1):630
- Pombert JF, Haag KL, Beidas S, Ebert D et al (2015) The *Ordospora colligata* genome: evolution of extreme reduction in microsporidia and host-to-parasite horizontal gene transfer. *MBio* 6(1):e02400-14
- Pomport-Castillon C, De Jonckheere JF, Romestand B (2000) Ribosomal DNA sequences of *Glugea anomala*, *G. stephani*, *G. americanus* and *Spraguea lophii* (Microsporidia): phylogenetic reconstruction. *Dis Aquat Organ* 40:125–129
- Pomport-Castillon C, Romestand B, De Jonckheere JF (1997) Identification and phylogenetic relationship of microsporidia by riboprinting. *J Euk Microbiol* 44:540–544
- Pontes JS, Sánchez-Castro I, Palenzuela J, Maia LC et al (2013) *Scutellospora alterata*, a new gigasporalean species from the semi-arid Caatinga biome in Northeastern Brazil. *Mycotaxon* 125:169–181
- Porter TM, Martin W, James TY, Longcore JE et al (2011) Molecular phylogeny of the Blastocladiomycota (Fungi) based on nuclear ribosomal DNA. *Fungal Biol* 115:381–392
- Powell MJ, Letcher PM, Chambers JG, Roychoudhury S (2015) A new genus and family for the misclassified chytrid, *Rhizophlyctis harderi*. *Mycologia* 107:419–431
- Powell MJ, Letcher PM, Chen S-F (2018) Phylogeny and taxonomic revision of the soil chytrid, Gaertneriomycetes. And description of the new genus *Barromyces* (Spizellomycetaceae Chytridiomycota). *Nova Hedwig*. https://doi.org/10.1127/nova_hedwigia/2018/0465
- Powell MJ, Letcher PM, Longcore JE (2011) *Operculomyces* is a new genus in the order Rhizophydiales. *Mycologia* 103(4):854–862
- Powell MJ, Letcher PM, Longcore JE (2013) *Pseudorhizidium* is a new genus with distinct zoospore ultrastructure in the order Chytridiales. *Mycologia* 105:496–507
- Prakash H, Ghosh AK, Rudramurthy SM, Paul RA et al (2016) The environmental source of emerging *Apophysomyces variabilis* infection in India. *Sabouraudia* 54:567–575
- Prakash H, Rudramurthy SM, Gandham PS, Ghosh AK et al (2017) *Apophysomyces variabilis*: draft genome sequence and comparison of predictive virulence determinants with other medically important Mucorales. *BMC Genomics* 18:736–749
- Pyle JD, Keeling PJ, Nibert ML (2017) Amalga-like virus infecting *Antonospora locustae*, a microsporidian pathogen of grasshoppers, plus related viruses associated with other arthropods. *Virus Res* 233:95–104
- Qi X, Liu B, Song Q, Zou B et al (2016) Assessing fungal population in soil planted with CryIAc and CPTI transgenic cotton and its conventional parental line using 18S and ITS rDNA sequences over four seasons. *Front Plant Sci* 7:1023. <https://doi.org/10.3389/fpls.2016.01023>
- Qin HE, Yan XU, Yun TE, Dong W (2008) Biodiesel production catalyzed by whole-cell lipase from *Rhizopus chinensis*. *Chin J Catal* 29:41–46
- Rabie ME, El Hakeem I, Al-Shraim M, Al Skini MS et al (2011) Basidiobolomycosis of the colon masquerading as stenotic colon cancer. *Case Rep Surg*. <https://doi.org/10.1155/2011/685460>
- Racsa LD, Willis B, Lockhart SR, Kraft CS (2016) Bloodstream infection caused by *Mucor velutinosus*. *Infect Dis Clin Pract* 24:e3–e4
- Radek R, Wellmanns D, Wolf A (2011) Two new species of *Nephridiophaga* (Zygomycota) in the Malpighian tubules of cockroaches. *Parasitol Res* 109:473–482
- Radek R, Wurzbacher C, Gisder S, Nilsson RH et al (2017) Morphologic and molecular data help adopting the insect-pathogenic nephridiophagids (Nephridiophagidae) among the early diverging fungal lineages, close to the Chytridiomycota. *MycKeys* 25:31–50
- Rajachan OA, Kanokmedhakul S, Kanokmedhakul K, Soyong K (2014) Bioactive depsidones from the fungus *Pilobolus heterosporus*. *Planta Medica* 80:1635–1640
- Ralphs JR, Matthews RA (1986) Hepatic microsporidiosis of juvenile grey mullet, *Chelon labrosus* (Risso), due to *Microgemma hepaticus* gen. nov., sp. nov. *J Fish Dis* 9:225–242
- Reda ES (2010) First record of microsporidium *Neonosemoides* sp. and some ciliates infecting *Chrysichthys auratus* (Bagridae) from the Damietta Branch of River Nile, Egypt. *J Am Sci* 6(12):1298–1305
- ~~Redecker D, Morton JB, Bruns TD (2000) Molecular phylogeny of the arbuscular mycorrhizal fungi *Glomus simosum* and *Sclerocystis coremoides*. *Mycologia* 92:282–285~~
- Redecker D, Schüßler A, Stockinger H, Stürmer SL et al (2013) An evidence-based consensus for the classification of arbuscular mycorrhizal fungi (*Glomeromycota*). *Mycorrhiza* 23:515–531
- Refardt D, Canning EU, Mathis A, Cheney SA, Lafranchi-Tristem NJ, Ebert D (2002) Small subunit ribosomal DNA phylogeny of microsporidia that infect *Daphnia* (Crustacea: Cladocera). *Parasitology* 124:381–389
- Refardt D, Ebert D (2006) Quantitative PCR to detect, discriminate and quantify intracellular parasites in their host: an example from three microsporidians in *Daphnia*. *Parasitology* 133:11–18
- Refardt D, Mouton L (2007) Reverse arrangement of rRNA subunits in the microsporidium *Glugoides intestinalis*. *J Eukaryot Microbiol* 54:83–85
- Richardson M (2009) The ecology of the Zygomycetes and its impact on environmental exposure. *Clin Microbiol Infect* 15:2–9
- Rocha LFN, Tai MHH, Santos AHD, Albernaz DADS et al (2009) Occurrence of invertebrate-pathogenic fungi in a Cerrado ecosystem in Central Brazil. *Biocontrol Sci Technol* 19:547–553
- Rode NO, Landes J, Lievens EJ, Flaven E et al (2013) Cytological, molecular and life cycle characterization of *Anostracospora*

- 7852 *rigaudi* ng, n. sp. and *Enterocytozpora artemiae* ng, n. sp., two
7853 new microsporidian parasites infecting gut tissues of the brine
7854 shrimp *Artemia*. Parasitology 140(9):1168–1185
- 7855 Rodrigues RC, Fernandez-Lafuente R (2010) Lipase from *Rhizomu-*
7856 *cor miehei* as an industrial biocatalyst in chemical process. J Mol
7857 Catal B 64:1–22
- 7858 Rodríguez-Gutiérrez G, Carrillo-Casas EM, Arenas R, García-
7859 Méndez JO et al (2015) Mucormycosis in a non-Hodgkin
7860 lymphoma patient caused by *Syncephalastrum racemosum*: case
7861 report and review of literature. Mycopathologia 180:89. <https://doi.org/10.1007/s11046-015-9878-1>
- 7862 Roth O, Ebert D, Vizoso DB, Bieger A et al (2008) Male-biased sex-
7863 ratio distortion caused by *Ocetospora bayeri*, a vertically and
7864 horizontally-transmitted parasite of *Daphnia magna*. Int J
7865 Parasitol 38(8–9):969–979
- 7866 Ruan Z, Zanotti M, Wang X, Ducey C et al (2012) Evaluation of lipid
7867 accumulation from lignocellulosic sugars by *Mortierella isabel-*
7868 *lina* for biodiesel production. Bioresour Technol 110:198–205
- 7869 Russ C, Lang BF, Chen Z, Gujja S et al (2016) Genome sequence of
7870 *Spizellomyces punctatus*. Genome Announc 4:e00849-16
- 7871 Ryan LJ, Ferrieri P, Powell RD Jr, Paddock CD et al (2011) Fatal
7872 *Cokeromyces recurvatus* pneumonia: report of a case highlight-
7873 ing the potential for histopathologic misdiagnosis as Coccid-
7874 ioides. Int J Surg Pathol 19:373–376
- 7875 Saad N, Abdeshahian P, Kalil MS, Wan Yusoff WM et al (2014)
7876 Optimization of aeration and agitation rate for lipid and gamma
7877 linolenic acid production by *Cunninghamella bainieri* 2A1 in
7878 submerged fermentation using response surface methodology.
