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Families of Sordariomycetes

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Abstract Sordariomycetes is one of the largest classes of Ascomycota that comprises a highly diverse range of fungi characterized mainly by perithecial ascomata and inoperculate unitunicate asci. The class includes many important plant pathogens, as well as endophytes, saprobes, epiphytes, coprophilous and fungicolous, lichenized or lichenicolous taxa. They occur in terrestrial, freshwater and marine habitats worldwide. This paper reviews the 107 families of the class

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Sordariomycetes and provides a modified backbone tree based on phylogenetic analysis of four combined loci, with a maximum five representative taxa from each family, where available. This paper brings together for the first time, since Barrs' 1990 Prodromus, descriptions, notes on the history, and plates or illustrations of type or representative taxa of each family, a list of accepted genera, including asexual genera and a key to these taxa of Sordariomycetes. Delineation of taxa is supported where possible by molecular data. The outline is based on literature to the end of 2015 and the Sordariomycetes now comprises six subclasses, 32 orders, 105 families and 1331 genera. The family *Obryzaceae* and *Pleurotremataceae* are excluded from the class.

Keywords *Amplistromatales* · *Annulatascales* · *Boliniales* · *Calosphaeriales* · *Chaetosphaeriales* · *Coniochaetales* · *Conioscyphales* · *Cordanales* · *Coronophorales* · *Diaporthales* · *Falcocladiales* · *Glomerellales* · *Hypocreales* · *Jobellisiales* · *Koralionastetales* · *Lulworthiales* · *Magnaporthales* · *Melanosporales* · *Meliolales* · *Microascales* · *Ophiostomatales* · Phylogeny · *Phyllachorales* · *Pisorisporiales* · *Pleurotheciales* · *Sordariales* · *Savoryellales* · *Tirisporellales* · *Togniniales* · *Torpedosporales* · *Trichosphaeriales* · Taxonomy · *Trichosphaeriales* · Type species · *Xylariales*

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47. Hyponectriaceae Petr. (S Konta* & EBG Jones)
48. Iodosphaeriaceae O. Hilber (Q Li & KD Hyde*)
49. Jobellisiaceae Réblová (MJ D'souza*)
50. Juncigenaceae E.B.G. Jones et al. (M Dayarathne* & EBG Jones)
51. Kathistaceae Malloch & M. Blackw. (C Norphanphoun)
52. Koralionastetaceae Kohlm. & Volkm.-Kohlm. (M Dayarathne* & EBG Jones)
53. Lasiosphaeriaceae Nannf. (S-K Huang*)
54. Lautosporaceae Kohlm. et al. (M Dayarathne*)
55. Lopadostomataceae Daranagama & K.D. Hyde (DA Daranagama* & KD Hyde)
56. Lulworthiaceae Kohlm. et al. (M Dayarathne* & EBG Jones)
57. Macrohilaceae Crous (IC Senanayake*)
58. Magnaporthaceae P.F. Cannon (C Norphanphoun* & EBG Jones)
59. Melanconidaceae G. Winter Chin (IC Senanayake* & EBG Jones)
60. Meliolaceae G.W. Martin ex Hansf. (S Hongsanan*)
61. Melogrammataceae G. Winter (Q Shang*)
62. Microascaceae Luttr. ex Malloch (M Dayarathne*)
63. Microdochiaceae M. Hern.-Restr. (SSN Maharachchikumbura*)
64. Myelospermataceae K.D. Hyde & S.W. Wong (S. Konta*)
65. Nectriaceae Tul. & C. Tul. (RH Perera*)
66. Niessliaceae Kirschst. (S-K Huang* & EBG Jones)
67. Nitschkiaceae Nannf. (S-K Huang* & EBG Jones)
68. Ophioceraceae Klaubauf et al. (C Norphanphoun*)
69. Ophiocordycipitaceae G.H. Sung et al. (Y Xiao*)
70. Ophiostomataceae Nannf. (C Norphanphoun*)
71. Papulosaceae Winka & O.E. Erikss. (MJ D'souza*)
72. Pestalotiopsidaceae Maharachch. & K.D. Hyde (SSN Maharachchikumbura*)
73. Phaeochoraceae K.D. Hyde et al. (RH Perera*)
74. Phlogicylindriaceae Senan. & K.D. Hyde (ID Goonasekara*)
75. Phyllachoraceae Theiss. & H. Syd. (M Dayarathne* & EBG Jones)
76. Pisorisporiaceae Réblová & J. Fourn. (MJ D'souza*)
77. Plectosphaerellaceae W. Gams et al. (Q Shang* & EBG Jones)
78. Pleurostomataceae Réblová et al. (S-K Huang*)
79. Pleurotheciaceae Réblová & Seifert[#]
80. Pseudomassariaceae Senan. & K.D. Hyde (IC Senanayake*)
81. Pseudoplagiostomataceae Cheew. et al. (IC Senanayake*)
82. Pseudovalsaceae M.E. Barr (IC Senanayake*)
83. Pyriculariaceae Klaubauf et al. (C Norphanphoun*)
84. Requienellaceae Boise[#]
85. Reticulascaceae Réblová & W. Gams (RS Jayawardena & Q Shang*)
86. Robillardaceae Crous (SSN Maharachchikumbura*)
87. Savoryellaceae Jaklitsch & Réblová (M Dayarathne*)
88. Schizoparmaceae Rossman (IC Senanayake*)
89. Scortechiniaceae Huhndorf et al. (S-K Huang*)
90. Sordariaceae G. Winter (S-K Huang*)
91. Spathulosporaceae Kohlm. (M Dayarathne*)
92. Sporocadaceae Corda (ID Goonasekara*)
93. Sporidesmiaceae Fr. [#]
94. Stachybotryaceae L. Lombard & Crous (C Norphanphoun*)
95. Stilbosporaceae Link (IC Senanayake*)
96. Sydowiellaceae Lar.N. Vassiljeva (IC Senanayake*)
97. Thyridiaceae O.E. Erikss & J.Z. Yue (RH Perera*)
98. Tilachlidiaceae L. Lombard & Crous (RH Perera)
99. Tirisporellaceae Suetrong et al. (EBG Jones* & M Dayarathne)
100. Togniniaceae Réblová et al. (IC Senanayake* & EBG Jones)
101. Torpedosporaceae E.B.G. Jones & K.L. Pang (M Dayarathne, KL Pang, EBG Jones*)
102. Trichosphaeriaceae G. Winter (C Norphanphoun*& EBG Jones)
103. Valsaceae Tul. & C. Tul. (IC Senanayake*)
104. Vialaeaceae P.F. Cannon (IC Senanayake*& EBG Jones)
105. Xylariaceae Tul. & C. Tul. (DA Daranagama*)

Excluded, doubtful, poorly known, or family previously included in Sordariomycetes

106. Obryzaceae Körb (RH Perera*)
107. Pleurotremataceae Walt. Watson (S-K Huang*)

*These are the main contributing authors to the family entry

[#] These were introduced in 2016 and thus no note are provided

Introduction

Sordariomycetes is the second largest class of *Ascomycota* (Kirk et al. 2008; Hyde et al. 2013). Kirk et al. (2008) included 15 orders, 64 families, 1119 genera and 10,564 species in *Sordariomycetes*, while Lumbsch and Huhndorf (2010) included 18 orders, 63 families and 947 genera. The *Sordariomycetes* have a cosmopolitan distribution and accommodates mostly terrestrial taxa, although several can be found in aquatic habitats (Hyde and Wong 2000; Samuels and Blackwell 2001; Cai et al. 2006a; Jones et al. 2009a, b, 2015; Pratibha et al. 2014). Some are phytopathogens that cause leaf, stem and root diseases on a wide variety of hosts, while some cause diseases in arthropods and mammals (Sung et al. 2007; Prados-Rosale et al. 2012; Hyde et al. 2014).

Sordariomycetes are also commonly isolated as endophytes from various plants (Keim et al. 2014). Some taxa are fungicolous (PeiGui et al. 2000), while many persist as saprobes involved in decomposition and nutrient cycling (Jaklitsch and Voglmayr 2012). Some species of *Sordariomycetes* (i.e. *Beauveria bassiana*, *Trichoderma viride*, *T. harzianum*) are economically important biocontrol agents (Wraight et al. 1998; Kaewchai et al. 2009) and others produce a wide range of chemically diverse metabolites important in medicinal and other biotechnological industries (Semenova et al. 2012; Debbab et al. 2013; Xu et al. 2014).

A large number of *Sordariomycetes* species are characterized by non-lichenized, perithecial ascomata and inoperculate unitunicate asci (Zhang et al. 2006) or non-fissitunicate asci (Kirk et al. 2008). Most members of the *Xylariomycetidae* and some of the *Sordariomycetidae* have dark perithecia, amyloid asci, true paraphyses and periphysate ostioles, while most of the taxa of the *Hypocreomycetidae* have light coloured perithecia, non-amyloid apical rings in the asci when apical rings are present and the lack true paraphyses (Zhang et al. 2006). The class *Sordariomycetes* was introduced by Eriksson and Winka (1997) for taxa with perithecial ascomata, paraphysate hamathecium, periphysate ostioles and unitunicate or pseudoprotunicate asci. With the support of sequence data, Eriksson and Winka (1997) divided the class into three subclasses: *Hypocreomycetidae*, *Sordariomycetidae* and *Xylariomycetidae*. The subclass *Sordariomycetidae* included three orders (i.e. *Diaporthales*, *Ophiostomatales* and *Sordariales*), while *Xylariomycetidae* was introduced to accommodate a single order *Xylariales* (Eriksson and Winka 1997). Eriksson and Winka (1997) separated *Onygenales* and *Eurotiales* from *Sordariomycetes* and placed them in the class *Eurotiomycetes* based on morphology and phylogenetic analyses. A comprehensive study of *Sordariomycetes* based on both morphological characters and SSU rDNA sequence data was carried out by Samuels and Blackwell (2001) and Eriksson (2006). In the classification of Eriksson (2006), the subclass *Hypocreomycetidae* comprised 4 orders (i.e. *Coronophorales*, *Halosphaeriales*, *Hypocreales* and *Microascales*). *Coronophorales*, *Halosphaeriales* and *Hypocreales* are recognized as monophyletic and *Microascales* as paraphyletic. Samuels and Blackwell (2001) excluded *Erysiphales* and *Coryneliales sensu* Barr (1990) from *Sordariomycetes*, while Eriksson (2006) placed *Erysiphales* in the class *Leotiomycetes*, a sister taxon of the *Sordariomycetes*. Eriksson (2006) also recognized *Melanosporales* as a distinct order in the *Hypocreomycetidae*. In a recent revision Maharachchikumbura et al. (2015) introduced three sub classes; *Diaporthomycetidae*, *Lulworthiomycetidae*, and *Meliolomycetidae* based on morphology and sequence data.

The recent Outline of the *Sordariomycetes* (Maharachchikumbura et al. 2015) included 28 orders, 90 families and 1344 genera. In addition, a list of 829 genera with uncertain placement in *Sordariomycetes* was provided. In this paper, we deal with the family level classification of *Sordariomycetes*.

Materials and methods

Layout of the paper

Each family is treated with a family description, notes on its history and presence of any asexual morphs, and an account of the genera, including phylogenetic data where applicable. The type is listed along with a description of the type genus except in cases where there is only a single genus in the family. Notes on the type genus are provided along with full citations for the type species. This is followed by accepted genera and their type species; important synonyms and occasional notes are given. Synonymies follow the basis of one name for a biological genus or species (see Hawksworth et al. 2011; Hawksworth 2012) and follow published papers or Index Fungorum (2016). A key to the genera included in the family is provided unless the number of genera is small. The type genus is illustrated with a representative plate of its key morphological features. For consistency, authorities and their abbreviations for all taxa and citations of place of publication and abbreviations follow Index Fungorum (2016), even though those are not always entirely consistent.

Arrangement of sordariomycetes

The circumscription of the *Sordariomycetes* is based on the previous arrangements given in Maharachchikumbura et al. (2015), which has been updated based on a consideration of recent publications and interpretation of genera from the literature (see Table 1). We consider this a working circumscription that will be further refined as more genera are studied both at the morphological and molecular levels. Basionyms and possible synonyms of genera and species are not listed as these can be found in Index Fungorum (2016).

Examination of specimens

Specimens or slides were obtained from ANM, AR, B, BBH, BCC, BISH, BP, BPI, BR, BRIP, CBS, DAOM, FH, G, GZU, H, HAL, HHUF, HKU (M), IFRD, ILLS, IMI, K, L, LPS, MFU, NY, P, PC, PREM, S, TRTC, UBC, UC, UCR, UPS, URM, URM and W. Fruiting bodies were rehydrated in water and/or 5 % KOH prior to examination and sectioning. Hand sections of the fruiting bodies were mounted in water for microscopic studies and photomicrography. The materials were examined by a Nikon ECLIPSE 80i compound microscope and photographed by Canon 450D digital camera fitted to the microscope. Measurements were made with the Tarosoft (R)

Table 1 Sordariomycetes orders and included families

Order	Family
Amplistromatales	*Amplistromataceae*
	Catabotrydaceae
Annulatascales	*Annulatascaceae*
Boliniales	*Boliniaceae*
Calosphaeriales	*Calosphaeriaceae*
	Pleurostomataceae
Chaetosphaeriales	*Chaetosphaeriaceae*
	Helminthosphaeriaceae
	Pleurotremataceae
Coniochaetales	*Coniochaetaceae*
Conioscyphales	*Conioscyphaceae*
Cordanales	*Cordanaceae*
Coronophorales	*Bertiaceae*
	Chaetosphaerellaceae
	Coronophoraceae
	Nitschkiaceae
	Scortechiniaceae
Diaporthales	*Cryphonectriaceae*
	Diaporthaceae
	Gnomoniaceae
	Harknessiaceae
	Macrohilaceae
	Melanconidaceae
	Pseudoplagiostomataceae
	Pseudovalsaceae
	Schizoparmaceae
	Stilbosporaceae
	Sydowiellaceae
	Valsaceae
Falcocladiales	*Falcocladiaceae*
Glomerellales	*Australiascaceae*
	Glomerellaceae
	Reticulascaceae
	Plectosphaerellaceae
Hypocreales	*Bionectriaceae*
	Clavicipitaceae
	Cordycipitaceae
	Flammocladiaceae
	Hypocreaceae
	Nectriaceae
	Niessliaceae
	Ophiocordycipitaceae
	Stachybotriaceae
	Tilachlidiaceae
Jobellisiales	*Jobellisiaceae*
Koralionastetales	*Koralionastetaceae*
Lulworthiales	*Lulworthiaceae*
Magnaporthales	*Magnaporthaceae*
	Ophioceraceae
	Pyriculariaceae
Melanosporales	*Ceratostomataceae*
Meliolales	*Armatellaceae*
	Meliolaceae
Microascales	*Chadefaudiellaceae*
	Ceratocystidaceae
	Gondwanamycetaceae
	Graphiaceae
	Halosphaeriaceae
	Microascaceae
Ophiostomatales	*Kathistaceae*
	Ophiostomataceae
Phyllachorales	*Phaeochoraceae*
	Phyllachoraceae
Pisorisporiales	*Pisorisporiaceae*
Pleurotheciales	*Pleurotheciaceae*
Savoryellales	*Savoryellaceae*
Sordariales	*Chaetomiaceae*
	Lasiosphaeriaceae
	Sordariaceae
Spathulosporales	*Hispidicarpomycetaceae*
	Spathulosporaceae
Tirisporellales	*Tirisporellaceae*
Togniniales	*Togniniaceae*
Torpedosporales	*Etheirophoraceae*
	Juncigenaceae
	Torpedosporaceae
Trichosphaeriales	*Trichosphaeriaceae*
Xylariales	*Amphisphaeriaceae*
	Apiosporaceae
	Bartaliniaceae
	Beltraniaceae
	Cainiaceae
	Clypeosphaeriaceae
	Coniocessiaceae
	Diatrypaceae
	Hyponectriaceae
	Iodosphaeriaceae
	Lopadostomaceae
	Melogrammataceae
	Microdochiaceae
	Myelospermataceae
	Pestalotiopsidaceae
	Phlogicylindriaceae
	Pseudomassariaceae
	Requienellaceae
	Robillardaceae
	Sporocadaceae
	Vialaeaceae

Table 1 (continued)

Order	Family
	Xylariaceae
Diaporthomycetidae, families *incertae sedis*	*Distoseptisporaceae*
	Papulosaceae
	Sporidesmiaceae
	Thyridiaceae
Sordariomycetidae, families *incertae sedis*	*Batistiaceae*
Sordariomycetes, families *incertae sedis*	*Cephalothecaceae*
	Lautosporaceae
Excluded from *Sordariomycetes*	*Obryzaceae*
	Pleurotremataceae

Image Frame Work program (v. 0.9.0.7) and images used for figures were processed with Adobe Photoshop CS6 software (Adobe Systems, USA). Several type specimen were in poor condition and very little information could be obtained. In order to generate more information for this taxon, we relied on the original publication. Hand drawings of these specimens were made using drawing pens on parchment papers. Faces of fungi and Index Fungorum numbers are as explained in Jayasiri et al. (2015) and Index Fungorum (2016)

Phylogenetic analyses

Sequences were obtained from GenBank mostly following previous literature and are listed in supplementary Table 1. This study used LSU, SSU, TEF and RPB2 sequence data in the analyses. Multiple sequence alignments were generated with MAFFT v. 7 (http://mafft.cbrc.jp/alignment/server/) then manually corrected using MEGA v. 6.06 (Kumar et al. 2012) to ensure alignment and to minimize the number of uninformative gaps. The datasets were produced to show families and order relationships within the class *Sordariomycetes*.

The combined alignments were split between the genera to improve the robustness of the alignment across the four loci. Phylogenyies used Maximum Likelihood (ML) analyses. Ambiguously aligned regions were excluded from all analyses and gaps were treated as "missing data" in the analysis. A Maximum Likelihood analysis was performed using RAxMLGUI v. 1.3 (Silvestro and Michalak 2011). The optimal ML tree search was conducted with 1000 separate runs, using the default algorithm of the program from a random starting tree for each run. The final tree was selected among suboptimal trees from each run by comparing likelihood scores under the GTR+GAMMA substitution model. The resulting trees were printed with FigTree v. 1.4.0 (http://tree.bio.ed.ac.uksoftware/figtree/) and the final layout was done with Adobe Illustrator CS v. 6.

Definitions of previously inconsistently defined terms used in the study

We noticed that it was not always possible to be consistent with terminology, especially because some terms are not commonly accepted and some have been interpreted differently by different authors. Instead of distinguishing between ascolocular **pseudothecia** and ascohymenial **perithecia**, we used the neutral terms **perithecioid ascomata** or else the term **perithecia** in a broad sense, since by definition all ascomata in the higher Ascomycota (Pezizomycotina) are homologous and thus a differential terminology using the term pseudothecia for ascolocular perithecioid ascomata does not reflect phylogenetic relationships.

Results and discussion

The combined LSU, SSU, TEF and RPB2 gene data set comprised 383 taxa, with *Botryotinia fuckeliana*, *Dothidea sambuci*, *Exophiala dermatitidis* and *Pyxidiophora arvernensis* as the outgroup taxa. The combined dataset comprised 4367 characters including gaps. The best scoring RAxML trees are shown in Figs. 1 and 2. Bootstrap support values of ML (MLB) (equal to or above 50 %) are given at the nodes.

In the phylogenetic trees (Figs. 1 and 2), the 380 strains of *Sordariomycetes* included in the analysis cluster into six subclasses. *Sordariomycetidae*, *Hypocreomycetidae* and *Xylariomycetidae* as in the previous treatment of Lumbsch and Huhndorf (2010), *Meliolomycetidae* as suggested by Kirk et al. (2001), as well as *Diaporthomycetidae* and *Lulworthiomycetidae* as suggested by Maharachchikumbura et al. (2015). Figure 1 is a reduced version of the tree in Fig. 2. Maharachchikumbura et al. (2015) placed the orders *Coniochaetales* and *Cordanales* in the *Diaporthomycetidae*. However, given the inconsistency in the placement of the latter two orders, it would be more appropriate to refer them to *Sordariomycetes* order *incertae sedis* The internal classification of *Xylariomycetidae* is also somewhat problematic. The orders of the *Xylariomycetidae* as circumscribed by Senanayake et al. (2015) were not supported by the phylogenetic analyses in

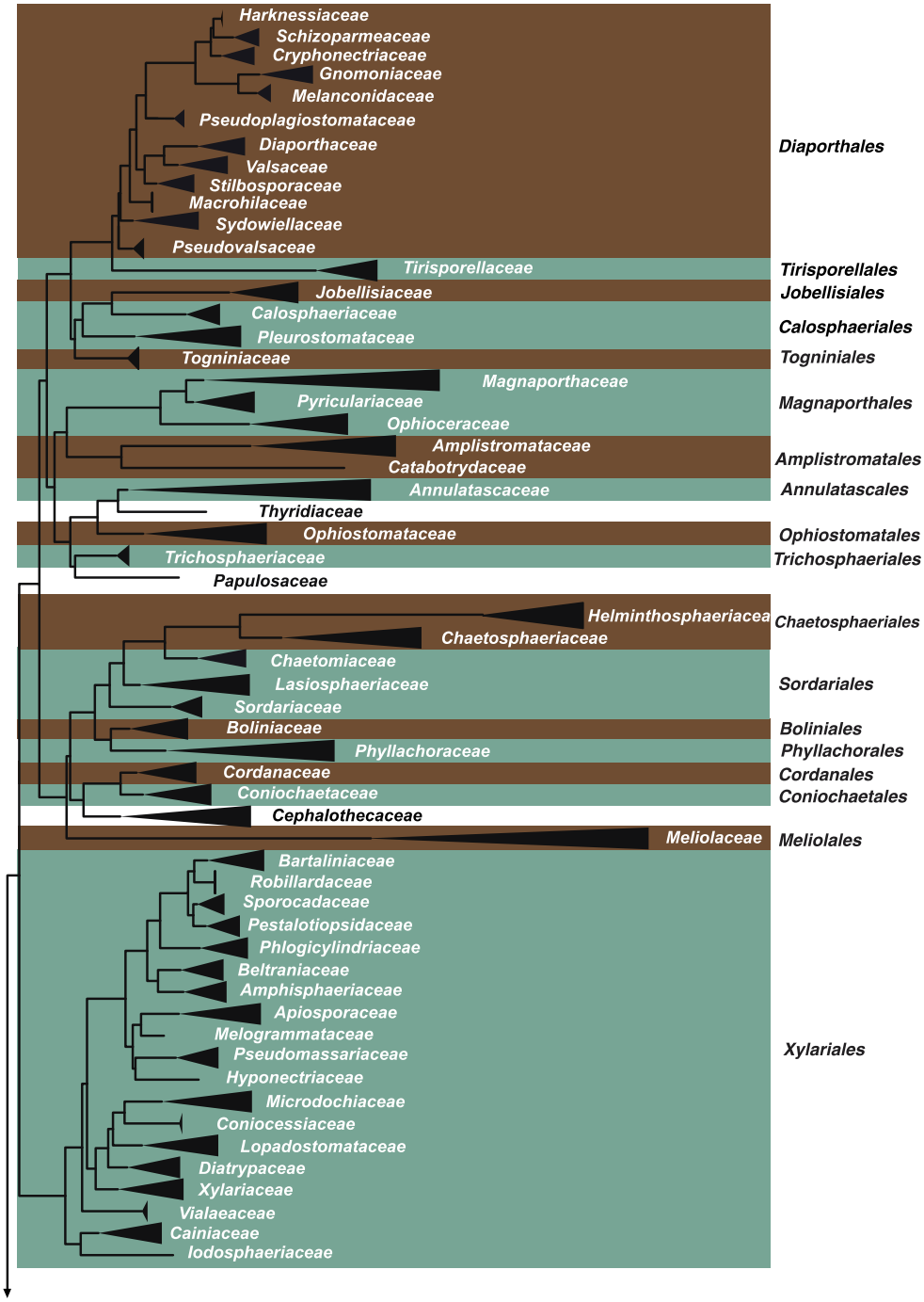


Fig. 1 The best scoring RAxML *Sordariomycetes* tree (compressed overview tree) from 383 taxa based on a combined dataset of LSU, SSU, TEF and RPB2 genes with all lineages collapsed to family level where possible. Orders are indicated in coloured blocks and RAxML bootstrap support values (MLB) are given at the nodes. The tree is rooted with *Botryotinia fuckeliana*, *Dothidea sambuci*, *Exophiala dermatitidis* and *Pyxidiophora arvernensis*

this study. Senanayake et al. (2015) re-validated the order *Amphisphaeriales* based on both sequence data and morphology. However, there is little support to validate this order and the placement of the families within the subclass are not stable. Therefore, we would like to keep the order *Xylariales* to represent the taxa in the *Xylariomycetidae*.

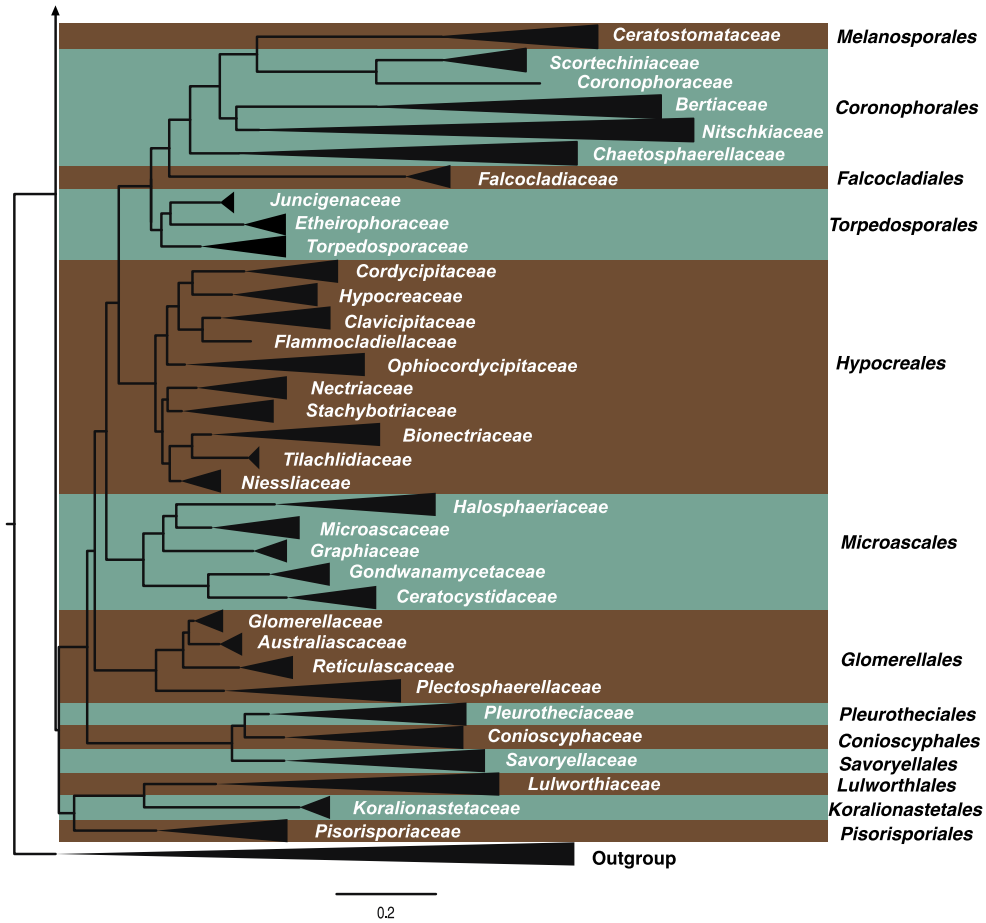


Fig. 1 (continued)

Presently accepted orders of *Sordariomycetes*

The Sordariomycetes comprise 32 orders.

Amplistromatales D'souza et al., in Maharachchikumbura et al., Fungal Divers 72: 212 (2015)

An order comprising families *Amplistromataceae* and *Catabotrydaceae* and was introduced by Maharachchikumbura et al. (2015). Two genera are included in *Amplistromataceae* namely *Amplistroma* Huhndorf et al. and *Wallrothiella* Sacc. The genus *Wallrothiella* was redescribed by Réblová and Seifert (2004) along with neotypification of its type species *Wallrothiella congregata* (Wallr.) Sacc. *Amplistroma* has been segregated from *Wallrothiella* based on the presence of stromatic ascomata. *Catabotrydaceae* is monotypic with *Catabotrys* as its type genus. However, *Catabotrys* Theiss. & Syd. and *Wallrothiella* do not possess stromatic ascomata, while *Amplistroma* is stromatic. LSU sequence data shows that *Amplistromataceae* has no relationship with *Chaetosphaeriales* and *Magnaporthaceae* (Huhndorf et al. 2009). In phylogenetic analyses, *Amplistromatales* appear to have a distant relationship with *Meliolomycetidae* and *Sordariomycetidae* and thus are placed in *Sordariomycetes* order *incertae sedis* (Maharachchikumbura et al. 2015).