7879 Sci World J. <https://doi.org/10.1155/2014/280146>
- 7880 Sagristà E, Bozzo MG, Bigas M, Poquet M, Durfort M (1998)
7881 Developmental cycle and ultrastructure of *Steinhausia mytilo-*
7882 *vum*, a microsporidian parasite of oocytes of the mussel, *Mytilus*
7883 *galloprovincialis* (Mollusca, Bivalvia). Eur J Protistol 34:58–68
- 7884 Sahadevan Y, Richter-Fecken M, Kaerger K, Voigt K et al (2013)
7885 Early and late trisporoids differentially regulate β -carotene
7886 production and gene transcript levels in the mucoralean fungi
7887 *Blakeslea trispora* and *Mucor mucedo*. Appl Environ Microbiol
7888 79:7466–7475. <https://doi.org/10.1128/AEM.02096-13>
- 7889 Saikawa M (2011) Ultrastructural studies on zygomycotan fungi in
7890 the *Zoopagaceae* and *Cochlonemataceae*. Mycoscience
7891 52:83–90
- 7892 Saikawa M (2012) Morphological studies on fungi in the *Zoopag-*
7893 *aceae* and *Cochlonemataceae*. Bull Tokyo Gakugei Univ Div
7894 Nat Sci 64:55–76
- 7895 Sakai M, Baxa DV, Kurobe T, Kono T et al (2009) Detection of
7896 *Nucleospora salmonis* in cutthroat trout (*Oncorhynchus clarki*)
7897 and rainbow trout (*Oncorhynchus mykiss*) by loop-mediated
7898 isothermal amplification. Aquaculture 288(1–2):27–31
- 7899 Sakuradani E, Ando A, Ogawa J, Shimizu S (2009) Improved
7900 production of various polyunsaturated fatty acids through
7901 filamentous fungus *Mortierella alpina* breeding. Appl Microbiol
7902 Biotechnol 84:1–10
- 7903 Salas V, Pastor FJ, Calvo E, Sutton D et al (2012) Experimental
7904 murine model of disseminated infection by *Saksenaia vasi-*
7905 *formis*: successful treatment with posaconazole. Med Mycol
7906 50:710–715. <https://doi.org/10.3109/13693786.2012.673137>
- 7907 Saleh M, Kumar G, Abdel-Baki AA, Al-Quraishy S et al (2016a)
7908 In vitro antimicrosporidial activity of gold nanoparticles against
7909 *Heterosporis saurida*. BMC Vet Res 12:44
- 7910 Saleh M, Kumar G, Abdel-Baki AA, Dkhil MA et al (2016b) In Vitro
7911 gene silencing of the fish Microsporidian *Heterosporis saurida*
7912 by RNA interference. Nucl Acid Ther 26(4):250–256
- 7913 Sanders J, Myers MS, Tomanek L, Cali A et al (2012) *Ichthyosporid-*
7914 *ium weissii* n. sp. (Microsporidia) Infecting the arrow goby
7915 (*Clevelandia ios*). J Eukaryot Microbiol 59(3):258–267
- 7916 Sanders JL, Kent ML (2011) Development of a sensitive assay for the
7917 detection of *Pseudoloma neurophilia* in laboratory populations
7918 of the zebrafish *Danio rerio*. Dis Aquat Organ 96:145–156
- 7919 Sanders JL, Lawrence C, Nichols DK, Brubaker JF et al (2010)
7920 *Pleistophora hyphessobryconis* (Microsporidia) infecting zebra-
7921 fish (*Danio rerio*) in research facilities. Dis Aquat Organ
7922 91(1):47–56
- 7923 Sanders JL, Watral V, Stidworthy MF, Kent ML (2016) Expansion of
7924 the known host range of the Microsporidium, *Pseudoloma*
7925 *neurophilia*. Zebrafish 13(Suppl 1):S102–S106
- 7926 Santiago AL, Benny GL, Maia LC (2011a) *Syncephalis aggregata*, a
7927 new species from the semiarid region of Brazil. Mycologia
7928 103:135–138
- 7929 Santiago AL, Trufem SF, Malosso E, Santos PJ et al (2011b)
7930 Zygomycetes from herbivore dung in the ecological reserve of
7931 Dois Irmãos, Northeast Brazil. Braz J Microbiol 42:89–95
- 7932 Santos FR, Garcia NF, da Paz MF, Fonseca GG et al (2016)
7933 Production and characterization of β -glucosidase from *Gon-*
7934 *gronella butleri* by solid-state fermentation. Afr J Biotechnol
7935 15:633–641
- 7936 Sanz C, Rodríguez-Romero J, Idrum A, Christie JM et al (2009)
7937 *Phycomyces* MADB interacts with MADA to form the primary
7938 photoreceptor complex for fungal phototropism. Proc Natl Acad
7939 Sci 106(17):7095–7100. <https://doi.org/10.1073/pnas.0900879106>
- 7940 Sanz C, Velayos A, Álvarez MI, Benito EP et al (2011) Functional
7941 analysis of the *Phycomyces* carRA gene encoding the enzymes
7942 phytoene synthase and lycopene cyclase. PLoS ONE 6:e23102
- 7943 Sapir A, Dillman AR, Connon SA, Grupe BM, Ingels J, Mundo-
7944 Ocampo M, Levin LA, Bladwin JG, Orphan VJ, Sternberg PW
7945 (2014) Microsporidia-Nematode associations in methane seeps
7946 reveal basal fungal parasitism in the deep sea. Front Microbiol
7947 5(43):1–12
- 7948 Saroj A, Kumar A, Qamar N, Alam M (2012) First report of wet rot of
7949 *Withania somnifera* caused by *Choanephora cucurbitarum* in
7950 India. Plant Dis 96:293
- 7951 Satari B, Karimi K (2017) Mucoralean fungi for sustainable
7952 production of bioethanol and biologically active molecules.
7953 Appl Microbiol Biotechnol 102:1097–1117
- 7954 Sato H (2013) *Bojamyces repens* (Harpellales) from exuviae of
7955 mayfly, a new record from Japan. Mycoscience 54:217–220
- 7956 Sato Y, Narisawa K, Tsuruta K, Umezumi M et al (2010) Detection of
7957 Betaproteobacteria inside the mycelium of the fungus *Mortier-*
7958 *ella elongata*. Microbes Environ 25(4):321–324
- 7959 Schachtschabel D, David A, Menzel KD, Schimek C et al (2008)
7960 Cooperative biosynthesis of trisporoids by the (+) and (–)
7961 mating types of the zygomycete *Blakeslea trispora*. ChemBio-
7962 Chem 9:3004–3012
- 7963 Schimek C, Wöstemeyer J (2009) Carotene derivatives in sexual
7964 communication of zygomycete fungi. Phytochemistry
7965 70(15–16):1867–1875
- 7966 Schofield C, Stern A, Jevtic A (2013) Disseminated zygomycosis due
7967 to *Mycocladius corymbifera* with cutaneous and cerebral
7968 involvement. Australas J Dermatol 54:e8–e11. <https://doi.org/10.1111/j.1440-0960.2011.00752.x>
- 7969 Scholz B, Guillou L, Marano AV, Neuhauser S et al (2016) Zoospore
7970 parasites infecting marine diatoms—a black box that needs to be
7971 opened. Fungal Ecol 19:59–76
- 7972 Scholz F, Fringuelli E, Bolton-Warberg M, Marcos-López M,
7973 Mitchell S, Prodhon P, Moffet D, Savage P, O’Sullivan SM,
7974 O’Connor I, McCarthy E, Rodger HD (2017) First record of
7975 *Tetramicra brevifilum* in lumpfish (*Cyclopterus lumpus* L.).
7976 J Fish Dis 40:757–771
- 7977 Schrödl W, Heydel T, Schwartze VU, Hoffmann K et al (2011) Direct
7978 analysis and identification of pathogenic *Lichtheimia* species by
7979 matrix assisted laser desorption ionization (MALDI) time-of-
7980 7981 7982

- 7983 flight (TOF) analyzer-mediated mass spectrometry. *J Clin*
7984 *Microbiol* 50:419–427
- 7985 Schüßler A, Krüger M, Walker C (2011) Revealing natural relationships among arbuscular mycorrhizal fungi: culture line BEG47 represents *Diversispora epigaea*, not *Glomus versiforme*. *PLoS ONE* 6(8):e23333
- 7986 Schüßler A, Schwarzott D, Walker C (2001) A new fungal phylum, the *Glomeromycota*: phylogeny and evolution. *Mycol Res* 105:1413–1421
- 7987 Schüßler A, Walker C (2010) The *Glomeromycota*: a species list with new families and new genera. The Royal Botanic Garden Kew, Botanische Staatssammlung Munich, and Oregon State University.
- 7988 Schwartze VU, Hoffmann K, Nyilasi I, Papp T et al (2012) *Lichtheimia* species exhibit differences in virulence potential. *PLoS ONE* 7(7):e40908. <https://doi.org/10.1371/journal.pone.0040908>
- 7989 Schwartze VU, Santiago A, Luiz A, Jacobsen ID et al (2014a) The pathogenic potential of the *Lichtheimia* genus revisited: *Lichtheimia brasiliensis* is a novel, non-pathogenic species. *Mycoses* 57(s3):128–131. <https://doi.org/10.1111/myc.12230.L>
- 7990 Schwartze VU, Winter S, Shelest E, Marcet-Houben M et al (2014b) Gene expansion shapes genome architecture in the human pathogen *Lichtheimia corymbifera*: an evolutionary genomics analysis in the ancient terrestrial Mucorales (Mucoromycotina). *PLoS Genet* 10(8):e1004496
- 8000 Schweikert M, Schnepf E (1996) *Pseudaphelidium drebesii*, gen. et sp. nov. (incerta sedis), a parasite of the marine centric diatom *Thalassiosira punctigera*. *Arch Protistenkd* 147:11–17
- 8001 Seifert KA, Morgan-Jones G, Gams W, Kendrick B (2011) The genera of Hyphomycetes. CBS Biodiversity Series 9, CBSKNAW Fungal Biodiversity Centre, Utrecht.