Annulatascales D'souza et al., in Maharachchikumbura et al., Fungal Divers 72: 212 (2015)

A order within the class *Sordariomycetes*, subclass *Diaporthomycetidae*. This order is characterized by its typical freshwater habitat, growing on submerged woody substrates, with most genera distributed in the tropics. Significant characters of the taxa in *Annulatascales* include cylindrical, thin-walled asci, with a massive, J-, refractive, apical ring, which assists in active spore ejection (Tsui and Hyde 2003). Ascospores are usually equipped with appendages or sheaths. These characters might be important in aquatic habitats where they aid in the attachment to substrates (Shearer et al. 2007). The order presently comprises 20 genera that belong to, or are referred to, the family *Annulatascaceae*. To date, DNA sequences of many genera have not yet been analysed, and it is likely that the family as presently circumscribed is polyphyletic (Campbell and Shearer 2004; Vijaykrishna et al. 2005; Abdel-Wahab et al. 2011). Phylogenies herein reveals a close relationship of the *Annulatascaceae* to the *Thyridiaceae* and *Ophiostomataceae* with moderate support (Fig 2).

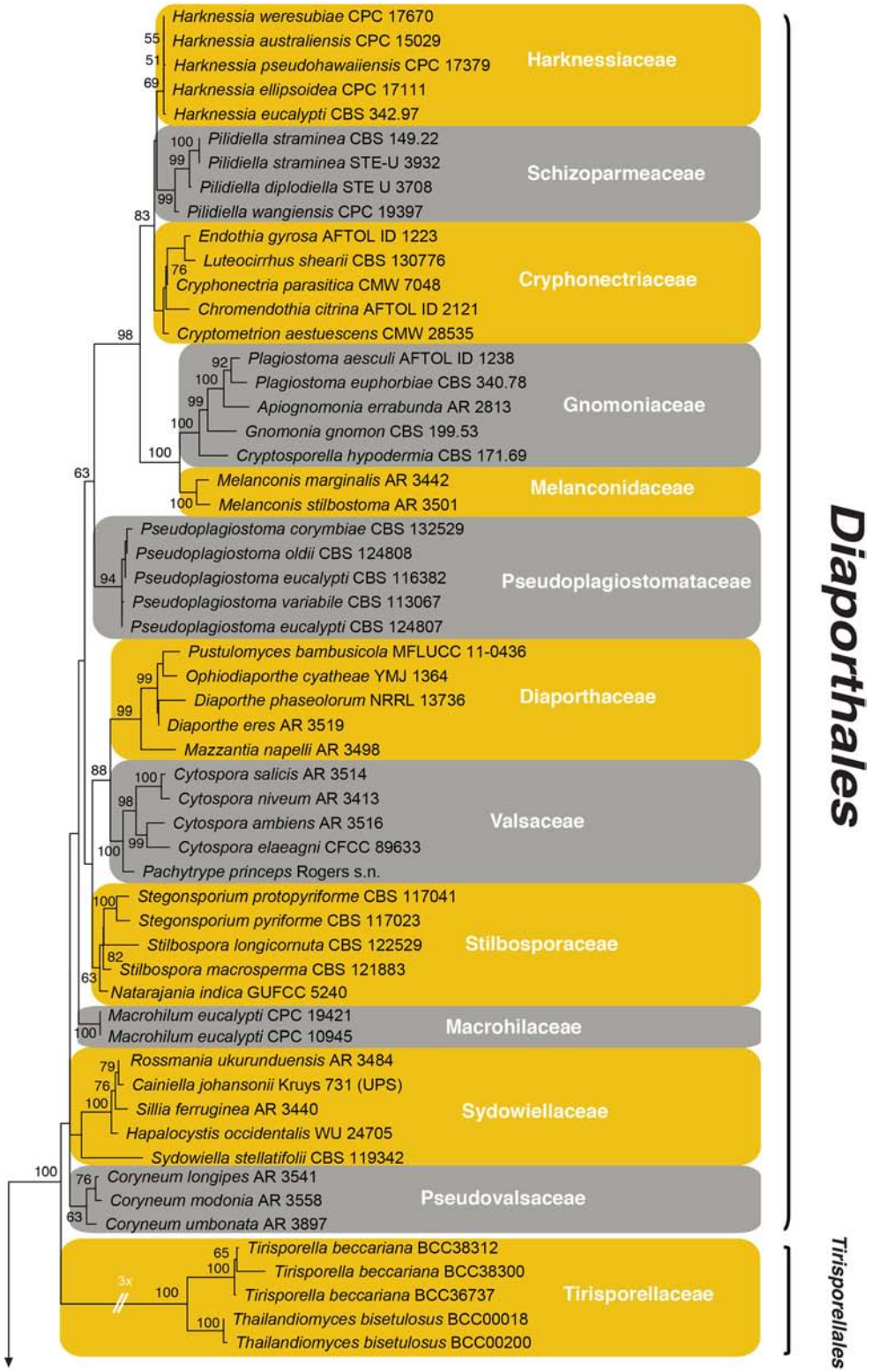


Fig. 2 Maximum likelihood (ML) majority rule combined LSU, SSU, TEF and RPB2 consensus tree for the analysed *Sordariomycetes* isolates. Families are indicated in coloured blocks and RAxML bootstrap support values (MLB above 50 %) are given at the nodes. The scale bar represents the expected number of changes per site. The tree is rooted with *Botryotinia fuckeliana*, *Dothidea sambuci*, *Exophiala dermatitidis* and *Pyxidiophora arvernensis*

Boliniales P.F. Cannon, in Kirk et al., Ainsworth & Bisby's Dictionary of the Fungi, Edn 9 (Wallingford): x (2001)

An order of saprobic fungi within the subclass *Sordariomycetidae*, which was introduced by Cannon (Kirk

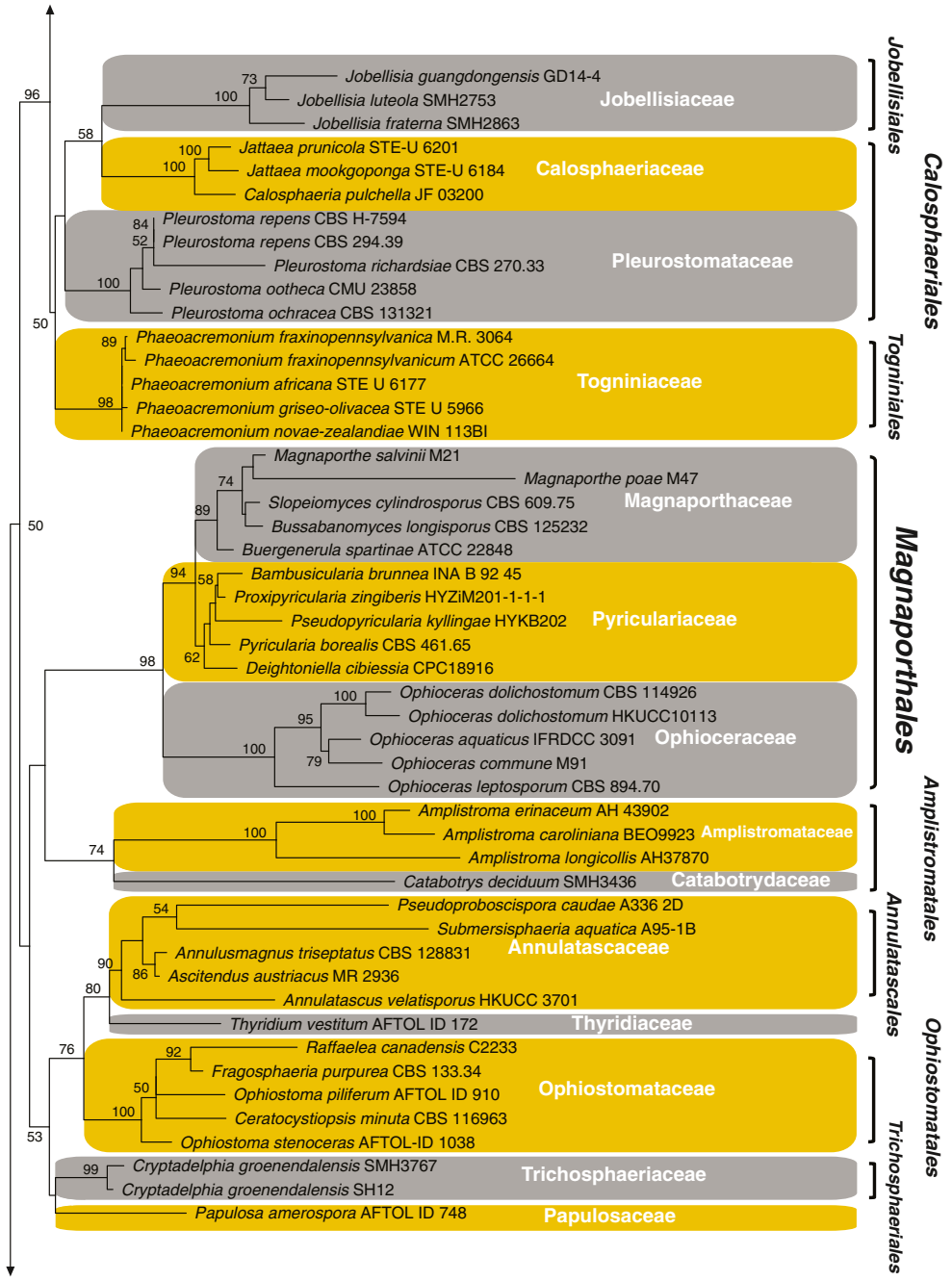


Fig. 2 (continued)

et al. 2001). In our phylogenetic analysis (Figs 1 and 2), *Boliniales* is nested in between the *Phyllachorales* and *Sordariales*, but appears to be more related to the *Phyllachorales*. *Boliniales* comprises a single family, *Boliniaceae*, with nine genera.

Calosphaeriales M.E. Barr, Mycologia 75(1): 11 (1983)

This order was introduced by Barr (1985). It presently comprises *Calosphaeriaceae* and *Pleurostomataceae* (Figs. 1 and 2). The taxa belonging to the order mainly comprise simple, dark perithecia, unitunicate asci, and hyaline to slightly pigmented, ellipsoid to allantoid ascospores (Réblová et al. 2004). The order forms a sister clade to the order *Jobellisiales* and *Togniniales* (Figs. 1 and 2).

Chaetosphaeriales Huhndorf et al., Mycologia 96(2): 378 (2004a)

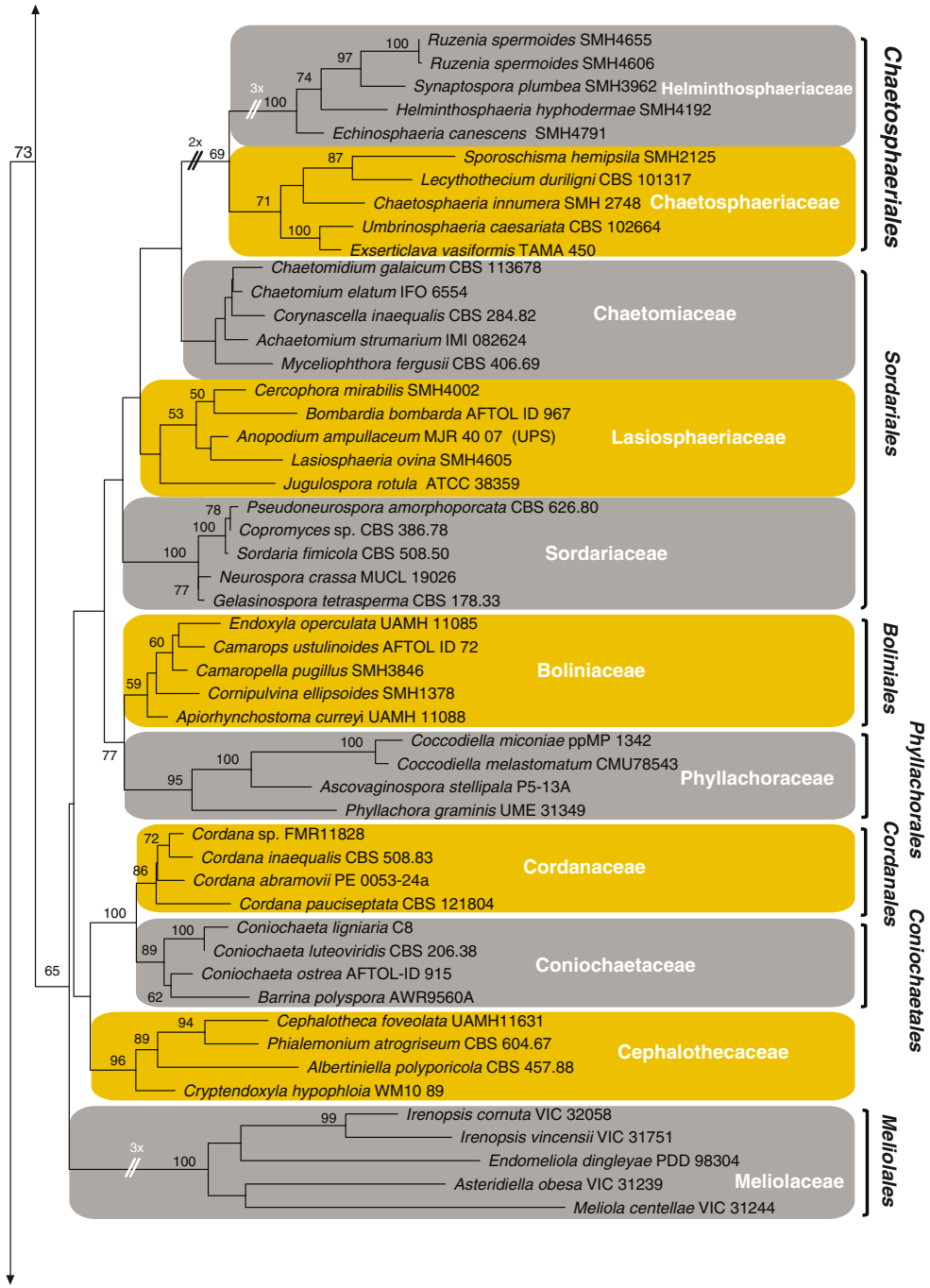


Fig. 2 (continued)

This order was introduced in *Sordariomycetidae* based on molecular analysis of LSU nrDNA sequence data by Huhndorf et al. (2004a). In our phylogenetic analysis (Fig. 1), *Chaetosphaeriales* is close to *Sordariales*. The order comprises *Chaetosphaeriaceae* with 35 genera and *Helminthosphaeriaceae* with seven genera.

Coniochaetales Huhndorf et al., Mycologia 96(2): 378 (2004a)

This order was introduced by Huhndorf et al. (2004a) and incorporates a single family *Coniochaetaceae* with three genera. *Coniochaetaceae* differs from *Sordariaceae* and related families in having ascospores with elongate germ slits (Malloch and Cain 1971). *Cephalothecaceae*

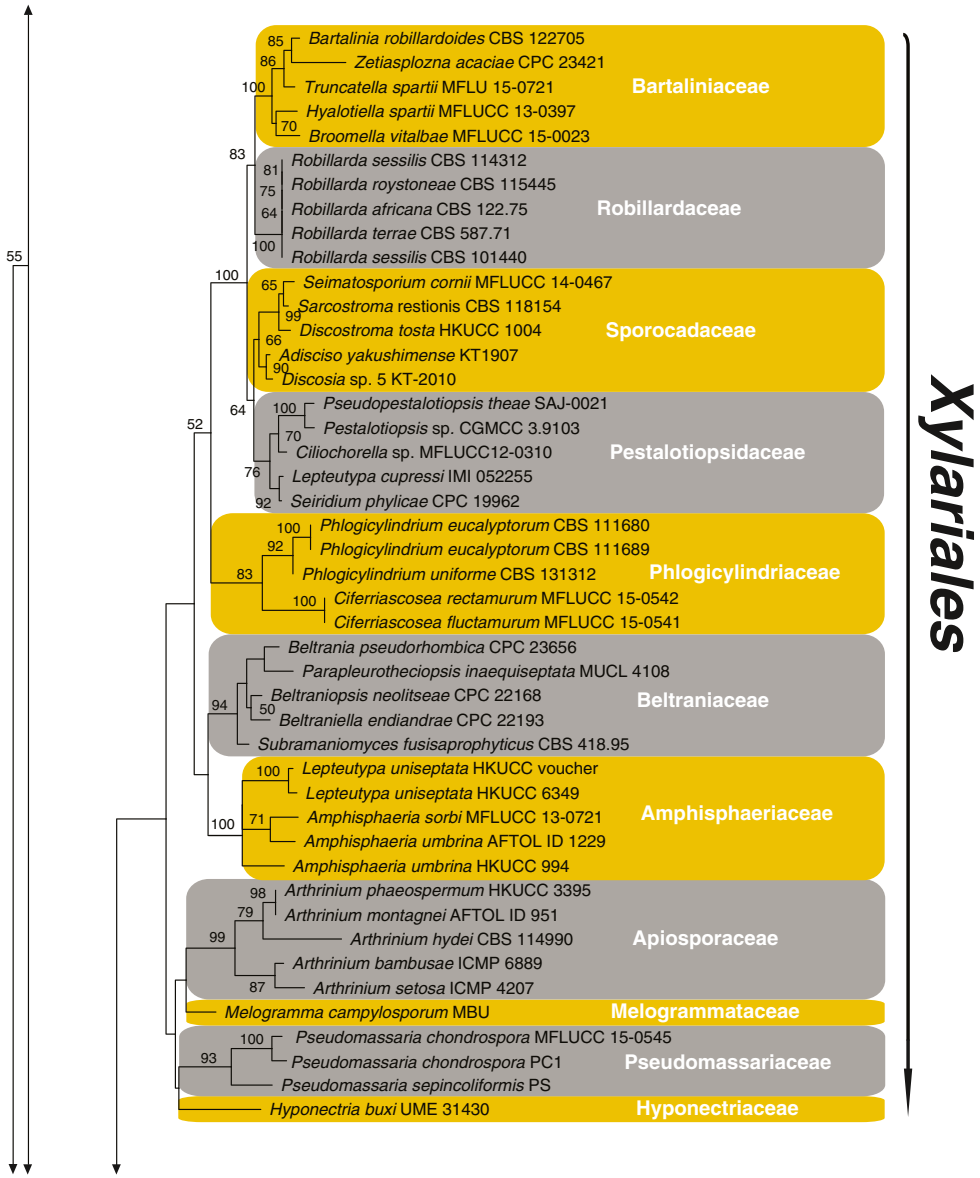


Fig. 2 (continued)

and *Cordanaceae* are sister families with strong phylogenetic support. Maharachchikumbura et al. (2015) referred the *Cordanales* and *Coniochaetales* to the *Diaporthomycetidae* but recent publications reported that ordinal placement is still unresolved (Su et al. 2016; Yang et al. 2015). Therefore, in the present study, we treat them under *Sordariomycetes*, orders *incertae sedis*.

Conioscyphales Réblová & Seifert, in Réblová et al., Persoonia 37: 63 (2016)

This order accommodates the family *Conioscyphaceae* with the monotypic genus *Conioscypha*. Members of this family inhabit freshwater and terrestrial habitats. The mode of conidiogenesis is unique with multiple, conspicuous collarettes forming a multi-lamellar structure around the blastic conidiogenous locus of the intercalary conidiogenous cells (Shearer and Motta 1973)

Cordanales M. Hern.-Rest. & Crous, in Hernández-Restrepo et al., Phytotaxa 205(4): 233 (2015a)

This order was introduced by Hernández-Restrepo et al. (2015a) to accommodate the family *Cordanaceae* with a single genus *Cordana* Preuss. Morphologically it is easily

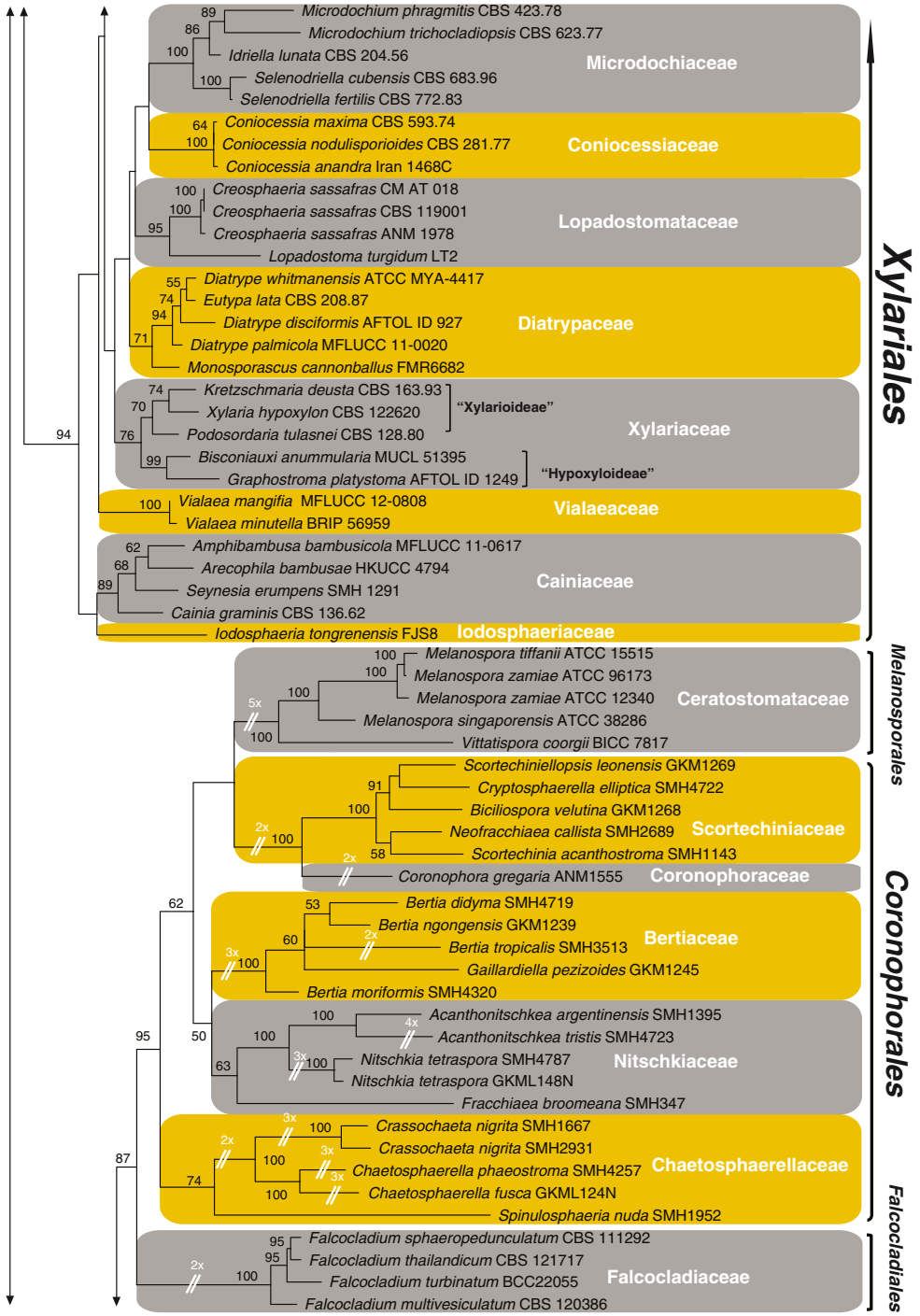


Fig. 2 (continued)

distinguished from its sister order *Coniochaetales* (*Coniochaetaceae*) by having a basal stroma, ascospores without germ slits and polyblastic asexual morphs (Hernández-Restrepo et al. 2015a). Our molecular data also support the segregation of these two orders as both of them constitute two distinct monophyletic groups with reliable support.

Coronophorales Nannf., Nova Acta R. Soc. Scient. upsal., Ser. 4 8(no. 2): 54 (1932)

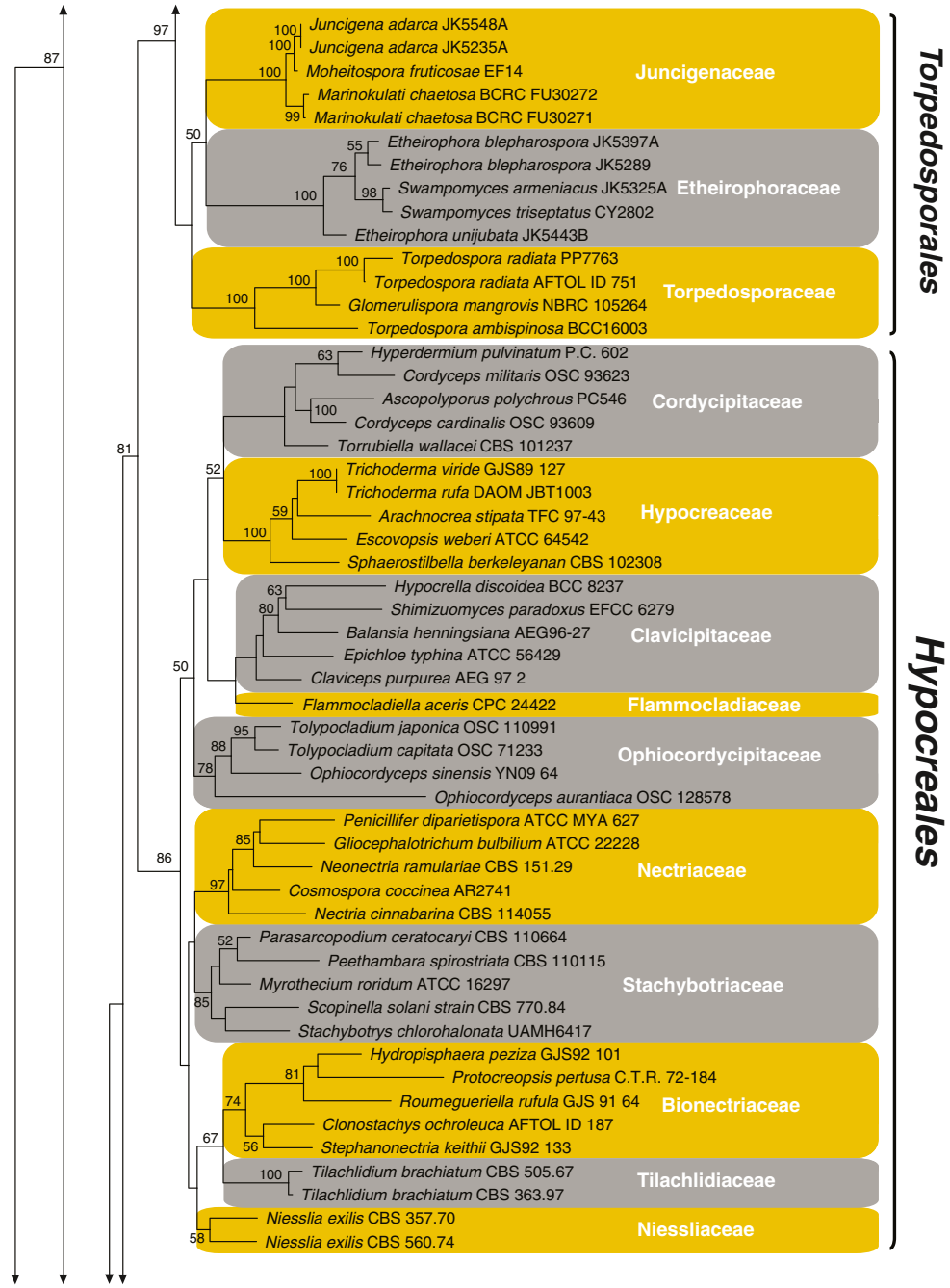


Fig. 2 (continued)

Taxa belonging to the order *Coronophorales* inhabit wood and comprise *Bertiaceae*, *Ceratostomataceae*, *Chaetosphaerellaceae*, *Coronophoraceae*, *Nitschkiaceae* and *Scortechiniaceae*. Taxa in the order are characterised by mostly superficial ascomata, sometimes with an extensive hyphal subiculum or well-developed basal stroma that often becomes cupulate or collapsed, and in some cases the ostiolar opening is either indistinct or lacking (Mugambi and Huhndorf 2010).