- 8002 Senderskiy IV, Timofeev SA, Seliverstova EV, Pavlova OA et al (2014) Secretion of *Antonospora* (Paranosema) locustae proteins into infected cells suggests an active role of Microsporidia in the control of host programs and metabolic processes. *PLoS ONE* 9(4):e93585
- 8003 Seto K, Degawa Y (2018) *Pendulichytrium sphaericum* gen. et sp. nov. (Chytridiales, Chytriomycetaceae), a new chytrid parasitic on the diatom, *Aulacoseira granulata*. *Mycoscience* 59:59–66
- 8004 Seto K, Degawa Y (2015) *Cyclopsomyces plurioperculatus*: a new genus and species of Lobulomycetales (Chytridiomycota, Chytridiomycetes) from Japan. *Mycologia* 107(3):633–640
- 8005 Seto K, Kagami M, Degawa Y (2017) Phylogenetic position of parasitic chytrids on diatoms: characterization of a novel clade in Chytridiomycota. *J Eukaryot Microbiol* 64(3):383–393
- 8006 Seye F, Faye O, Ndiaye M, Njie E et al (2009) Pathogenicity of the fungus, *Aspergillus clavatus*, isolated from the locust, *Oedaleus senegalensis*, against larvae of the mosquitoes *Aedes aegypti*, *Anopheles gambiae* and *Culex quinquefasciatus*. *J Insect Sci* 9(53):1–7. <https://doi.org/10.1673/031.009.5301>
- 8007 Shakya VP, Idnurm A (2017) The inhibition of mating in *Phycomyces blakesleeenanus* by light is dependent on the MadA-MadB complex that acts in a sex-specific manner. *Fungal Genet Biol* 101:20–30
- 8008 Shakya VPS, Idnurm A (2014) Sex determination directs uniparental mitochondrial inheritance in *Phycomyces*. ~~*Eukaryot Cell*~~ 13:186–189. <https://doi.org/10.1128/EC.00203-13>
- 8009 Shankar S, More SV, Laxman RS (2010) Recovery of silver from waste X-ray film by alkaline protease from *Conidiobolus coronatus*. *Kathmandu Uni J Sci Eng Technol* 6:60–69
- 8010 Sharma N, Schwartzman JD, Gutmann EJ, Marotti JD et al (2018) *Cokeromyces recurvatus* in a papanicolaou test: an exceedingly rare finding that can be mistaken for *Paracoccidioides brasiliensis*. *CytoJournal* 12(15):5. https://doi.org/10.4103/cytojournal.cytojournal_35_17
- 8011 Sharma P, Cohen JK, Lockhart SR, Hurst SF et al (2011) Ruptured mycotic aortic aneurysm in a sooty mangabey (*Cercocebus atys*). *Comp Med* 61:532–537
- 8012 Shelburne SA, Ajami NJ, Chibucos MC, Beird HC et al (2015) Implementation of a pan-genomic approach to investigate holobiont-infecting microbe interaction: a case report of a leukemic patient with invasive mucormycosis. *PloS ONE* 10(11):e0139851. <https://doi.org/10.1371/journal.pone.0139851>
- 8013 Shi WP, Wang YY, Lv F, Guo C et al (2009) Persistence of *Paranosema* (Nosema) locustae (Microsporidia: Nosematidae) among grasshopper (Orthoptera: Acrididae) populations in the Inner Mongolia Rangeland, China. *Biol Control* 54(1):77–84
- 8014 Siddiqui M, Ahmad MS, Yousuf S, Fatima N et al (2017) Biotransformation of a potent anabolic steroid, mibolerone, with *Cunninghamella blakesleeana*, *C. echinulata*, and *Macrophomina phaseolina*, and biological activity evaluation of its metabolites. *PLoS ONE* 12(2):e0171476. <https://doi.org/10.1371/journal.pone.0171476>
- 8015 Siddiqui Y, Meon S, Ismail MR, Ali A (2008) Trichoderma-fortified compost extracts for the control of choanephora wet rot in okra production. *Crop Protect* 27:385–390
- 8016 Siddiqui Y, Meon S, Ismail R, Rahmani M (2009) Bio-potential of compost tea from agro-waste to suppress *Choanephora cucurbitarum* L. the causal pathogen of wet rot of okra. *Biol Control* 49:38–44
- 8017 Sieverding E, da Silva GA, Berndt R, Oehl F (2015) ~~*Rhizoglossus*, a new genus of the Glomeraceae. Mycotaxon 129:373–386~~
- 8018 Silva NRA, Luna MAC, Santiago ALCMA, Franco LO et al (2014) Biosurfactant-and-bioemulsifier produced by a promising *Cunninghamella echinulata* isolated from caatinga soil in the Northeast of Brazil. *Int J Mol Sci* 15:15377–15395. <https://doi.org/10.3390/ijms150915377>
- 8019 Silveira H, Canning EU (1995) *Vittaforma corneae* n. comb. for the human microsporidium *Nosema corneum* Shadduck, Meccoli, Davis & Font, 1990; based on its ultrastructure in the liver of exply infected athymic mice. *J Eukaryot Microbiol* 42:158–165
- 8020 Simakova AV (2014) Comparison of taxonomic importance of morphological and molecular-genetic characters in systematics of Microsporidia (Microsporidia) of blood-sucking mosquitoes (Diptera: Culicidae). *Parazitologija* 48(4):284–301
- 8021 Simakova AV, Lukiantsev VV, Vossbrink SR, Andreadis TG (2011) Identification of mosquito-parasitic microsporidia, *Amblyospora rugosa* and *Trichoctosporea pygopellita* (Microsporidia: Amblyosporidae), from *Acanthocyclops venustus* and *Acanthocyclops reductus* (Copepoda: Cyclopidae), based on small subunit rDNA analysis. *Parazitologija* 45(2):140–146
- 8022 Simakova AV, Pankova TF, Issi IV (2003) *Crepidula beklemishevi* gen. et sp. n. and *Dimeiospora palustris* gen. et sp. n. (Microspora: Amblyosporidae) new microsporidian genera and species from blood-sucking mosquitoes (Diptera: Culicidae) from the south of the western Siberia. *Parazitologija* 37(2):145–153
- 8023 Simakova AV, Pankova TF, Issi IV (2004) *Crepidulospora* nomen novum for the junior generic homonym (preoccupied generic name) *Crepidula*. *Parazitologija* 38(5):477–478
- 8024 Simakova AV, Pankova TF, Tokarev YS, Issi IV (2005) *Senoma* gen. n., a new genus of microsporidia, with the type species *Senoma globulifera* comb. n. (syn. *Issia globulifera* Issi et Pankova 1983) from the malaria mosquito *Anopheles messeae* Fall. *Protistology* 4(2):135–144
- 8025 Simakova AV, Tokarev YS, Issi IV (2009a) *Pankovaia semitubulata* gen. et sp. n. (Microsporidia: Tuzetiidae) from nymphs of mayflies *Cloeon dipterum* L. (Insecta: Ephemeroptera) in Western Siberia. *Eur J Protistol* 45(1):13–20
- 8026 Simakova AV, Tokarev YuS, Issi IV (2009b) *Tuzetia dualis* sp. n. (Microsporidia, Tuzetiidae) from the mayfly *Cloeon dipterum* L.

- 8115 (Insecta, Ephemeroptera) in Western Siberia. Protistology
8116 6(2):92–97
- 8117 Simakova AV, Tokarev YS, Issi IV (2018a) A new microsporidium
8118 *Fibrillaspora daphniae* gn sp. n. infecting *Daphnia magna*
8119 (Crustacea: Cladocera) in Siberia and its taxonomic placing
8120 within a new family Fibrillasporidae and new superfamily
8121 Tubulinosematoidea (Opisthosporidia: Microsporidia). Parasitol
8122 Res 117(3):759–766
- 8123 Simakova AV, Tokarev YS, Issi IV (2018b) Correction to: a new
8124 microsporidium *Fibrillaspora daphniae* g. n. sp. n. infecting
8125 *Daphnia magna* (Crustacea: Cladocera) in Siberia and its
8126 taxonomic placing within a new family Fibrillasporidae and
8127 new superfamily Tubulinosematoidea (Opisthosporidia: Micro-
8128 sporidia). Parasitol Res 117(4):1301
- 8129 Simakova AV, Vossbrinck CR, Andreadis TG (2008) Molecular and
8130 ultrastructural characterization of *Andreanna caspii* n. gen., n.
8131 sp. (Microsporidia: Amblyosporidae), a parasite of *Ochlerotatus*
8132 *caspius* (Diptera: Culicidae). J Invertebr Pathol 99(3):302–311
- 8133 Simelane DO, Steinkraus DC, Kring TJ (2008) Predation rate and
8134 development of *Coccinella septempunctata* L. influenced by
8135 *Neozygites fresenii*-infected cotton aphid prey. Biol Control
8136 44:128–135
- 8137 Simmons DR (2011) Phylogeny of Powellomycetaceae fam. nov. and
8138 description of *Geranomyces variabilis* gen. et comb. nov.
8139 Mycologia 103:1411–1420
- 8140 Simmons DR, James TY, Meyer AF, Longcore JE (2009) Lobu-
8141 lomycetales, a new order in the Chytridiomycota. Mycol Res
8142 113:450–460
- 8143 Simmons DR, Letcher PM, Powell MJ, Longcore JE (2012)