Diaporthales Nannf., Nova Acta R. Soc. Scient. upsal., Ser. 4 8(no. 2): 53 (1932)

The order *Diaporthales* comprises 12 families, which are *Cryphonectriaceae*, *Diaporthaceae*, *Gnomoniaceae*,

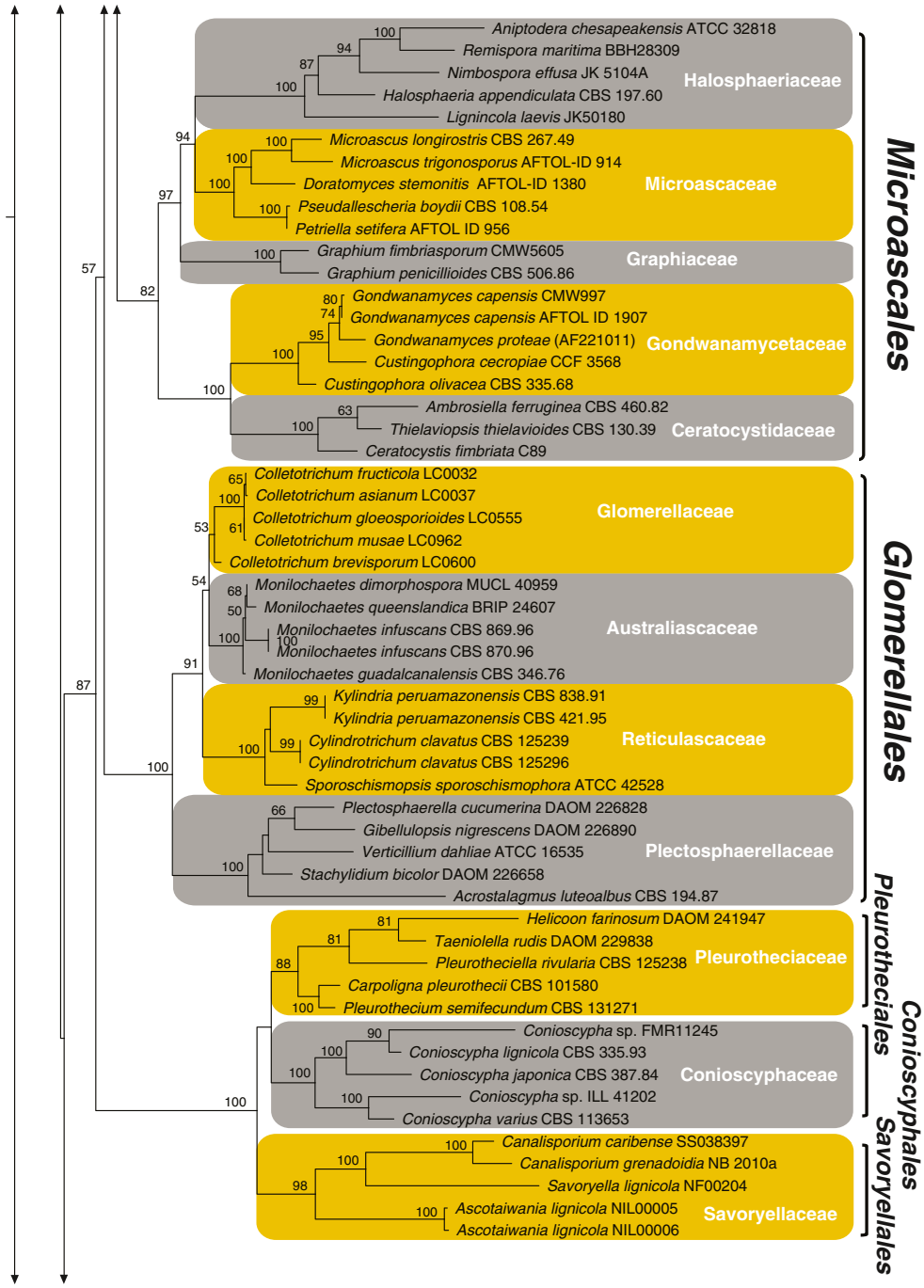


Fig. 2 (continued)

Harknessiaceae, *Macrohilaceae*, *Melanconidaceae*, *Pseudoplagiostomataceae*, *Pseudovalsaceae*, *Schizoparmaceae*, *Stilbosporaceae*, *Sydowiellaceae* and *Valsaceae*. Members of *Diaporthales* are pathogens, parasites, and endophytes of plants, human-animal pathogens, saprobes and soil inhabitants (Rossman et al. 2007). The order *Diaporthales* is characterized by perithecia with an elongate beak, often forming within stromatic tissues (Rossman et al. 2007). Asci generally deliquesce at the base when mature and have a characteristic refractive apical annulus.

Falcocladiales R.H. Perera et al. in Maharachchikumbura et al., Fungal Divers 72: 218 (2015)

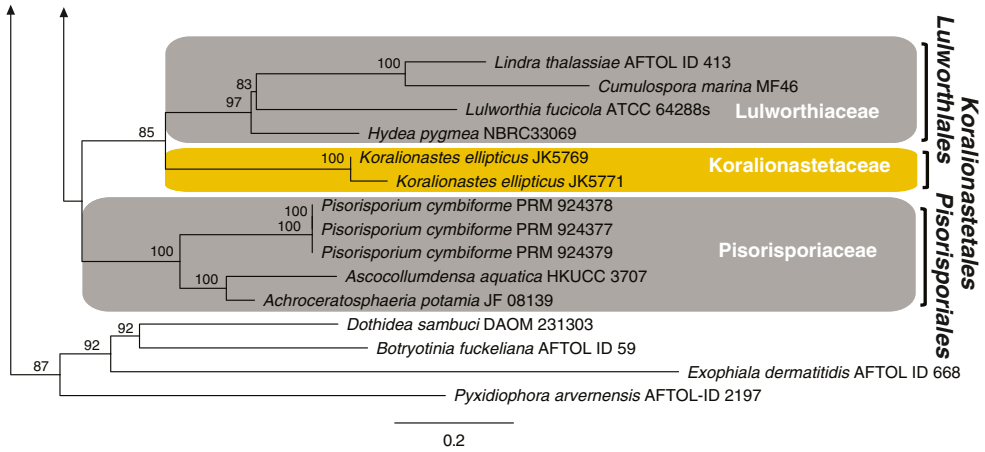


Fig. 2 (continued)

This monotypic order in the subclass *Hypocreomycetidae* accommodate the family *Falcocladiaceae*. Members of this family are saprobes on leaf litter and leaves including *Eucalyptus grandis* and *E. camaldulensis* in tropical, terrestrial habitats (Crous et al. 1994; Jones et al. 2014). The order presently includes one hyphomycetous asexual genus *Falcocladium* introduced by Crous et al. (1994). Jones et al. (2014) introduced the monotypic family *Falcocladiaceae* based on SSU and LSU sequence data to accommodate members of genus *Falcocladium* and suggested further taxon sampling was needed to determine its ordinal status. There is no recorded sexual morph for this order. Phylogenies recovered herein depict that the *Falcocladiales* is most closely related to the order *Coronophorales* (Figs. 1 and 2).

Glomerellales Chadef. ex Réblová et al., Stud. Mycol. 68(1): 170 (2011)

Chadefaud (1960) proposed the order "*Glomérellales*" but without a Latin diagnosis and the name was thus invalid. The order *Glomerellales* was therefore validly published by Réblová et al. (2011) in the class *Sordariomycetes* and comprised three families *Australiascaceae*, *Reticulascaceae* and *Glomerellaceae*. The introduction was based on analysis of ITS1, 5.8S rDNA and ITS2 (ITS), nc28S (LSU) rDNA, and nc18S (SSU) rDNA datasets, and a combined data set of LSU-SSU-RPB2. Maharachchikumbura et al. (2015) included *Plectosphaerellaceae* in to this order based on a combined data set of LSU-SSU-TEF-RPB2. Current analyses clearly demonstrate that this order, represented by four families is monophyletic.

Hypocreales Lindau, in Engler & Prantl, Nat. Pflanzenfam., Teil. I (Leipzig) 1(1): 343 (1897)

Members of the *Hypocreales* are highly diverse in the tropics, subtropics temperature regions (Põldmaa 2011). *Hypocreales* is represented by *Bionectriaceae*, *Clavicipitaceae*, *Cordycipitaceae*, *Flammocladiaceae*, *Hypocreaceae*, *Nectriaceae*, *Niessliaceae*, *Ophiocordycipitaceae*, *Stachybotriaceae* and *Tilachlidiaceae*.

Jobellisiales D'souza & K.D. Hyde, in Maharachchikumbura et al., Fungal Divers 72: 219 (2015)

Jobellisiales is a monotypic order in the class *Sordariomycetes*, subclass *Diaporthomycetidae*. It includes a single family *Jobellisiaceae* characterized by saprobic lignicolous taxa found in terrestrial and freshwater habitats. This order encompasses taxa that possess relatively large, superficial ascomata, a three layered, thick peridium, cylindrical asci and one septate ascospores. Ascomata of *Jobellisia luteola* (Ellis & Everh.) M.E. Barr are peculiar in appearing orange to yellow brown, whereas those of *J. barrii* Huhndorf et al. and *J. viridifusca* K.M. Tsui & K.D. Hyde have a bright orange middle wall layer (Ranghoo et al. 2001, Liu et al. 2012). The family *Jobellisiaceae* was introduced by Réblová (2008) as a monotypic family and currently includes seven species. Réblová (2008), using LSU rDNA sequence analysis, showed that the closest relatives to *Jobellisiaceae* are *Calosphaeriales* and *Togniniaceae*. No asexual morph is reported for this order.

Koralionastetales Kohlm. et al., Mycol. Res. 113(3): 377 (2009)

Based on the combined dataset of SSU and LSU rDNA sequences and morphological characters the genera *Koralionastes* and *Pontogeneia* were assigned to the new

order *Koralionastetales* (Campbell et al. 2009). *Koralionastetales* shows phylogenetic affinities to *Lulworthiales* and *Pisorisporiales*.

Lulworthiales Kohlm. et al., Mycologia 92(3): 456 (2000)

Kohlmeyer et al. (2000) assigned two genera *Lulworthia* and *Lindra* to this new order and the new family (*Lulworthiaceae*). Abdel-Wahab et al. (2010) showed that a number of asexual morphs also belong in this family, i.e. *Halazoon*, *Hydea* and *Orbimyces*. Members of *Lulworthiales* lack an apical ring in the asci and have ascospores with apical chambers from which mucilage is released (Campbell et al. 2005). The *Lulworthiaceae* is a monophyletic lineage with high support and is a sister family to the *Koralionastetaceae* (Fig 2)

Magnaporthales Thongk. et al., Fungal Diversity 34: 166 (2009)

A phylogenetic study of *Pyricularia* (Sacc.) Sacc. and related genera in *Magnaporthales* by Klaubauf et al. (2014) resulted in the introduction of two new families, *Ophioceraceae* and *Pyriculariaceae. Ophioceraceae* comprises a single genus *Ophioceras*, containing species that mostly occur on wood submerged in freshwater. *Magnaporthaceae* was considered to include *Buergenerula*, *Bussabanomyces*, *Endopyricularia*, *Gaeumannomyces*, *Harpophora*, *Magnaporthiopsis*, *Nakataea*, *Omnidemptus*, *Pyriculariopsis* and *Slopeiomyces* with *Nakataea* as the correct name for the type of the family. The new genus *Kohlmeyeriopsis* was introduced based on molecular data and morphology. *Pyriculariaceae* was introduced and included *Deightoniella* and *Pyricularia*, and the new genera *Bambusicularia*, *Barretomyces*, *Macgarvieomyces*, *Neopyricularia*, *Proxipyricularia*, *Pseudopyricularia* and *Xenopyricularia* (Klaubauf et al. 2014).

Melanosporales N. Zhang & M. Blackw., in Hibbett et al., Mycol. Res. 111(5): 531 (2007)

This order was suggested in Zhang et al. (2006) but not validly published; it was formally introduced by Hibbett et al. (2007) to accommodate *Melanospora* and *Sphaerodes* in *Ceratostomataceae*.

Meliolales Gäum et al., Syst. Ascom. 5(1): 180 (1986)

This order was introduced by Hawksworth and Eriksson (1986) and it accommodates a single family *Meliolaceae*, which are the black mildews, and comprise eight genera. This group is unique in producing black web-like colonies on the host, comprising superficial brown to black mycelium with appressoria (Hosagoudar 2004). Until recently the family was thought to be a member of *Dothideomycetes* (Lumbsch and Huhndorf 2007a).

Microascales Luttr. et al., Mycotaxon 12(1): 40 (1980)

The order *Microascales* was introduced by Benny and Kimbrough (1980) to accommodate *Chadefaudiellaceae*, *Microascaceae* and *Pithoascaceae*, and later expanded to include *Ceratocystidaceae*, *Gondwanamycetaceae*, *Halosphaeriaceae* and *Graphiaceae* (Réblová et al. 2011).

Ophiostomatales Benny & Kimbr., Mycotaxon 12(1): 48 (1980)

This order was introduced by Benny and Kimbrough (1980) for the family *Ophiostomataceae*; while *Kathistaceae* was added by Malloch and Blackwell (1990).

Phyllachorales M.E. Barr, Mycologia 75(1): 11 (1983)

The order *Phyllachorales* was introduced by Barr (1983) comprising two families, viz. *Phaeochoraceae* and *Phyllachoraceae*. This order is distinctive as the species are biotrophs on various hosts, where they form bright or black stroma (Pearce and Hyde 1994). Asci are unitunicate and ascospores are hyaline or lightly pigmented (Barr 1983; Pearce and Hyde 1993a, b, 1994). There is a close phylogenetic association of the *Phyllachorales* to the *Boliniales*.

Pisorisporiales Réblová & J. Fourn., Persoonia 34: 43 (2015)

This monotypic order was introduced by Réblová et al. (2015) based on LSU, SSU and RPB2 sequence data. It currently includes the family *Pisorisporiaceae*. In their analyses, the *Pisorisporiales* nested in a weakly-supported clade sister to the orders *Lulworthiales* and *Koralionastetales*.

Pleurotheciales Réblová & Seifert, in Réblová et al., Persoonia 37: 63 (2016)

Pleurotheciales accommodates the family *Pleurotheciaceae*, which comprises 11 genera. Members of the order *Pleurotheciales* share dark, papillate, glabrous or sparsely setose perithecia, upright or lying horizontally to the host, asci with a distinct non-amyloid apical annulus, filiform paraphyses that disintegrate partially at maturity and fusiform to ellipsoidal, septate, hyaline ascospores (Réblová et al. 2016).