8144 *Alogomyces tanneri* gen. et sp. nov., a chytrid in Lobulomyc-
8145 etales from horse manure. Mycologia 104:157–163
- 8146 Simmons DR, Longcore JE (2012) *Thoreauomyces* gen. nov.,
8147 *Fimicolochytrium* gen. nov. and additional species in *Geran-*
8148 *omyces*. Mycologia 104:1229–1243
- 8149 Singh I, Kushwaha RKS (2017) Biology and significance of
8150 *Saksenaea vasiformis*. In: Satyanarayana T, Deshmukh S, Johri
8151 B (eds) Developments in fungal biol and applied mycology.
8152 Springer, Singapore. [https://doi.org/10.1007/978-981-10-4768-](https://doi.org/10.1007/978-981-10-4768-8_2)
8153 [8_2](https://doi.org/10.1007/978-981-10-4768-8_2)
- 8154 Siri A, López Lastra CC (2010) Diversity of trichomycetes in larval
8155 flies from aquatic habitats in Argentina. Mycologia 102:347–362
- 8156 Slothouber Galbreath JGM, Smith JE, Terry RS et al (2004) Invasion
8157 success of *Fibrillanosema crangonycis*, n. sp., ng: a novel
8158 vertically transmitted microsporidian parasite from the invasive
8159 amphipod host *Crangonyx pseudograçilis*. Int J Parasitol
8160 34(2):235–244
- 8161 Smith DS, Rocheleau H, Chapados JT, Abbott C et al (2014)
8162 Phylogeny of the genus *Synchytrium* and the development of
8163 TaqMan PCR assay for sensitive detection of *Synchytrium*
8164 *endobioticum* in soil. Phytopathology 104:422–432
- 8165 Smith ME, Gryganskyi A, Bonito G, Nouhra E et al (2013)
8166 Phylogenetic analysis of the genus *Modicella* reveals an
8167 independent evolutionary origin of sporocarp-forming fungi in
8168 the Mortierellales. Fungal Genet Biol 61:61–68
- 8169 Sokolova YY, Kryukova NA, Glupov VV, Fuxa JR (2006) *Systemos-*
8170 *trema alba* Larsson 1988 (Microsporidia, Thelohaniidae) in the
8171 Dragonfly *Aeshna viridis* (Odonata, Aeshnidae) from South
8172 Siberia: morphology and molecular characterization. J Eukaryot
8173 Microbiol 53:49–57
- 8174 Sokolova Y, Pelin A, Hawke J, Corradi N (2015) Morphology and
8175 phylogeny of *Agmasoma penaei* (Microsporidia) from the type
8176 host, *Litopenaeus setiferus*, and the type locality, Louisiana,
8177 USA. Int J Parasitol 45(1):1–6
- 8178 Sokolova YK, Issi IV, Voronin VN (2018) Annotated list of species
8179 of the Microsporidia described in the Former Soviet Union and
8180 Russia in 20th century (1967–2000). Protistology 12(1):12–37
- Sokolova YY, Lange CE, Fuxa JR (2008) Phylogenetic relationships
8181 of *Heterovesicula cowani*, a microsporidian pathogen of Mor-
8182 mon crickets, *Anabrus simplex* (Orthoptera: Tettigoniidae),
8183 based on SSU rDNA-sequence analyses. J Invertebr Pathol
8184 99(1):112–116
- Sokolova YY, Lange CE, Mariottini Y, Fuxa JR (2009) Morphology
8185 and taxonomy of the microsporidium *Liebertmannia covasacrae*
8186 n. sp. from the grasshopper *Covasacris pallidinota* (Orthoptera,
8187 Acrididae). J Invertebr Pathol 101(1):34–42
- Sokolova YY, Paskerova GG, Rotari YM, Nasonova ES et al (2013)
8188 Fine structure of *Metchnikovella incurvata* Caullery and Mesnil
8189 1914 (microsporidia), a hyperparasite of gregarines *Polyrhabd-*
8190 *ina* sp. from the polychaete *Pygospio elegans*. Parasitology
8191 140(7):855–867
- Sokolova YY, Paskerova GG, Rotari YM, Nasonova ES et al (2014)
8192 Description of *Metchnikovella spiralis* sp. n. (Microsporidia:
8193 Metchnikovellidae), with notes on the ultrastructure of metch-
8194 nikovellids. Parasitology 141(8):1108–1122
- Sokolova YY, Senderskiy IV, Tokarev YS (2016) Microsporidia
8195 *Alfvenia sibirica* sp. n. and *Agglomerata cladocera* (Pfeiffer)
8196 1895, from Siberian microcrustaceans and phylogenetic rela-
8197 tionships within the “Aquatic outgroup” lineage of fresh water
8198 microsporidia. J Invertebr Pathol 136:81–91
- Sokolova YY, Sokolov IM, Carlton CE (2010a) New microsporidia
8200 parasitizing bark lice (Insecta: Psocoptera). J Invertebr Pathol
8201 104(3):186–194
- Sokolova YY, Sokolov IM, Carlton CE (2010b) New microsporidia
8202 parasitizing bark lice (Insecta: Psocoptera). J Invertebr Pathol
8203 104:186–194
- Spatafora JW, Chang Y, Benny GL, Lazarus K et al (2016) A
8204 phylum-level phylogenetic classification of zygomycete fungi
8205 based on genome-scale data. Mycologia 108:1028–1046
- Sprague V (1977a) System of classification of the microspora. Proc
8206 Int Congr Protozool 5:266A
- Sprague V (1977b) The zoological distribution of the microsporidia.
8207 In: Bulla LA, Cheng TC (eds) Comparative pathobiology.
8208 Springer, Boston, MA
- Sprague V, Becnel JJ, Hazard EI (1992) Taxonomy of phylum
8209 microspora. Crit Rev Microbiol 18:285–395
- Sprague V, Ormieres R, Manier J-F (1972) Creation of a new genus
8210 and a new family in the microsporidia. J Invertebr Pathol
8211 20:228–231
- Sridhar M, Kumar D, Anandan S (2014) *Cyllumyces icaris* sp. nov., a
8212 new anaerobic gut fungus with nodular sporangiophores isolated
8213 from Indian water buffalo (*Bubalus bubalis*). Int J Curr Res Aca
8214 Rev 2:7–24
- Steiger RA, Simmons RD, Longcore JE (2012) *Cylindrochytridium*
8215 *johnstonii* is a member of the Cladochytriales. Mycotaxon
8216 118:293–302
- Steinkraus DC, Hajek AE, Liebherr JK (2017) Zombie soldier beetles:
8217 epizootics in the goldenrod soldier beetle, *Chauliognathus*
8218 *pennsylvanicus* (Coleoptera: Cantharidae) caused by *Eryniopsis*
8219 *lampyridarum* (Entomophthoromycotina: Entomophthoraceae).
8220 J Invertebr Pathol 148:51–59
- Stentiford GD, Bateman KS, Dubuffet A, Chambers E et al (2011)
8221 *Hepatospora eriocheir* (Wang and Chen, 2007) gen. et comb.
8222 nov. infecting invasive Chinese mitten crabs (*Eriocheir sinensis*)
8223 in Europe. J Invertebr Pathol 108(3):156–166
- Stentiford GD, Bateman KS, Feist SW, Oyarzún S et al (2014)
8224 *Areospora rohanae* n. gen. n. sp. (Microsporidia; Areosporidae
8225 n. fam.) elicits multi-nucleate giant-cell formation in southern
8226 king crab (*Lithodes santolla*). J Invertebr Pathol 118:1–11
- Stentiford GD, Bateman KS, Small HJ, Moss J et al (2010) *Myospora*
8227 *metanephrops* (ng, n. sp.) from marine lobsters and a proposal
8228 for erection of a new order and family (Crustacea:acidia;
8229 8240 8241 8242 8243 8244 8245

- 8246 Myosporidae) in the class marinosporidia (Phylum Microsporidia). *Int J Parasitol* 40(12):1433–1446
- 8248 Stentiford GD, Feist SW, Stone DM, Bateman KS (2013) Microsporidia: diverse, dynamic, and emergent pathogens in aquatic systems. *Trends Parasitol* 29(11):567–578
- 8250 Stentiford GD, Ramilo A, Abollo E, Kerr R (2017) *Hyperspora aquatica* n. gn., n. sp. (Microsporidia), hyperparasitic in *Marteilia cochillia* (Paramyxida), is closely related to crustacean-infecting microsporidian taxa. *Parasitology* 144(2):186–199
- 8252 Stentiford GD, Ross S, Minardi D, Feist SW et al (2018) Evidence for trophic transfer of *Inodosporus octospora* and *Ovipleistophora arlo* n. sp. (Microsporidia) between crustacean and fish hosts. *Parasitology* 145:1105–1117. <https://doi.org/10.1017/S0031182017002256>
- 8260 Stentiford GD, Ross SH, Kerr R, Bass D (2015) *Paradoxium irvingi* n. gen. n. sp. (Microsporidia) infecting the musculature of European pink shrimp *Pandalus montagui*. *J Invertebr Pathol* 130:1–8
- 8262 Strittmatter M, Guerra T, Silva J, Gachon CM (2016) A new flagellated dispersion stage in *Paraphysoderma sedebokerense*, a pathogen of *Haematococcus pluvialis*. *J App Phycol* 28:1553–1558
- 8266 Strongman DB (2010) Trichomycetes from Newfoundland, including Gros Morne National Park. *Botany* 88:1011–1022
- 8270 Strongman DB, Wang J (2015) New trichomycete species from China and additional information on Gauthieromyces. *Mycologia* 107:874–888
- 8272 Strongman DB, Wang J, Xu S (2010) New trichomycetes from western China. *Mycologia* 102:174–184
- 8274 Strongman DB, White MM (2008) Trichomycetes from lentic and lotic aquatic habitats in Ontario, Canada. *Botany* 86:1449–1466
- 8276 Strongman DB, White MM (2011) *Trifoliellum bioblitzii*, a new genus of trichomycete from mayfly nymphs in Nova Scotia, Canada. *Mycologia* 103(1):219–225
- 8278 Strullu-Derrien C, Kenrick P, Pressel S, Duckett JG et al (2014) Fungal associations in *Horneophyton ligneri* from the Rhynie Chert (c. 407 million year old) closely resemble those in extant lower land plants: novel insights into ancestral plant–fungus symbioses. *New Phytol* 203:964–979
- 8282 Su Y, Feng J, Sun X, Jiang J, Guo Z, Ye L, Xu L (2014) A new species of *Glugea* Thélohan, 1891 in the red sea bream *Pagrus major* (Temminck & Schlegel) (Teleostei: Sparidae) from China. *Syst Parasitol* 89:175–183
- 8286 Subramanian C, Sobel JD (2011) A case of *Conidiobolus coronatus* in the vagina. *Med Mycol* 49:427–429
- 8290 Sun J, Li H, Yuan Q (2012) Metabolic regulation of trisporic acid on *Blakeslea trispora* revealed by a GC-MS-based metabolomic approach. *PLoS ONE* 7:e46110. <https://doi.org/10.1371/journal.pone.0046110>
- 8294 Sun Q, Chen F, Geng F, Luo Y et al (2018) A novel aspartic protease from *Rhizomucor miehei* expressed in *Pichia pastoris* and its application on meat tenderization and preparation of turtle peptides. *Food Chem* 245:570–577
- 8298 Suyama Y, Degawa Y (2013) *Sigmoidomycesaceae*, a family new to Japan, recorded from Japanese Alps and Ryukyu Islands. In: Anon. Abstracts of the 2013 annual meeting of the Japanese Alps inter-university cooperative project Sugadaira, Japan, p 79 (ES-A15_2013.pdf). http://jalps.suiri.tsukuba.ac.jp/files/6813/9478/3916/2013_meeting_Jalps_program_v2.2.pdf
- 8300 Sveen S, Øverland H, Karlsbakk E, Nylund A (2012) *Paranucleospora theridion* (Microsporidia) infection dynamics in farmed Atlantic salmon *Salmo salar* put to sea in spring and autumn. *Dis Aquat Organ* 101(1):43–49
- 8302 Symanczik S, Al-Yahya'ei MN, Kozłowska A, Ryszka P et al (2018) A new genus, *Desertispora*, and a new species, *Diversispora*
- 8311 *bulbosa*, in the family Diversisporaceae (order Diversisporales, subphylum Glomeromycotina). *Mycol Prog* 17:437–449
- 8313 Symanczik S, Blaszkowski J, Chwat G, Boller T et al (2014) Three new species of arbuscular mycorrhizal fungi discovered at one location in a desert of Oman: *Diversispora omaniana*, *Septoglossum nakheelum* and *Rhizophagus arabicus*. *Mycologia* 106:243–259
- 8317 Tabaković-Tošić M, Georgiev G, Mirchev P, Tošić D et al (2012) *Entomophaga maimaiga*—new entomopathogenic fungus in the Republic of Serbia. *Afr J Biotechnol* 11:8571–8577
- 8318 Taha M, Adetutu EM, Shahsavari E, Smith AT et al (2014) Azo and anthraquinone dye mixture decolourization at elevated temperature and concentration by a newly isolated thermophilic fungus, *Thermomucor indiciae-seudaticae*. *J Env Chem Eng* 2:415–423. <https://doi.org/10.1016/j.jece.2014.01.015>
- 8325 Taj-Aldeen SJ, Almaslamani M, Theelen B, Boekhout T (2017) Phylogenetic analysis reveals two genotypes of the emerging fungus *Mucor indicus*, an opportunistic human pathogen in immunocompromised patients. *Emerg Microbes Infect* 6:e63
- 8327 Tajdini F, Amini MA, Nafissi-Varcheh N, Faramarzi MA (2010) Production, physicochemical and antimicrobial properties of fungal chitosan from *Rhizomucor miehei* and *Mucor racemosus*. *Int J Biol Macromol* 47:180–183
- 8329 Takeda I, Tamano K, Yamane N, Ishii T et al (2014) Genome sequence of the Mucoromycotina fungus *Umbelopsis isabellina*, an effective producer of lipids. *Genome Announc* 2:e00071-14
- 8334 Takó M, Farkas E, Lung S, Krisch J et al (2010) Identification of acid- and thermotolerant extracellular β -glucosidase activities in zygomycetes fungi. *Acta Biol Hung* 61:101–110
- 8336 Takó M, Kotogán A, Németh B, Radulov I et al (2012) Extracellular lipase production of zygomycetes fungi isolated from soil. *Rev Agri Rural Dev* 1(1):61–65
- 8337 Takov D, Pilarska D (2009) Single and mixed infections in *Ips typographus* (Coleoptera: Scolytinae) caused by the entomopathogens *Entomopoxvirus typographi* (Virales), *Gregarina typographi* (Sporozoa) and *Chytridiopsis typographi* (Microsporidia). *Acta Zool Bulg* 61(1):45–48
- 8340 Tang X, Zan X, Zhao L, Chen H et al (2016) Proteomics analysis of high lipid-producing strain *Mucor circinelloides* WJ11: an explanation for the mechanism of lipid accumulation at the proteomic level. *Microbial Cell Fact* 15:35–51. <https://doi.org/10.1186/s12934-016-0428-4>
- 8342 Tawil G, Viksø-Nielsen A, Rolland-Sabaté A, Colonna P et al (2010) In depth study of a new highly efficient raw starch hydrolyzing α -amylase from *Rhizomucor* sp. *Biomacromolecules* 12:34–42
- 8344 Tedersoo L, Liiv I, Kivistik PA, Anslan S et al (2016) Genomics and metagenomics technologies to recover ribosomal DNA and single-copy genes from old fruit-body and ectomycorrhiza specimens. *MycKeys* 13:1–20. <https://doi.org/10.3897/mycokeys.13.8140>
- 8345 Thélohan P (1891) Sur deux Sporozoaires nouveaux, parasites des muscles des Poissons. *C r hebdomadaire Séances Acad Sci Paris* 112:168–171
- 8347 Tibpromma S, Hyde KD, Jeewon R, Maharachchikumbura SSN et al (2017) Fungal diversity notes 491–602: taxonomic and phylogenetic contributions to fungal taxa. *Fungal Divers* 83:1–261
- 8349 Tkaczyk C, Bałazy S, Krzyczkowski T, Wegensteiner R (2011) Extended studies on the diversity of arthropod-pathogenic fungi in Austria and Poland. *Acta Mycol* 46:211–222
- 8350 Tokarev YS, Simakova AV, Timofeev SA, Malyshev JM, Sokolova OI, Issi IV (2016) Host specificity in microsporidia. *Parasitologiya* 50(6):446–459
- 8351 Tokarev YS, Voronin VN, Seliverstova EV, Dolgikh VV, Pavlova OA, Ignatieva AN, Issi IV (2010a) Ultrastructure and molecular phylogeny of *Anisofilariata chironomi* sp.n. g.n. (Microsporidia):

- 8376 Terresporidia), a microsporidian parasite of *Chironomus plumosus* L. (Diptera: Chironomidae). Parasitol Res 106:39–46
- 8377 Tokarev YS, Voronin VN, Seliverstova EV, Grushetskaya TA et al (2012) Ultrastructure and molecular phylogenetics of *Helmichia lacustris*, a microsporidium with an uncoiled isofilar polar filament. Parasitol Res 110(3):1201–1208
- 8382 Tokarev YS, Voronin VN, Seliverstova EV, Pavlova OA, Issi IV (2010b) Life cycle, ultrastructure and molecular phylogeny of *Crispospora chironomi* g.n. sp.n. (Microsporidia: Terresporidia), a microsporidian parasite of *Chironomus plumosus* L. (Diptera: Chironomidae). Parasitol Res 107:1381–1389
- 8387 Tonka T, Weiser J (2000) *Becnelia sigarae* gen. n., sp. n. isolated from testes of the water boatmen, *Sigara lateralis* (Heteroptera: Corixidae) in Czech Republic. Acta Protozool 39(3):241–252
- 8390 Tonka T, Weiser-Jr J, Weiser J (2010) Budding: a new stage in the development of *Chytridiopsis typographi* (Zygomycetes: Microsporidia). J Invertebr Pathol 104(1):17–22
- 8392 Torres-Cruz TJ, Billingsley Tobias TL, Almatruk M et al (2017) *Bifiguratus adelaidae*, gen. et sp. nov., a new member of Mucoromycotina in endophytic and soil-dwelling habitats. Mycologia 109(3):363–378
- 8397 Tretter ED, Johnson EM, Benny GL, Lichtwardt RW et al (2014) An eight-gene molecular phylogeny of the Kickxellomycotina, including the first phylogenetic placement of Asellariales. Mycologia 106:912–935
- 8401 Tretter ED, Johnson EM, Wang Y, Kandel P et al (2013) Examining new phylogenetic markers to uncover the evolutionary history of early-diverging fungi: comparing MCM7, TSR1 and rRNA genes for single- and multi-gene analyses of the Kickxellomycotina. Persoonia 30:106–125. <https://doi.org/10.3767/003158513X666394>
- 8407 Truong C, Mujic AB, Healy R, Kuhar F et al (2017) How to know the fungi: combining field inventories and DNA-barcoding to document fungal diversity. New Phytol 214:913–919
- 8410 Tsukada R, Tsuchiyama A, Sasaki M, Park CH, Fujii Y, Takesue M, Hatai H, Kudo N, Ikada H (2013) Encephalitozoon infections in Rodentia and Soricomorpha in Japan. Vet Parasitol 198:193–196
- 8413 Tully CC, Romanelli AM, Sutton DA, Wickes BL et al (2009) Fatal *Actinomyces elegans* var. *kuwaitiensis* infection following combat trauma. J Clin Microbiol 47:3394–3399
- 8416 ~~Tupe SG, Kulkarni RR, Shirazi F, Sant DG et al (2015) Possible mechanism of antifungal phenazine-1-carboxamide from *Pseudomonas* sp. against dimorphic fungi *Benjaminiella poitrasii* and human pathogen *Candida albicans*. J Appl Microbiol 118:39–48~~
- 8419 Uehling J, Gryganskyi A, Hameed K, Tschaplinski T et al (2017) Comparative genomics of *Mortierella elongata* and its bacterial endosymbiont *Mycoavidus cysteinexigens*. Environ Microbiol 19:2964–2983
- 8424 Uloth MB, Clode PL, You MP, Barbetti MJ (2015) Calcium oxalate crystals: an integral component of the *Sclerotinia sclerotiorum*/*Brassica carinata* pathosystem. PLoS ONE 10:e0122362. <https://doi.org/10.1371/journal.pone.0122362>
- 8428 Urquhart AS, Coulon PM, Idnurm A (2017) *Pilaira australis* sp. nov. (Mucorales, Mucoromycota) isolated from emu faeces in Australia. Phytotaxa 329:277–283
- 8431 Vaingankar JD, Rodrigues BF (2011) *Acaulospora soloidea*, a new arbuscular mycorrhizal fungus from rhizosphere soils of *Muraya paniculata*. Mycotaxon 115:323–326
- 8434 Valencáková A, Bálent P, Novotný F, Cisláková L (2005) Application of specific primers in the diagnosis of *Encephalitozoon* spp. Ann Agric Environ Med 12:321–323
- 8437 Valencáková A, Balent P, Ravaszova P, Horak A, Obornik M, Halanova M, Malcekova B, Novotny F, Goldova M (2012) Molecular identification and genotyping of Microsporidia in selected hosts. Parasitol Res 110:689–693
- 8441 Valle LG (2010) Description of zygospores in *Tectimyces robustus* and clarifications on homothallic species within Harpellales. Mycologia 102:384–391
- 8443 Valle LG (2013a) Consolidating the legacy of J.-F. Manier: new species and records of trichomycetes from France. Mycologia 105(6):1607–1617