Savoryellales Boonyuen et al., in Boonyuen et al., Mycologia 103(6): 1368 (2011)

The taxonomic placement of the genus *Savoryella* has been widely debated and Jones et al. (2009a, b) referred it to the *Sordariales* genera *incertae sedis*. Boonyuen et al. (2011), in a combined phylogenetic analysis of *Savoryella* species (LSU, SSU, 5.8S rRNA genes, RPB1, RPB2, TEF), showed that

they formed a monophyletic group in the *Sordariomycetes*, but showed no affinities with other accepted orders. The order *Savoryellales* was introduced to accommodate *Savoryella* species, along with the genera *Ascotaiwania*, *Ascothailandia* (and its asexual morph *Canalisporium*), as they formed a distinct lineage in the *Sordariomycetes* (Boonyuen et al. 2011).

Sordariales Chadef. ex D. Hawksw. & O.E. Erikss., Syst. Ascom. 5(1): 182 (1986)

This order was introduced by Hawksworth and Eriksson (1986) and comprises three families viz. *Chaetomiaceae*, *Sordariaceae* and *Lasiosphaeriaceae sensu lato*. Most species grow on either dung or decaying substrata, such as wood, or are aquatic, growing on submerged wood (Zhang et al. 2006). The *Sordariales* are characterized by membranous or coriaceous ascomata, and hyaline or brown ascospores often with appendages or sheaths (Zhang et al. 2006). In most studies, a close relationship between *Sordariales* and Chaetosphaeriales has always been observed.

Spathulosporales Kohlm., Mycologia 65(3): 615 (1973)

The *Spathulosporales* is a marine order that includes the family *Hispidicarpomycetaceae* and *Spathulosporaceae*. Some *Spathulosporaceae* species show affinities to the order *Lulworthiales* (Inderbitzin et al. 2004), although the type species (*Spathulospora phycophila* A.R. Caval. & T.W. Johnson) has not been sequenced. Presently this order is classified under *Sordariomycetes*, order *incertae sedis*.

Tirisporellales Suetrong et al., in Jones et al., Fungal Diversity: 73(1): 42 (2015)

Tirisporellales is a monotypic order in the class Sordariomycetes, subclass *Diaporthomycetidae* and includes a single family *Tirisporellaceae*. The family was introduced by Suetrong et al. (2015) with two monotypic genera *Tirisporella* and *Thailandiomyces*, based on SSU and LSU rDNA sequences analysis and morphological observations. *Tirisporella* is a mangrove species found growing on the palm *Nypa fruticans* while *Thailandiomyces* is a freshwater ascomycete growing on the trunks of the palm *Licuala longicalycata*.

Togniniales Senan. et al., in Maharachchikumbura et al., Fungal Diversity: 10.1007/s13225-015-0331-z, [22] (2015)

Togniniales is a monotypic order in the class *Sordariomycetes*, subclass *Diaporthomycetidae*. Our analyses also reveal a similar scenario and the order is basal to the Diaporthales. The *Togniniales* includes a single family *Togniniaceae* containing plant pathogen and saprobic on dead wood. *Togniniaceae* comprising the sexual morph genera *Conidiotheca* and *Togninia* and the asexual morph genus *Phaeoacremonim* (Réblová and Mostert 2007).

Torpedosporales E.B.G. Jones et al., in Jones et al., Fungal Diversity 73(1): 43 (2015)

Based on combined SSU and LSU rDNA sequence analysis Jones et al. (2015) showed that taxa in the families *Etheirophoraceae*, *Juncigenaceae* and *Torpedosporaceae* form a highly supported clade in the *Hypocreomycetidae* and a new order *Torpedosporales* was introduced. Similar phylogenies are obtained in this study. Members of the order are saprobic on lignicolous substrates and leaves, in marine habitats. The *Torpedosporales* shows phylogenetic affinities to the orders *Falcocladiales*, *Coronophorales* and *Melanosporales* (Jones et al. 2015)

Trichosphaeriales M.E. Barr, Mycologia 75(1): 11 (1983)

This order was introduced by Barr (1983) based on *Trichosphaeria pilosa* (Pers.) Fuckel. The current classification of *Trichosphaeriales* recognizes only one family, the terrestrial *Trichosphaeriaceae. Trichosphaeriaceae* has affinities with *Annulatascaceae*, *Ophiostomataceae* and *Papulosporaceae.*

Xylariales Nannf., Nova Acta R. Soc. Scient. upsal., Ser. 4 8(no. 2): 66 (1932)

The *Xylariales* is a large order of perithecial ascomycetes with eight-spored unitunicate asci, with a J+, apical ring and ascospores with a prominent germ slit (Smith et al. 2003). Presently there are 22 families accepted in *Xylariales*.

Taxonomy

Outline of *Sordariomycetes*, 31 December 2015

• = sequence data in GenBank as at date on submission

Class *SORDARIOMYCETES* *sensu* O.E. Erikss. & Winka

Diaporthomycetidae Senan. et al.

Annulatascales D'souza et al.
Annulatascaceae S.W. Wong et al.
Annulatascus K.D. Hyde •
Annulusmagnus J. Campb. & Shearer •
Aqualignicola V.M. et al.
Aquaticola W.H. Ho et al. •
Ascitendus J. Campb. & Shearer•
Ayria Fryar & K.D. Hyde
Cataractispora K.D. Hyde et al. •
Chaetorostrum Zelski et al.
Clohiesia K.D. Hyde •
Cyanoannulus Raja et al. •
Dictyosporella Abdel-Aziz •

Diluviocola K.D. Hyde et al.
Fusoidispora D. Vijaykrishna et al. •
Longicollum Zelski et al.
Pseudoannulatascus Z.L. Luo et al. •
Pseudoproboscispora Punith. •
Rhamphoria Niessl. •
Submersisphaeria K.D. Hyde •
Torrentispora K.D. Hyde et al.
Vertexicola K.D. Hyde et al. •

Calosphaeriales M.E. Barr
Calosphaeriaceae Munk •
Calosphaeria Tul. & C Tul. •
Calosphaeriophora Réblová et al. •
Conidiotheca Réblová & L Mostert
Jattaea Berl •
= *Phragmocalosphaeria* Petr.
= *Wegelina* Berl.
Kacosphaeria Speg.
Sulcatistroma A.W. Ramaley
Togniniella Réblová et al. •
= *Phaeocrella* Réblová et al. •
Tulipispora Révay & J. Gönczöl, in Révay et al.

Pleurostomataceae Réblová, L. Mostert, W. Gams & Crous
Pleurostoma Tul. & C. Tul. •
= *Pleurostomophora* Vijaykr.et al.

Calosphaeriales genera, *incertae sedis*
Enchnoa Fr. •

Diaporthales Nannf.
Cryphonectriaceae Gryzenh. & M.J. Wingf.
Amphilogia Gryzenh. et al. •
Aurantiosacculus Dyko & B. Sutton •
Aurapex Gryzenh. & M.J. Wingf. •
Aurifilum Begoude et al. •
Celoporthe Nakab. et al. •
Chromendothia Lar.N. Vassiljeva •
Chrysocrypta Crous & Summerell •
Chrysofolia Crous & M.J. Wingf. •
Chrysoporthe Gryzenh. & M.J. Wingf. •
= *Chrysoporthella* Gryzenh. & M.J. Wingf. •
Cryphonectria (Sacc.) Sacc. & D. Sacc. •
= *Endothiella* Sacc.
Cryptometrion Gryzenh. & M.J. Wingf. •
Diversimorbus S.F. Chen & J. Roux •
Endothia Fr. •
Foliocryphia Cheewangkoon & Crous •
Holocryphia Gryzenh. & M.J. Wingf. •
Immersiporthe S.F. Chen et al. •
Lasmenia Speg. •
Latruncellus M. Verm. et al. •
Luteocirrhus C.F. Crane & T.I. Burgess •
Mastigosporella Höhn. •
Microthia Gryzenh. & M.J. Wingf. •
Prosopidicola Crous & C.L. Lennox •
Rostraureum Gryzenh. & M.J. Wingf. •
Ursicollum Gryzenh. & M.J. Wingf. •

Diaporthaceae Höhn. ex Wehm.
Allantoporthe Petr.
Apioporthella Petr.
Clypeoporthella Petr.
Diaporthe Nitschke •
= *Phomopsis* (Sacc) Bubák
Diaporthella Petr. •
Leucodiaporthe M.E. Barr & Lar.N. Vassiljeva
Mazzantia Mont. •
= *Mazzantiella* Höhn.
Ophiodiaporthe Y.M. Ju et al. •
Pustulomyces D.Q. Dai et al. •
Stenocarpella Syd. & P. Syd. •

Gnomoniaceae G. Winter
Alnecium Voglmayr & Jaklitsch •
Ambarignomonia Sogonov •
Amphiporthe Petr. •
Anisomyces Theiss. & Syd.
Apiognomonia Höhn. •
Apioplagiostoma M.E. Barr •
Asteroma DC. •
Bagcheea E. Müll. & R. Menon
Clypeoporthe Höhn.
Cryptosporella Sacc. •
Cylindrosporella Höhn.
Depazea Fr.
Diplacella Syd.
= *Discosporium* Höhn.
= *Discula* Sacc.
Ditopella De Not. •
Ditopellopsis J. Reid & C. Booth •
Gloeosporidina Petr.
Gnomonia Ces. & De Not.
Gnomoniella Sacc. •
Gnomoniopsis Berl. •
Mamiania Ces & De Not.
Millerburtonia Cif .
Occultocarpon L.C. Mejía & Zhu L. Yang •
Ophiognomonia (Sacc.) Sacc. •
Phragmoporthe Petr. •
Phylloporthe Syd.
Plagiostoma Fuckel •
= *Cryptodiaporthe* Petr.
= *Diplodina* Westend

Pleuroceras Riess. •
= *Linospora* Fuckel
Skottsbergiella Petr.
Sirococcus Preuss •
Spataporthe Bronson et al.
Uniseta Ciccar
Xenotypa Petr.
Zythia Fr. •

Harknessiaceae Crous
Harknessia Cooke •

Macrohilaceae Crous
Macrohilum H.J. Swart •

Melanconidaceae G. Winter
Botanamphora Nograsek & Scheuer
Ceratoporthe Petr.
Cytomelanconis Naumov
Dicarpella Syd. & P. Syd. •
Dictyoporthe Petr.
Fremineavia Nieuwl.
Gibellia Sacc.
Hypophloeda K.D. Hyde & E.B.G. Jones
Kensinjia J. Reid & C. Booth
Macrodiaporthe Petr.
Massariovalsa Sacc.
Mebarria J. Reid & C. Booth
Melanamphora Lafl.
Melanconiella Sacc. •
Melanconiopsis Ellis & Everh.
Melanconis Tul. & C. Tul. •
= *Melanconium* Link
Phragmodiaporthe Wehm.
Plagiophiale Petr.
Plagiostigme Syd.
Prostratus Sivan. et al.
Pseudovalsella Höhn.
Wehmeyera J. Reid & C. Booth
Wuestneia Auersw. ex Fuckel •
Wuestneiopsis J. Reid & Dowsett

Pseudoplagiostomataceae Cheew. et al.
Pseudoplagiostoma Cheew. et al. •

Pseudovalsaceae M.E. Barr
Apoharknessia Crous & S.J. Lee •
Coryneum Nees
= *Pseudovalsa* Ces. & De Not. •

Schizoparmaceae Rossman
Coniella Höhn. •
= *Baeumleria* Petr. & Syd.
Pilidiella Petr. & Syd. •
= *Schizoparme* Shear

Stilbosporaceae Link
Crinitospora B. Sutton & Alcorn •
Natarajania Pratibha & Bhat •
Stilbospora Pers. •
Stegonsporium Corda •

Sydowiellaceae Lar.N. Vassiljeva
Cainiella E. Müll. •
Calosporella J. Schröt •
Chapeckia M.E. Barr •
Hapalocystis Auersw. ex Fuckel •
Lambro Racib.
Rossmania Lar.N. Vassiljeva •
Sillia P. Karst. •
Stegophora Syd. & P. Syd.
Sydowiella Petr. •
Uleoporthe Petr.
Winterella (Sacc.) Kuntze •

Valsaceae Tul. & C. Tul.
Amphicytostroma Petr.
Chadefaudiomyces Kamat et al.
Cryptascoma Ananthap.
Cytospora Ehrenb. •
= *Leucostoma* (Nitschke) Höhn.
= *Valsa* Fr.
= *Valsella*Fuckel
= *Valseutypella* Höhn.
Ditopellina J. Reid & C. Booth
Durispora K.D. Hyde
Harpostroma Höhn.
Hypospilina (Sacc) Traverso
Kapooria J. Reid & C. Booth
Leptosillia Höhn.
Maculatipalma J. Fröhlich & K.D. Hyde •
Pachytrype Berl. ex M.E. Barr et al. •
Paravalsa Ananthap.

Diaporthales, genera *incertae sedis*
*Argentinomyces*N.I. Peña & Aramb.
Anisogramma Theiss. & Syd. •
Anisomycopsis I. Hino & Katum.
Apiosporopsis (Traverso) Mariani •
= *Sphaerognomonia* Potebnia ex Höhn.
Apomelasmia Grove
Auratiopycnidiella Crous & Summerell •
Bagadiella Cheew. & Crous •
Caudospora Starbäck

Chaetoconis Clem. •
Cryptoleptosphaeria Petr.
Cryptonectriella (Höhn.) Weese
Cryptonectriopsis (Höhn.) Weese
Diatrypoidiella Manohar et al.
Disculoides Crous et al. •
Dwiroopa Subram. & Muthumary
Erythrogloeum Petr. •
Exormatostoma Gray
Greeneria Scribn. & Viala •
Gyrostroma Naumov •
Hercospora Fr. •
Hyalorostratum Raja & Shearer •
Hypodermina Höhn.
Keinstirschia J. Reid & C. Booth
Lollipopaia Inderbitzin •
Mamianiella Höhn. •
Pseudocryptosporella J. Reid & C. Booth
Pseudothis Theiss. & Syd.
Rabenhorstia Fr. •
Savulescua Petr.
Sphaerognomoniella Naumov & Kusnezowa
Stioclettia Dennis
Trematovalsa Jacobesco
Tubakia B. Sutton •
Valsalnicola D.M. Walker & Rossman •
Vismaya V.V. Sarma & K.D. Hyde

Jobellisiales D'souza & K.D. Hyde
Jobellisiaceae Réblová
Jobellisia M.E. Barr •

Magnaporthales Thongk. et al.
Magnaporthaceae P.F. Cannon
Budhanggurabania P. Wong et al. •
Buergenerula Syd. •
Bussabanomyces Klaubauf et al. •
Ceratosphaerella Huhndorf et al. •
Ceratosphaeria Niessl. •
Clasterosphaeria Sivan.
Clasterosporium Schwein
Clavatisporella K.D. Hyde
Gaeumannomyces Arx & D.L. Olivier •
Harpophora W. Gams •
Herbampulla Scheuer & Nograsek
Kohlmeyeriopsis Klaubauf et al. •
Magnaporthe R.A. Krause & R.K. Webster •
Magnaporthiopsis J. Luo & N. Zhang •
Muraeriata Huhndorf et al. •
Mycoleptodiscus Ostaz. •
Nakataea Hara •
Neogaeumannomyces D.Q. Dai & K.D. Hyde •
Omnidemptus P.F. Cannon & Alcorn •
Phomatospora Sacc. •
Pseudophialophora J. Luo & N. Zhang •
Pyriculariopsis M.B. Ellis •
Slopeiomyces Klaubauf et al. •

Ophioceraceae Klaubauf et al.
Ophioceras Sacc. •

Pyriculariaceae Klaubauf et al.
Bambusicularia Klaubauf et al. •
Barretomyces Klaubauf et al. •
Deightoniella S. Hughes •
= *Utrechtiana* Crous & Quaedvl.
Macgarvieomyces Klaubauf et al. •
Neocordana Hern.-Rest. & Crous •
Neopyricularia Klaubauf et al. •
Proxipyricularia Klaubauf et al. •
Pseudopyricularia Klaubauf et al. •
Pyricularia Sacc. •
Xenopyricularia Klaubauf et al. •

Magnaporthales, genera *incertae sedis*
Pseudohalonectria Minoura & T. Muroi •

Ophiostomatales Benny & Kimbr.
Kathistaceae Malloch & M. Blackw. •
Kathistes Malloch & M. Blackw. •
Mattirolella S. Colla
Termitariopsis M. Blackw. et al.

Ophiostomataceae Nannf.
Ceratocystiopsis H.P. Upadhyay & W.B. Kendr. •
Fragosphaeria Shear •
Hyalobelemnospora Matsush.
Hyalorhinocladiella H.P. Upadhyay & W.B. Kendr. •
Klasterskya Petr.
Leptographium Lagerb. & Melin •
Ophiostoma Syd. & P. Syd. •
Pesotum JL Crane & Schokn. •
Phialographium H.P. Upadhyay & W.B. Kendr. •
Raffaelea Arx & Hennebert •
Spumatoria Massee & E.S. Salmon
Subbaromyces Hesselt. •

Ophiostiomatales, genera *incertae sedis*
Lanspora K.D. Hyde & E.B.G. Jones •

Tirisporellales Jones et al.
Tirisporellaceae Suetrong et al. •
Bacusphaeria Norlailatul et al. •
Tirisporella E.B.G. Jones et al. •

Thailandiomyces Pinruan et al. •

Togniniales Senan. et al.
Togniniaceae Réblová et al. •
Conidiotheca Réblová & L. Mostert
Phaeoacremonium W. Gams et al. •
= *Togninia*Berl. •

Trichosphaeriales M.E. Barr
Trichosphaeriaceae G. Winter
Acanthosphaeria Kirschst.
Brachysporium Sacc.
Collematospora Jeng & Cain
Coniobrevicolla Réblová
Cresporhaphis M.B. Aguirre
Cryptadelphia Réblová & Seifert •
Eriosphaeria Sacc.
Fluviostroma Samuels & E. Müll.
Kananascus Nag Raj •
Khuskia H.J. Huds. •
Koorchaloma Subram. •
Neorehmia Höhn.
Oplothecium Syd.
Rizalia Syd. & P. Syd.
Schweinitziella Speg.
Setocampanula Sivan. & W.H. Hsieh
Trichosphaeria Fuckel •
Unisetosphaeria Pinnoi et al.

Diaportheomycetidae, families *incertae sedis*
Distoseptisporaceae K.D. Hyde & McKenzie
Distoseptispora K.D. Hyde et al.•

Papulosaceae Winka & O.E. Erikss.
Brunneosporella V.M. Ranghoo & K.D. Hyde
Fluminicola S.W. Wong et al.
Papulosa Kohlm & Volkm-Kohlm •

Sporidesmiaceae Fr.
Sporidesmium Link •

Thyridiaceae O.E. Erikss & J.Z. Yue
Mattirolia Berl. & Bres.
= *Balzania* Speg.
= *Thyronectroidea* Seaver
Pleurocytospora Petr.
Thyridium Nitschke •

Diaportheomycetidae, genera *incertae sedis*
Platytrachelon Réblová •

Subclass *Hypocreomycetidae* O.E. Erikss. & Winka

Conioscyphales Réblová & Seifert
Conioscyphaceae Réblová & Seifert
Conioscypha Höhn. •
= *Conioscyphascus* Réblová & Seifert
Coronophorales Nannf.
Bertiaceae Smyk
Bertia De Not. •
Gaillardiella Pat. •

Chaetosphaerellaceae Huhndorf et al.
Chaetosphaerella E. Müll. & C. Booth •
Crassochaeta Réblová •
Oedemium Link
= *Veramycina* Subram.
Spinulosphaeria Sivan. •

Coronophoraceae Höhn.
Coronophora Fuckel •

Nitschkiaceae (Fitzp) Nannf.
Acanthonitschkea Speg. •
Biciliosporina Subram. & Sekar
Botryola Bat. & J.L. Bezerra
Fracchiaea Sacc. •
Groenhiella Jørg. Koch et al.
Janannfeldtia Subram. & Sekar
Lasiosphaeriopsis D. Hawksw. & Sivan.
Loranitschkia Lar.N. Vasiljeva
Neochaetosphaerella Lar.N. Vassiljeva et al.
Neotrotteria Sacc. •
Nitschkia G.H. Otth ex P. Karst.
Rhagadostoma Körb.
Rhagadostomella Etayo
Tortulomyces Lar.N. Vassiljeva et al.

Scortechiniaceae Huhndorf et al.
Biciliospora Petr. •
Coronophorella Höhn. •
Cryptosphaerella Sacc. •
Euacanthe Theiss. •
Neofracchiaea Teng •
Scortechinia Sacc. •
Scortechiniella Arx & E. Müll. •
Scortechiniellopsis Sivan. •
Tympanopsis Starbäck •

Coronophorales, genera *incertae sedis*
Pseudocatenomycopsis Crous & L.A. Shuttlew. •

Falcocladiales R.H. Perera et al.
Falcocladiaceae Somrithipol et al.
Falcocladium S.F. Silveira et al. •

Glomerellales Chadef. ex Réblová et al.
Australiascaceae Réblová & W. Gams
Monilochaetes Halst. ex Harter •
= *Australiasca* Sivan. & Alcorn
Hyalocylindrophora J.L. Crane & Dumont

Glomerellaceae Locq. ex Seifert & W. Gams
Colletotrichum Corda •
= *Glomerella* Spauld. & Schrenk

Plectosphaerellaceae W. Gams et al.
Acrostalagmus Corda •
Chordomyces Bilanenko, M.L et al. •
Gibellulopsis Bat. & H. Maia •
Lectera P.F. Cannon •
Musicillium Zare & W Gams •
Plectosphaerella Kleb. •
= *Plectosporium* M.E. Palm et al.
= *Spermosporina* U. Braun
Sodiomyces A.A. Grum-Grzhim. et al. •
Stachylidium Link •
Verticillium Nees •

Reticulascaceae Réblová & W. Gams
Cylindrotrichum Bonord. •
= *Reticulascus* Réblová & W. Gams
Kylindria DiCosmo et al. •
Sporoschismopsis Hol-Jech. & Hennebert •
= *Porosphaerellopsis* Samuels & E. Müll.

Glomerellales, genera, *incertae sedis*
Ascocodinaea Samuels et al. •

Hypocreales Lindau
Bionectriaceae Samuels & Rossman
= *Spicariaceae* Nann.
Acremonium Link •
Anthonectria Döbbeler
Aphanotria Döbbeler
Battarrina (Sacc.) Clem. & Shear
Bryocentria Döbbeler •
Clonostachys Corda •
= *Bionectria* Speg. •
Clibanites (P. Karst.) P. Karst.
Didymostilbe Henn •
Dimerosporiella Speg.
Gliomastix Guég. •
Globonectria Etayo
Gracilistilbella Seifert
Halonectria E.B.G. Jones
Heleococcum P.M. Jørg. •
Hydropisphaera Dumort •
Ijuhya Starbäck •
Kallichroma Kohlm. & Volkm.-Kohlm. •
Lasionectria (Sacc) Cooke •
Mycocitrus Möller
Nectriella Nitschke ex Fuckel
Nectriopsis Maire •
Ochronectria Rossman & Samuels •
Ovicuculospora Etayo •
Paranectria Sacc.
Peristomialis (W. Phillips) Boud. •
Pronectria Clem.
Protocreopsis Yoshim Doi •
Rhopalocladium Schroers et al.
Roumegueriella Speg. •
Selinia P. Karst. •
Spicellum Nicot & Roquebert •
Stephanonectria Schroers & Samuels •
Stilbocrea Pat. •
Stromatocrea W.B. Cooke
Stromatonectria Jaklitsch & H. Voglmayr •
Trichonectria Kirschst. •
Vesicladiella Crous & M.J. Wingf. •
Verrucostoma Hirooka et al. •
Virgatospora Finley •

Clavicipitaceae (Lindau) Earle ex Rogerson
Aciculosporium I. Miyake •
= *Albomyces* I. Miyake
= *Mitosporium* Clem. & Shear
Amphichorda Fr.
Atkinsonella Diehl. •
Balansia Speg. •
= *Dothichloë* G.F. Atk. •
Cavimalum Yoshim. Doi et al.
Chamaeleomyces Sigler •
Claviceps Tul. •
Collarina Giraldo et al. •
Conoideocrella D. Johnson et al. •
Corallocytostroma Y.N. Yu & Z.Y. Zhang •
Diploöspora Grove
Dussiella Pat. •
Ephelis Fr. •
Epichloë (Fr.) Tul. & C. Tul. •
Epicrea Petr.
Helminthascus Tranzschel
Heteroepichloë E. Tanaka et al. •
Hypocrella Sacc. •
= *Aschersonia* Mont. •
Konradia Racib.
Loculistroma F. Patt & Charles
Metacordyceps G.H. Sung et al. •
Metarhiziopsis D.W. Li et al. •

Metarhizium Sorokīn •
Metapochonia Kepler et al. •
Moelleriella Bres. •
Mycomalus Möller
Myriogenospora G.F. Atk. •
Neobarya Lowen •
Neoclaviceps J. White et al. •
Neocordyceps Kobayasi
Neotyphodium Glenn et al. •
Nigrocornus Ryley & Langdon •
Nomuraea Maubl. •
Orbiocrella D. Johnson et al. •
Parepichloë F.J. White Jr. & Reddy •
Periglandula U. Steineret al. •
Pochonia Bat. & O.M. Fonseca •
Pseudogibellula Samson & H.C. Evans •
Pseudomeria G.L. Barron
Regiocrella Chaverri & K.T. Hodge •
Romanoa Thirum.
Rotiferophthora G.L. Barron •
Samuelsia Chaverri & K.T. Hodge •
Shimizuomyces Kobayasi •
Sphacelia Lév. •
Sphaerocordyceps Kobayasi
Stereocrea Syd. & P. Syd.
Tyrannicordyceps Kepler & Spatafora •
Ustilaginoidea Bref. •
= *Villosiclava* E. Tanaka & C. Tanaka

Cordycipitaceae Kreisel ex G.M. Sung et al.
Akanthomyces Lebert •
Ascopolyporus Möller •
Beejasamuha Subram. & Chandrash.
Beauveria Vuill. •
Coremiopsis Sizova & Suprun
Engyodontium de Hoog •
Cordyceps (Fr.) Link •
Gibellula Cavara •
Granulomanus de Hoog & Samson
Hyperdermium J. White et al. •
Isaria Pers. •
Lecanicillium W. Gams & Zare •
Microhilum H.Y. Yip & A.C. Rath •
Pseudogibellula Samson & H.C. Evans •
Rotiferophthora G.L. Barron •
Simplicillium W. Gams & Zare •
Syspastospora P.F. Cannon & D. Hawksw. •
Torrubiella Boud. •

Flammocladiaceae Crous et al.
Flammocladiella Crous et al. •

Hypocreaceae De Not.
= *Trichodermataceae* Fr.
Aphysiostroma Barrasa et al. •
Arachnocrea Z. Moravec. •
Dialhypocrea Speg.
Escovopsis J.J. Muchovej & Della Lucia •
Escovopsioides H.C. Evans & J.O. Augustin •
Hypocreopsis P. Karst. •
Hypomyces (Fr.) Tul. •
= *Cladobotryum* Nees
Lichenobarya Etayo et al. •
Mycogone Link •
Payoshaeria W.F. Leong •
Protocrea Petch •
Pseudohypocrea Yoshim. Doi
Rogersonia Samuels & Lodge
Sepedonium Link •
Sibirina G.R.W. Arnold
Sphaerostilbella (Henn.) Sacc. & D. Sacc •
= *Gliocladium* Corda
Sporophagomyces K. Põldmaa & Samuels •
Stephanoma Wallr •
Trichoderma Pers. •
= *Hypocrea* Fr.
= *Sarawakus* Lloyd

Nectriaceae Tul. & C. Tul.
= *Tubercul ariaceae* Fr.
Albonectria Rossman & Samuels •
Allantonectria Earle •
Allonectella Petr.
Antipodium Piroz.
Aquanectria L. Lombard & Crous •
Atractium Link •
Baipadisphaeria Pinruan •
Bisifusarium L. Lombard et al. •
Calonectria De Not. •
= *Cylindrocladium* Morgan
Calostilbe Sacc. & Syd.
= *Calostilbella* Höhn. •
Campylocarpon Halleen et al. •
Chaetonectrioides Matsush. •
Chaetopsina Rambelli •
= *Chaetopsinectria* J Luo & WY Zhuang
Coccinonectria Lombard & Crous •
Corallomycetella Henn. •
Corallonectria C. Herrera & P. Chaverri •
Cosmospora Rabenh. •
= *Dialonectria* (Sacc.) Cooke
Curvicladiella Decock & Crous
Curvicladium Decock & Crous •
Cyanochyta Höhn.
Cyanonectria Samuels & Chaverri •
Cyanophomella Höhn.