- 8444 Valle LG (2013b) New and rare harpellales from Portugal and northwestern Iberian Peninsula: discovering the hidden mycobiota of Galicia-Tras-os-Montes region. Mycologia 105:748–759
- 8445 ~~Valle LG, Cafaro MJ (2008) First report of zygospores in Asellariales and new species from the Caribbean. Mycologia 100:122–131~~
- 8446 Valle LG, Rossi W, Santamaria S (2013) New species and new records of trichomycetes from Italy. Mycologia 105(3):712–727
- 8447 Valle LG, Rossi W, Santamaria S (2014) *Orphella intropus* (Kickxellomycotina), a new insect endosymbiont with an unusual perforating holdfast system and other trichomycetes from Italy. Mycologia 106:589–606
- 8448 Valle LG, White MM, Cafaro MJ (2008) Harpellales in the digestive tracts of *Ephemeroptera* and *Plecoptera* nymphs from Veracruz, Mexico. Mycologia 100:149–162
- 8449 Van den Wyngaert S, Seto K, Rojas-Jimenez K, Kagami M et al (2017) A new parasitic chytrid, *Staurastromyces oculus* (Rhizophydiales, Staurastromycetaceae fam. nov.), infecting the freshwater desmid *Staurastrum* sp. Protist 168:392–407
- 8450 Van Rooij P, Martel A, D'Herde K, Brutyn M et al (2012) Germ tube mediated invasion of *Batrachochytrium dendrobatidis* in amphibian skin is host dependent. PLoS ONE 7:e41481. <https://doi.org/10.1371/journal.pone.0041481>
- 8451 Vavra J, Hylis M, Fiala I, Nebesarova J (2016) *Globulispora mitoportans* n.g., n. sp., (Opisthosporidia: Microsporidia) a microsporidian parasite of daphnids with unusual spore organization and prominent mitosome-like vesicles. J Invertebr Pathol 135:43–52
- 8452 Vávra J, Hylis M, Fiala I, Refardt D et al (2016) Microsporidia in a woodland pool I. *Lanatospora costata* sp. n. (Opisthosporidia, Microsporidia), parasite of *Megacyclops viridis* (Crustacea, Copepoda): fine structure and molecular phylogeny. Acta Protozool 55(4):269–280
- 8453 Vávra J, Hylis M, Fiala I, Sacherová V et al (2017) Microsporidian genus *Berwaldia* (Opisthosporidia, Microsporidia), infecting daphnids (Crustacea, Branchiopoda): biology, structure, molecular phylogeny and description of two new species. Eur J Protistol 61:1–2
- 8454 Vávra J, Larsson JR, Baker MD (1997) Light and electron microscopic cytology of *Trichotuzetia guttata* gen. et. sp. n. (Microspora, Tuzetiidae), a microsporidian parasite of *Cyclops vicinus* Uljanin 1875 (Crustacea, Copepoda). Arch Protistenkd 147(3–4):293–306
- 8455 Vávra J, Norlevine NG (1984) A new genus for *Glugea daphniae* (Protozoa: Microspore), a parasite of *Daphnia longispina* (Crustacea: Phyllopoa) 1. J Protozool Res 31(4):508–513
- 8456 Vedmed AI, Krylova SV, Issi IV (1991) The *Pulicispora xenopsyllae* new genus new species microsporidium from fleas of the genus *Xenopsylla*. Parazitologiya 25:13–19
- 8457 Vélez CG, Letcher PM, Schultz S, Mataloni MG et al (2013) Three new genera in chytridiales from aquatic habitats in Argentina and North America. Mycologia 105:1251–1265
- 8458 Vélez CG, Letcher PM, Schultz S, Powell MJ (2011) Molecular phylogenetic and zoospore ultrastructural analyses of *Chytridium olla* establish the limits of a monophyletic Chytridiales. Mycologia 103:118–130
- 8459 Verma V (2008) Fungus disease in fish, diagnosis and treatment. Vet World 1(2):62
- 8460 Videira M, Casal G, Rocha S, Gonçalves E et al (2015) *Potaspora aequidens* n. sp. (Microsporidia, Tetramicridae), a parasite

- 8506 infecting the freshwater fish *Aequidens plagiozonatus* (Teleostei, 8507 Cichlidae) from Brazil. *Parasitol Res* 114(7):2435–2442
- 8508 Vidtmann SS, Sokolova YY (1994) The description of the new genus 8509 *Larssonia* gen. n. based on the ultrastructural analysis of 8510 *Microsporidium* (Pleistophora) obtusa from *Daphnia pulex*. 8511 *Parazitologiya* 28:202–213
- 8512 Vijendravarma RK, Godfray HC, Kraaijeveld AR (2008) Infection of 8513 *Drosophila melanogaster* by *Tubulinosema kingi*: stage-specific 8514 susceptibility and within-host proliferation. *J Invertebr Pathol* 8515 99(2):239–241
- 8516 Vilela R, Silva SMS, Riet-Correa F, Dominguez E et al (2010) 8517 Morphologic and phylogenetic characterization of *Conidiobolus* 8518 *lampreae* recovered from infected sheep. *J Clin Microbiol* 8519 48:427–432. <https://doi.org/10.1128/JCM.01589-09>
- 8520 Vinckier D (1975) *Nosemoides* gen. n., *N. vivieri* (Vinckier, 8521 Devauchelle & Prensier, 1970) comb. nov. (Microsporidie); 8522 etude de la différentiation sporoblastique et genèse des 8523 différentes structures de la spore. *J Protozool Res* 22(2):170–184
- 8524 Vivares CP, Bouix G, Manier JF (1977) *Ormieresia carcini* gen. n., 8525 sp. n., Microsporidie du Crabe Méditerranéen, *Carcinus* 8526 *mediterraneus* Czerniavsky 1884: cycle Évolutif et Étude 8527 Ultrastructurale. *J Protozool Res* 24(1):83–94
- 8528 Vivarès CP, Méténier G (2000) Towards the minimal eukaryotic 8529 parasitic genome. *Curr Opin Microbiol* 3:463–467
- 8530 Vivarès CP, Méténier G (2001) The microsporidian encephalitozoon. 8531 *Bioessays* 23:194–202
- 8532 Voglmayr H, Cléménçon H (2016) Identification and taxonomic 8533 position of two mucoralean endoparasites of *Hysterangium* 8534 (Basidiomycota) based on molecular and morphological data. 8535 *Mycol Progress* 15:9. <https://doi.org/10.1007/s11557-015-1150-z>
- 8536 Vojvodic S, McCreadie JW (2008) Do different species of *Smittium* 8537 (Harpellales, Legeriomycetaceae) influence each other in the 8538 host gut? *Mycol Res* 112(12):1409–1413
- 8539 Vojvodic S, McCreadie JW (2009) Morphological differences of 8540 symbiotic fungi *Smittium culisetae* (Harpellales: Legeriomyc- 8541 etaceae) in different Dipteran hosts. *Mycol Res* 113:967–972
- 8542 Voos JR, Olive LS (1968) A new chytrid with aerial sporangia. 8543 *Mycologia* 60:730–733
- 8544 Voronin VN (1976) Characteristics of the genus *Glugea* (Protozoa, 8545 Microsporidia) based on the example of the type species *Glugea* 8546 *anomala* (Moniez, 1887) Gurley 1893 and its varieties. *Paraz- 8547 itologia* 10:263–267
- 8548 Voronin VN (1986a) Microsporidia of crustaceans. *Protozoology* 8549 10:137–165
- 8550 Voronin VN (1986b) The microsporidia of crustaceans. *Protozoology* 8551 (Leningrad) 10:137–165
- 8552 Voronin VN (1993) The microsporidium *Toxospora volgae* gen. n., 8553 sp. n. from chironomidae larvae of the genus *Corynoneura*. 8554 *Parazitologiya* 27:148–154
- 8555 ~~Vossbrinck CR, Andreadis TG (2007) The phylogenetic position of~~ 8556 ~~*Ovavesicula popilliae* (Microsporidia) and its relationship to~~ 8557 ~~*Antonospora* and *Paranosema* based on small subunit rDNA~~ 8558 ~~analysis. *J Invertebr Pathol* 96:270–273~~
- 8559 Vossbrinck CR, Baker MD, Andreadis TG (2010) Phylogenetic 8560 position of *Octosporea muscaedomesticae* (Microsporidia) and 8561 its relationship to *Octosporea bayeri* based on small subunit 8562 rDNA analysis. *J Invertebr Pathol* 105(3):366–370
- 8563 Vossbrinck CR, Andreadis TG, Vavra J, Becnel JJ (2004) Molecular 8564 phylogeny and evolution of mosquito parasitic Microsporidia 8565 (Microsporidia: Amblyosporidae). *J Eukaryot Microbiol* 8566 51(1):88–95
- 8567 Vossbrinck CR, Baker MD, Didier ES, Debrunner-Vossbrinck BA, 8568 Shadduck JA (1993) Ribosomal DNA sequences of *Encephal- 8569 itozoon hellem* and *Encephalitozoon cuniculi*: species identifi- 8570 cation and phylogenetic construction. *J Eukaryot Microbiol* 8571 40:354–362
- Vossbrinck CR, Debrunner-Vossbrinck BA (2005) Molecular phy- 8572 logeny of the Microsporidia: ecological, ultrastructural and 8573 taxonomic considerations. *Folia Parasitol* 52:131–142
- 8574 Wagner L, Stielow B, Hoffmann K, Petkovits T et al (2013) A 8575 comprehensive molecular phylogeny of the Mortierellales 8576 (Mortierellomycotina) based on nuclear ribosomal DNA. *Per- 8577 soonia* 30:77–93. <https://doi.org/10.3767/003158513X666268>
- 8578 Wakefield WS, Powell MJ, Letcher PM, Barr DJ et al (2010) A 8579 molecular phylogenetic evaluation of the Spizellomycetales. 8580 *Mycologia* 102:596–604
- 8581 Walker C (2008) *Ambispora* and *Ambisporaceae* resurrected. *Mycol 8582 Res* 112:297–298
- 8583 Walker C, Trappe JM, Schüßler A, Hawksworth DL et al (2017) 8584 2491) Proposal to conserve the name *Rhizophagus* with a 8585 conserved type (Fungi: Glomeromycota: Glomeraceae. *Taxon* 8586 66:199–200
- 8587 Wang CY, Solter LF, Huang WF, Tsai YC (2009) A new 8588 microsporidian species, *Vairimorpha ocinarae* n. sp., isolated 8589 from *Ocinara lida* Moore (Lepidoptera: Bombycidae) in Taiwan. 8590 *J Invertebr Pathol* 100(2):68–78
- 8591 Wang H, Chen H, Hao G, Yang B et al (2013a) Role of the 8592 phenylalanine-hydroxylating system in aromatic substance 8593 degradation and lipid metabolism in the oleaginous fungus 8594 *Mortierella alpina*. *Appl Environ Microbiol* 79:3225–3233. 8595 <https://doi.org/10.1128/AEM.00238-13>
- 8596 Wang H, Yang B, Hao G, Feng Y et al (2011a) Biochemical 8597 characterization of the tetrahydrobiopterin synthesis pathway in 8598 the oleaginous fungus *Mortierella alpina*. *Microbiology* 8599 157:3059–3070. <https://doi.org/10.1099/mic.0.051847-0>
- 8600 Wang J, Xu SQ, Strongman DB (2010) Two new *Harpellales* 8601 inhabiting the digestive tracts of midge larvae and other 8602 trichomyces from Tianshan Mountains, China. *Mycologia* 8603 102:135–141
- 8604 Wang L, Chen W, Feng Y, Ren Y et al (2011b) Genome 8605 characterization of the oleaginous fungus *Mortierella alpina*. 8606 *PLoS ONE* 6:e28319. <https://doi.org/10.1371/journal.pone.0028319>
- 8607 Wang R, Sui P, Hou X, Cao T et al (2017a) Cloning and identification 8608 of a novel steroid 11 α -hydroxylase gene from *Absidia coerulea*. 8609 *J Steroid Biochem Mol Biol* 171:254–261
- 8610 Wang R, Zhang H, Sun L, Qi G (2017b) Microbial community 8611 composition is related to soil biological and chemical properties 8612 and bacterial wilt outbreak. *Sci Rep* 7:343. <https://doi.org/10.1038/s41598-017-00472-6>
- 8613 Wang S, Li P, Su J, Liang R et al (2014a) Enhanced glucosamine 8614 production with *Actinomucor elegans* based on stimulating 8615 factor of methanol. *Indian J Microbiol* 54:459–465
- 8616 Wang TC, Nai YS, Wang CY, Solter LF, Hsu HC, Wang CH, Lo CF 8617 (2013b) A new microsporidium, *Triwangia caridinae* gen. nov., 8618 sp. nov. parasitizing fresh water shrimp, *Caridina formosae* 8619 (decapoda: Atyidae) in Taiwan. *J Invertebr Pathol* 112:281–293
- 8620 Wang X, Liu X, Groenewald JZ (2017c) Phylogeny of anaerobic 8621 fungi (phylum *Neocallimastigomycota*), with contributions from 8622 yak in China. *Antonie Van Leeuwenhoek* 110:87–103. <https://doi.org/10.1007/s10482-016-0779-1>
- 8623 Wang Y, Li XC, Fu G, Zhao S et al (2017d) Morphology and 8624 phylogeny of *Ameson portunus* n. sp. (Microsporidia) infecting 8625 the swimming crab *Portunus trituberculatus* from China. *Eur J 8626 Protistol* 61:122–136
- 8627 Wang Y, Tretter ED, Johnson EM, Kandel P et al (2014b) Using a 8628 five-gene phylogeny to test morphology-based hypotheses of 8629 *Smittium* and allies, endosymbiotic gut fungi (Harpellales) 8630 associated with arthropods. *Mol Phylogenet Evol* 79:23–41
- 8631 Wang Y, Tretter ED, Lichtwardt RW, White MM (2013c) Overview 8632 of 75 years of *Smittium* research, establishing a new genus for 8633 8634 8635 8636

- 8637 *Smittium culisetae*, and prospects for future revisions of the
8638 'Smittium' clade. *Mycologia* 105(1):90–111
- 8639 Wang Y, White MM, Kvist S, Moncalvo J-M (2016a) Genome-wide
8640 survey of gut fungi (Harpellales) reveals the first horizontally
8641 transferred ubiquitin gene from a mosquito host. *Mol Biol Evol*
8642 33:2544–2554. <https://doi.org/10.1093/molbev/msw126>
- 8643 Wang Y, White MM, Moncalvo J-M (2016b) Draft genome sequence
8644 of *Capniomyces stellatus*, the obligate gut fungal symbiont of
8645 stonefly. *Genome Announc* 4:e00761-16. <https://doi.org/10.1128/genomeA.00761-16>
- 8646 Wang Y, Yue Q, Ma X, Xi R et al (2014c) Biotransformation of
8647 resibufogenin by *Actinomucor elegans* and the cytotoxicity of
8648 the resulting metabolites. *Phytochem Lett* 9:132–136
- 8649 Wang YN, Liu XY, Zheng RY (2013d) Four new species records of
8650 *Umbelopsis* (Mucoromycotina) from China. *J Mycol.* <https://doi.org/10.1155/2013/970216>
- 8651 Wang YN, Liu XY, Zheng RY (2015) *Umbelopsis longicollis* comb.
8652 nov. and the synonymy of *U. roseonana* and *U. versiformis* with
8653 *U. nana*. *Mycologia* 107:1023–1032
- 8654 Wang Z, Xiao Y, Wang W, Wang Z (2017e) The optimization of the
8655 production conditions of gamma aminobutyric acid by *Absidia*
8656 fermentation. *Biomed Res* 28:9139–9143
- 8657 Watts MR, Chan RC, Cheong EY, Brammah S et al (2014) *Anncaliia*
8658 *algerae* microsporidial myositis. *Emerg Infect Dis*
8659 20(2):185–191
- 8660 Weidner E, Canning EU, Rutledge CR, Meek CL (1999) Mosquito
8661 (Diptera: Culicidae) host compatibility and vector competency
8662 for the human myositic parasite *Trachipleistophora hominis*
8663 (Phylum Microspora). *J Med Entomol* 36:522–525
- 8664 Weiser J (1977) Contribution to the classification of microsporidia.
8665 *Vest Cesk Spol Zool* 41:308–321
- 8666 Weiser J, Belton P, Zizka Z, Holusa J (2015) Ultrastructure of the
8667 microsporidium, *Duboscqia legeri*, the type species of the genus
8668 *Duboscqia* Perez, 1908. *Acta Protozool* 49(2):125–131
- 8669 Weiser J, David L (1997) A light and electron microscopic study of
8670 *Larsoniella resinellae* n. gen., n. sp. (Microspora, Unikaryo-
8671 onidae), a parasite of *Petrova resinella* (Lepidoptera, Tortrici-
8672 dae), in Central Europe. *Arch Protistenkd* 147(3–4):405–410
- 8673 Weiser J, Purrini K (1980) Seven new microsporidian parasites of
8674 springtails (*Collembola*) in the Federal Republic of Germany
8675 Sieben neue Mikrosporidien-Arten der Springschwänze (*Collem-
8676 bola*) aus der Bundesrepublik Deutschland. *Z Parasitenkd*
8677 62(1):75–84
- 8678 Weiser J, Wegensteiner R, Zizka Z (1995) *Canningia spinidentis* gen.
8679 et. sp. n. (Protista: Microspora), a new pathogen of the fir bark
8680 beetle *Pityokteines spinidens*. *Folia Parasitol* 42(1):1–10
- 8681 Weissenberg R (1976) Microsporidian interactions with the host cell.
8682 In: Bulla LA, Cheng TC (eds) *Comparative pathobiology*, vol 1.
8683 Plenum Press, New York, pp 203–237
- 8684 Weli SC, Dale OB, Hansen H, Gjessing MC et al (2017) A case study
8685 of *Desmozoon lepeophtherij* infection in farmed Atlantic salmon
8686 associated with gill disease, peritonitis, intestinal infection,
8687 stunted growth, and increased mortality. *Parasit Vectors*
8688 10(1):370
- 8689 Werner S, Peršoh D, Rambold G (2016) New aspects of the biology of
8690 *Mortierella alliacea*. *Mycol Prog* 15:1293–1301
- 8691 ~~Wetzel J, Burmester A, Kolbe M, Wöstemeyer J et al (2012) The~~
8692 ~~mating-related loci *sexM* and *sexP* of the zygomycetous fungus~~
8693 ~~*Mucor mucedo* and their transcriptional regulation by trisporoid~~
8694 ~~pheromones. *Microbiology* 158:1016–1023. <https://doi.org/10.1099/mic.0.054106-02012>~~
- 8695 Whippes CM, Kent ML (2006) Polymerase chain reaction detection of
8696 *Pseudoloma neurophilia*, a common microsporidian of zebrafish
8697 (*Danio rerio*) reared in research laboratories. *J Am Assoc Lab*
8698 *Anim Sci* 45:36–39
- 8699 White MM, Strongman DB (2012a) New species of *Spartiella* and
8700 *Legeriosimilis* from mayflies and other arthropod-associated
8701 trichomycetes from Nova Scotia, Canada. *Botany*
8702 90(11):1195–1203
- 8703 White MM, Strongman DB (2012b) New species of *Smittium* and
8704 *Stachylina* and other trichomycetes in larval Diptera from
8705 streams in Nova Scotia, Canada. *Botany* 90:1204–1219
- 8706 Wijayawardene DNN, McKenzie EHC, Hyde KD (2012) Towards
8707 incorporating anamorphic fungi in a natural classification—
8708 checklist and notes for 2011. *Mycosphere* 3:157–228
- 8709 Wijayawardene NN, Crous PW, Kirk PM, Hawksworth DL et al
8710 (2014) Naming and outline of Dothideomycetes—2014 includ-
8711 ing proposals for the protection or suppression of generic names.
8712 *Fungal Divers* 69:1–55
- 8713 Wijayawardene NN, Hyde KD, Lumbsch HT, Liu JK et al (2018)
8714 Outline of ascomycota: 2017. *Fungal Divers* 88:167–263
- 8715 Wijayawardene NN, Hyde KD, Rajeshkumar KC, Hawksworth DL
8716 et al (2017a) Notes for genera: ascomycota. *Fungal Divers*
8717 86:1–594
- 8718 Wijayawardene NN, Hyde KD, Tibpromma S, Wanasinghe DN et al
8719 (2017b) Towards incorporating asexual fungi in a natural
8720 classification: checklist and notes 2012–2016. *Mycosphere*
8721 8:1457–1554
- 8722 Wijayawardene NN, Hyde KD, Wanasinghe DN, Papizadeh M et al
8723 (2016) Taxonomy and phylogeny of dematiaceous coelomy-
8724 cetes. *Fungal Divers* 77:1–316
- 8725 Wilkinson TJ, Rock J, Whiteley NM, Ovcharenko MO et al (2011)
8726 Genetic diversity of the feminising microsporidian parasite
8727 *Dictyocoela*: new insights into host-specificity, sex and phylo-
8728 geography. *Int J Parasitol* 41(9):959–966
- 8729 William RT, Strongman DB (2013) Trichomycetes occurring in both
8730 lentic (lake) and lotic (stream) habitats within the Halifax
8731 Regional Municipality, Nova Scotia, Canada. *Botany*
8732 91:382–402
- 8733 Williams BA, Lee RC, Becnel JJ, Weiss LM et al (2008) Genome
8734 sequence surveys of *Brachiola algerae* and *Edhazardia aedis*
8735 reveal microsporidia with low gene densities. *BMC Genomics*
8736 9(1):200
- 8737 Williams RT, Strongman DB (2012) Two new genera of fungal
8738 trichomycetes, *Bactromyces* and *Laculus* (Harpellales), from
8739 Nova Scotia, Canada. *Botany* 90:101–111
- 8740 Willis A, Błaszczkowski J, Prabhu T, Chwat G et al (2016)
8741 *Sacculospora felinovii*, a novel arbuscular mycorrhizal fungal
8742 species (Glomeromycota) from dunes on the west coast of India.
8743 *Mycol Prog* 15:791–798
- 8744 Wilson ER, Smalling KL, Reilly TJ, Gray E et al (2014) Assessing the
8745 potential effects of fungicides on nontarget gut fungi (Trichomycetes) and their associated larval black fly hosts. *J Am Water Resour Assoc* 50:420–433. <https://doi.org/10.1111/jawr.12166>
- 8746 Wilson JM (1979) The biology of *Encephalitozoon cuniculi*. *Med Biol* 57:84–101
- 8747 Winters AD, Faisal M (2014) Molecular and ultrastructural charac-
8748 terization of *Dictyocoela diporeiae* n. sp. (Microsporidia), a
8749 parasite of *Diporeia* spp. (Amphipoda, Gammaridea). *Parasite*
8750 21:26
- 8751 Wolk DM, Schneider SK, Wengenack NL, Sloan LM, Rosenblatt JE
8752 (2002) Real-time PCR method for detection of *Encephalitozoon*
8753 *intestinalis* from stool specimens. *J Clin Microbiol*
8754 40:3922–3928
- 8755 Wolkow N, Jakobiec FA, Stagner AM, Cunnane ME et al (2017)
8756 Chronic orbital and calvarial fungal infection with *Apophysomyces variabilis* in an immunocompetent patient. *Surv Ophthalmol* 62(1):70–82
- 8757 Woo PCY, Leung SY, Ngan AHY, Lau SK et al (2012) A significant
8758 number of reported *Absidia corymbifera* (*Lichtheimia* 8762
8763
8764
8765
8766
8767

- 8768 *corymbifera*) infections are caused by *Lichtheimia ramosa* (syn. 8769
8770 *Lichtheimia hongkongensis*): an emerging cause of mucormycosis. 8771
8772 *Emerg Microbes Infect* 8:e15. <https://doi.org/10.1038/emi.2012.11>
- 8773 Woodbury N, Gries G (2013) Firebrats, *Thermobia domestica*, 8774
8775 aggregate in response to the microbes *Enterobacter cloacae* 8776
8777 and *Mycotypha microspora*. *Entomol Exp Appl* 147:154–159
- 8778 Wu X, Liu Q, Deng Y, Chen X et al (2018) Production of fumaric 8779
8780 acid by bioconversion of corn cob hydrolytes using an improved 8781
8782 *Rhizopus oryzae* strain. *Appl Biochem Biotechnol* 184:553–569
- 8783 Wüppenhorst N, Lee M-K, Rappold E et al (2010) Rhino-orbitocere- 8784
8785 bral zygomycosis caused by *Conidiobolus incongruus* in an 8786
8787 immunocompromised patient in Germany. *J Clin Microbiol* 8788
8789 48:4322–4325. <https://doi.org/10.1128/JCM.01188-10>
- 8790 Xess I, Mohapatra S, Shivaprakash MR, Chakrabarti A et al (2012) 8791
8792 Evidence implicating *Thamnostylum lucknowense* as an etiological 8793
8794 agent of rhino-orbital mucormycosis. *J Clin Microbiol* 8795
8796 50:1491–1494. <https://doi.org/10.1128/JCM.06611-11>
- 8797 Xiang H, Zhang R, Butler RR, Liu T, Zhang L, Pombert JF, Zhou Z 8798
8799 (2015) Comparative analysis of codon usage bias patterns in 8800
8801 microsporidian genomes. *PLoS ONE* 10(6):e0129223
- 8802 Xu J, Baldwin D, Kindrachuk C, Hegedus DD (2009) Comparative 8803
8804 EST analysis of a *Zoophthora radicans* isolate derived from 8805
8806 *Pieris brassicae* and an isogenic strain adapted to *Plutella* 8807
8808 *xylostella*. *Microbiology* 155:174–185
- 8809 Xu Q, Li S, Fu Y, Tai C et al (2010) Two-stage utilization of corn 8810
8811 straw by *Rhizopus oryzae* for fumaric acid production. *Bioresour* 8812
8813 *Technol* 101:6262–6264
- 8814 ~~Xu W, Shi L, Chan O, Li J et al (2013) Assessing the effect of litter 8815
8816 species on the dynamic of bacterial and fungal communities during leaf decomposition in microcosm by molecular techniques. *PLoS ONE* 8:e84613. <https://doi.org/10.1371/journal.pone.0084613>~~
- 8817 Xu X, Shen Z, Zhu F, Tao H, Tang X, Xu L (2012) Phylogenetic 8818
8819 characterization of a microsporidium (*Endoreticulatus* sp. 8820
8821 Zhenjiang) isolated from the silkworm, *Bombyx mori*. *Parasitol* 8822
8823 *Res* 110:815–819
- 8824 Yamamoto K, Degawa Y, Hirose D, Fukuda M et al (2015) 8825
8826 Morphology and phylogeny of four *Endogone* species and 8827
8828 *Sphaerocreas pubescens* collected in Japan. *Mycol Prog* 14:86
- 8829 Yamamoto K, Degawa Y, Takashima Y, Fukuda M, Yamada A 8830
8831 (2017a) *Endogone corticioides* sp. nov. from subalpine conifer 8832
8833 forests in Japan and China, and its multi-locus phylogeny. 8834
8835 *Mycoscience* 58:23–29
- 8836 Yamamoto K, Endo N, Degawa Y, Fukuda M et al (2017b) First 8837
8838 detection of endogone ectomycorrhizas in natural oak forests. 8839
8840 *Mycorrhiza* 27:295–301
- 8841 Yaman M, Radek R, Weiser J, Toguebaye BS (2010) *Unikaryon* 8842
8843 *phyllotretae* sp. n. (Protista, Microspora), a new microsporidian 8844
8845 pathogen of *Phyllotreta undulata* (Coleoptera; Chrysomelidae). 8846
8847 *Eur J Protistol* 46(1):10–16
- 8848 Yong N, Xiao-Xiao T, Xiao-Yong L, Bo H (2016) *Conidiobolus* 8849
8850 *stilbeus*, a new species with mycelial strand and two types of 8851
8852 primary conidiophores. *Mycosphere* 7:801–809
- 8853 Yu J, Walther G, Van Diepeningen AD et al (2015) DNA barcoding 8854
8855 of clinically relevant *Cunninghamella* species. *Med Mycol* 8856
8857 53:99–106. <https://doi.org/10.1093/mmy/myu079>
- 8858 Yun HY, Kim YH, James TY (2011) First report of false rust caused 8859
8860 by *Synchytrium minutum* on Kudzu in Korea. *Plant Dis* 95:358. 8861
8862 <https://doi.org/10.1094/PDIS-09-10-0697>
- 8863 Zain ME, Moss ST, El-Sheikh HH (2012) Development of merospo- 8864
8865 rangia in *Linderina pennisporea* (Kickxellales, Kickxellaceae). 8866
8867 *IMA Fungus* 3(2):103–108. <https://doi.org/10.5598/ima fungus.2012.03.02.01>
- 8868 Zawadzka K, Bernat P, Felczak A, Lisowska K (2015) Carbazole 8869
8870 hydroxylation by the filamentous fungi of the *Cunninghamella* 8871
8872 species. *Environ Pollut Res Int* 22:19658–19666. <https://doi.org/10.1007/s11356-015-5146-7>
- 8873 Zhang H, Feng Y, Cui Q, Song X (2017) Expression of Vitreoscilla 8874
8875 hemoglobin enhances production of arachidonic acid and lipids 8876
8877 in *Mortierella alpina*. *BMC Biotechnol* 17(1):68
- 8878 Zhang H, Huang T, Chen S (2015) Ignored sediment fungal 8879
8880 populations in water supply reservoirs are revealed by quanti- 8881
8882 tative PCR and 454 pyrosequencing. *BMC Microbiol* 15:44. 8883
8884 <https://doi.org/10.1186/s12866-015-0379-7>
- 8885 Zhang P, Zhou W, Wang P, Wang L et al (2013) Enhancement of 8886
8887 chitosanase production by cell immobilization of *Gongronella* 8888
8889 sp. JG. *Braz J Microbiol* 44(1):189–195. <https://doi.org/10.1590/S1517-83822013005000017>
- 8890 Zheng RY, Liu XY (2009) Taxa of *Pilaira* (Mucorales, Zygomycota) 8891
8892 from China. *Nova Hedwig* 88(1–2):255–267
- 8893 Zheng RY, Liu XY (2014) *Ambomucor* gen. & spp. nov. from China. 8894
8895 *Mycotaxon* 126(1):97–108
- 8896 Zheng RY, Liu XY, Li RY (2009) More *Rhizomucor* causing human 8897
8898 mucormycosis from China: *R. chlamydosporus* sp. nov. *Sydowia* 8899
8900 61(1):135–147
- 8901 Zheng RY, Liu XY, Wang YN (2017) *Circinella* (Mucorales, 8902
8903 Mucoromycotina) from China. *Mycotaxon* 132(1):43–62
- 8904 Zhou X, Montalva C, Arismendi N, Hong F (2017) *Neozygites* 8905
8906 *linanensis* sp. nov., a fungal pathogen infecting bamboo aphids 8907
8908 in southeast China. *Mycotaxon* 13:305–315
- 8909 Zhou XX, Zhao DD, Liu JH, Lu F et al (2014) Physical, chemical and 8910
8911 microbiological characteristics of fermented surimi with *Actinomyces* 8912
8913 *elegans*. *LWT-Food Sci Technol* 59(1):335–341
- 8914 Žižić M, Živić M, Maksimović V, Stanić M et al (2014) Vanadate 8915
8916 influence on metabolism of sugar phosphates in fungus *Phycomyces* 8917
8918 *blakesleanus*. *PLoS ONE* 9(7):e102849. <https://doi.org/10.1371/journal.pone.0102849>

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