Cylindrocladiella Boesew. •
= *Nectricladiella* Crous & C.L. Schoch
Cylinrocarpostylus
Cylindrodendrum Bonord. •
Dacryoma Samuels
Dactylonectria L. Lombard & Crous •
Dematiocladium Allegr. et al. •
Fusarium Link •
= *Gibberella* Sacc.
Fusicolla Bonord •
Geejayessia Schroers et al. •
Gliocephalotrichum J.J. Ellis & Hesselt. •
= *Leuconectria* Rossman et al.
Gliocladiopsis S.B. Saksena •
= *Glionectria* Crous & C.L. Schoch
Ilyonectria P. Chaverri & C. Salgado •
Macroconia (Wollenw.) Gräfenhan et al. •
Mariannaea G. Arnaud ex Samson •
Microcera Desm. •
= *Pseudomicrocera* Petch
Nalanthamala Subram. •
= *Rubrinectria* Rossman & Samuels
Nectria (Fr.) Fr. •
= *Tubercularia* Tode
Nectricladiella Crous & C.L. Schoch •
Neonectria Wollenw. •
= *Cylindrocarpon* Wollenw.
= *Heliscus* Sacc
Neocosmospora E.F. Sm. •
= *Haematonectria* Samuels & Nirenberg
Ophionectria Sacc. •
Paracremonium L. Lombard & Crous •
Payosphaeria W.F. Leong •
Penicillifer Emden •
= *Viridispora* Samuels & Rossman
Persiciospora P.F. Cannon & D. Hawksw. •
Pleogibberella Sacc.
Pleonectria Sacc. •
= *Zythiostroma* Höhn ex Falck
Pleurocolla Petr. •
Pseudocosmospora C. Herrera & P. Chaverri •
Pseudonectria Seaver •
Rectifusarium Lombard et al. •
Rugonectria P. Chaverri & Samuels •
Sarcopodium Ehrenb. •
= *Actinostilbe* Petch
= *Lanatonectria* Samuels & Rossman
Stachybotryna Tubaki & T. Yokoy
Stalagmites Theiss. & Syd.
Stylonectria Höhn. •
Thelonectria P. Chaverri & C.G. Salgado •
Thyronectria Sacc. •
Volutella Fr. •
= *Chaetodochium* Höhn.
= *Volutellonectria* J. Luo & W.Y. Zhuang
Xenoacremonium Lombard & Crous •
Xenocalonectria Crous & C.L. Schoch •
= *Xenocylindrocladium* Decock et al. •
Xenogliocladiopsis Crous & W.B. Kendr. •
Xenonectriella Weese

Niessliaceae Kirschst.
Atronectria Etayo
Circinoniesslia Samuels & M.E. Barr
Eucasphaeria Crous •
Hyaloseta A.W. Ramaley •
Malmeomyces Starb.
Melanopsamma Niessl •
Melchioria Penz. & Sacc.
Miyakeomyces Hara
Myrmaeciella Lindau •
Niesslia Auersw. •
Paraniesslia K.M. Tsui et al.
Pseudonectriella Petr.
Pseudorhynchia Höhn.
Rosasphaeria Jaklitsch Voglmayr •
Taiwanascus Sivan. & H.S. Chang
Trichosphaerella E. Bommer et al. •
Valetoniella Höhn.

Ophiocordycipitaceae G.H. Sung et al.
Drechmeria W. Gams & H.B. Jansson •
= *Haptocillium* W. Gams & Zare
Harposporium Lohde •
= *Atricordyceps* Samuels
= *Podocrella* Seaver
= *Polyrhina* Sorokin
Ophiocordyceps Petch •
Polycephalomyces Kobayasi •
= *Blistum* B. Sutton
Purpureocillium Luangsa-ard et al. •
Tolypocladium W. Gams •
= *Chaunopycnis* W. Gams
= *Elaphocordyceps* G.H. Sung & Spatafora

Stachybotriaceae L. Lombard & Crous
Albosynnema E.F. Morris •
Myrothecium Tode •
Parasarcopodium Melnik et al. •
Peethambara Subram. & Bhat •
Sarcopodium Ehrenb. •
Scopinella Lév. •
Stachybotrys Corda •
= *Memnoniella* Höhn.
= *Ornatispora* K.D. Hyde et al.
= *Melanopsamma* Niessl.

= *Valsonectria* Speg.

Tilachlidiaceae Lombard & Crous
Septofusidium W. Gams •
Tilachlidium Preuss •

Hypocreales, genera *incertae sedis*
Acremoniopsis Giraldo et al. •
Alfaria Crous et al. •
Berkelella (Sacc.) Sacc.
Bulbithecium Udagawa & T Muroi •
Emericellopsis J.F.H. Beyma •
Fecundostilbum T.P. Devi & Chowdhry
Geosmithia J. Pitt •
Gynonectria Döbbeler
Hapsidospora Malloch & Cain •
Haptospora G.L. Barron
Harzia Costantin •
Illosporiopsis D. Hawksw.
Illosporium Mart. •
Leucosphaerina Arx •
Metadothella Henn.
Microcyclephaeria Bat. •
Munkia Speg.
Mycoarachis Malloch & Cain •
Neomunkia Petr •
Nigrosabulum Malloch & Cain •
Peloronectria Möller
Perennicordyceps Matočec & I. Kušan •
Pseudoacremonium Crous •
Pseudoidriella Crous & R.G. Shivas •
Pseudomeliola Speg.
Pseudomicrodochium B. Sutton
Rodentomyces Doveri et al. •
Roselliniella Vain •
Sarocladium W. Gams & D. Hawksw. •
Sedecimiella K.L. Pang et al. •
Septomyrothecium Matsush.
= *Sporothrix* Hektoen & C.F. Perkins
Stanjemonium W. Gams et al. •
Stilbella Lindau •
Ticonectria Döbbeler
Tilakidium Vaidya et al.
Trichothecium Link •
Valetoniellopsis Samuels & M.E. Barr •

Melanosporales N. Zhang & M. Blackw.
Ceratostomataceae G. Winter
Acrospeira Berk & Broome
Arxiomyces P.F. Cannon & D. Hawksw.
Erythrocarpon Zukal
Gonatobotrys Corda
Melanospora Corda •
= *Proteophiala* Cif.
Pteridiosperma J.C. Krug & Jeng
Pustulipora P.F. Cannon
Rhytidospora Jeng & Cain
Setiferotheca Matsush.
Vittatispora P. Chaudhary et al. •

Melanosporales genera, *incertae sedis*
Sphaerodes Clem. •
Papulaspora Preuss •

Microascales Luttr. ex Benny & Kimbr.
= *Halosphaeriales* Kohlm.
Chadefaudiellaceae Faurel & Schotter ex Benny & Kimbr.
Chadefaudiella Faurel & Schotter
Faurelina Locq-Lin. •

Ceratocystidaceae Locq. ex Réblova et al.
Ambrosiella Brader ex Arx & Hennebert •
Ceratocystis Ellis & Halst. •
Chalaropsis Peyronel •
Davidsoniella Z.W. de Beer et al. •
Endoconidiophora Münch •
Huntiella Z.W. de Beer et al. •
Thielaviopsis Went. •
Gondwanamycetaceae Réblová et al.
Custingophora Stolk et al. •
Gondwanamyces Marais & M.J. Wingf. •

Graphiaceae De Beer
Graphium Corda •

Halosphaeriaceae E. Müll & Arx ex Kohlm.
Alisea J. Dupont & E.B.G. Jones •
Aniptodera Shearer & M. Miller •
Anisostagma K.R.L. Petersen & Jørg. Koch
Antennospora Meyers •
Appendichordella R.G. Johnson et al.
Arenariomyces Höhnk •
Ascosacculus J. Campbell et al. •
Bathyascus Kohlm.
Carbosphaerella I. Schmidt •
Ceriosporopsis Linder •
= *Bovicornua* Jørg Koch & E.B.G. Jones
Chadefaudia Feldm.-Maz.
Corallicola Volkm.-Kohlm. & Kohlm.
Corollospora Werderm •
= *Halosigmoidea* Nakagiri et al.
= *Peritrichospora* Linder

Cucullosporella K.D. Hyde & E.B.G. Jones •
Ebullia K.L. Pang •
Fluviatispora K.D. Hyde •
Gesasha Abdel-Wahab & Nagah. •
Haiyanga K.L. Pang & E.B.G. Jones •
Haligena Kohlm. •
Halosarpheia Kohlm. & E. Kohlm. •
Halosphaeria Linder •
Halosphaeriopsis T.W. Johnson •
= *Culcitalna* Meyers & R.T. Moore
Havispora K.L. Pang & Vrijmoed •
Iwilsoniella EBG Jones
Kitesporella Jheng & K.L. Pang •
Kochiella Sakay. et al. •
Lautisporiopsis E.B.G. Jones et al. •
Lignincola Höhnk •
Limacospora Jørg. Koch & E.B.G. Jones
Luttrellia Shearer
Magnisphaera J. Campb. et al. •
= *Matsusphaeria* K.L. Pang & E.B.G. Jones
Marinospora A.R. Caval. •
= *Ceriosporella* (Kohlm.) A.R. Caval.
Moana Kohlm. & Volkm.-Kohlm.
Morakotiella Sakay. •
Nais Kohlm. •
Natantispora J. Campb. et al. •
Nautosphaeria E.B.G. Jones •
Neptunella K.L. Pang & E.B.G. Jones •
Nereiospora EBG Jones et al. •
= *Peritrichospora* Linder
Nimbospora Jørg. Koch •
Nohea Kohlm. & Volkm.-Kohlm. •
Oceanitis Kohlm. •
= *Ascosalsum* J. Campb. et al.
= *Falcatispora* K.L. Pang & E.B.G. Jones
Ocostaspora E.B.G. Jones et al. •
Okeanomyces K.L. Pang & E.B.G. Jones •
Ondiniella E.B.G. Jones et al. •
Ophiodeira Kohlm. & Volkm.-Kohlm. •
Phaeonectriella R.A. Eaton & E.B.G. Jones •
Praelongicaulis Jones et al. •
Panorbis J. Campb. et al. •
Pileomyces K.L. Pang & Jheng •
Pseudolignincola Chatmala & E.B.G. Jones
Remispora Linder •
Saagaromyces K.L. Pang & E.B.G. Jones •
= *Littispora* J. Campb. et al.
Sablicola E B.G. Jones et al. •
Thalassogena Kohlm. & Volkm.-Kohlm. •
Thalespora Chatmala & E.B.G. Jones •
Tirispora E.B.G. Jones & Vrijmoed •
Toriella Sakay. et al. •
Trailia G.K. Sutherl.
Trichomaris Hibbits et al.
Tubakiella Sakay. et al. •
Tunicatispora K.D. Hyde
= *Buxetroldia* K.R.L. Petersen & Jørg Koch

Microascaceae Luttr. ex Malloch
Anekabeeja Udaiyan & Hosag.
Brachyconidiellopsis Decock et al. •
Canariomyces Arx •
Cephalotrichum Link
Doratomyces Corda •
Echinobotryum Corda
Enterocarpus Locq.-Lin. •
Kernia Nieuwl. •
Knoxdaviesia M.J. Wingf. et al. •
Lophotrichus R.K. Benj. •
Microascus Zukal •
Parascedosporium Gilgado et al. •
Petriella Curzi •
Pseudallescheria Negroni & I. Fisch. •
= *Petriellopsis* Gilgado et al.
Pseudoscopulariopsis M. Sandoval-Denis et al. •
Scedosporium Sacc. ex Castell. & Chalm. •
Scopulariopsis Bainier •
Tinhaudeus K.L. Pang et al. •
Wardomyces F.T. Brooks & Hansf. •
Wardomycopsis Udagawa & Furuya •

Microascales**,** genera *incertae sedis*
Bisporostilbella Brandsb. & E.F. Morris
Cephalotrichiella Crous •
Cornuvesica C.D. Viljoen et al. •
Gabarnaudia Samson & W. Gams•
Sphaeronaemella P. Karst. •
Sporendocladia G. Arnaud ex Nag Raj & W.B. Kendr. •
Trichurus Clem. •
Viennotidia Negru & Verona ex Rogerson
Vermiculariopsiella Bender•

Pleurotheciales Réblová & Seifert
Pleurotheciaceae Réblová & Seifert
Adelosphaeria Réblová •
Brachysporiella Bat. •
Helicoön Morgan •
Melanotrigonum Réblová •
Phaeoisaria Höhn. •
Phragmocephala E.W. Mason & S. Hughes •
Plagiascoma Réblová & J. Fourn. •
Pleurotheciella Réblová •

Pleurothecium Höhn. •
Sterigmatobotrys Oudem. •
Taeniolella S. Hughes •

Savoryellales Boonyuen et al.
Savoryellaceae Jaklitsch & Réblová
Ascotaiwania Sivan. & H.S. Chang•
Canalisporium Nawawi & Kuthub. •
= *Ascothailandia* Sri-indr. et al.
Helicoon Morgan•
Monotosporella S. Hughes•
Savoryella E.B.G. Jones & R.A. Eaton•

Savoryellales**,** genera *incertae sedis*
Carpoligna F.A. Fernández & Huhndorf•
Conioscypha Höhn. •
Flammispora Pinruan et al. •

Hypocreomycetidae, families *incertae sedis*
Etheirophoraceae Rungjindamai et al.
Etheirophora Kohlm. & Volkm.-Kohlm. •
Swampomyces Kohlm. & Volkm. •

Juncigenaceae E.B.G. Jones et al.
Juncigena Kohlm et al. •
Fulvocentrum E.B.G. Jones & Abdel-Wahab •
Marinokulati E.B.G. Jones & K.L. Pang •
Moheitospora Abdel-Wahab et al. •

Torpedosporaceae E.B.G. Jones & K.L. Pang
Glomerulispora Abdel-Wahab & Nagah. •
Torpedospora Meyers •
Hypocreomycetidae, genera *incertae sedis*
Myrmecridium Arzanlou et al. •

Subclass *Lulworthiomycetidae* Dayarathne et al.

Koralionastetales Kohlm. et al.
Koralionastetaceae Kohlm. & Volkm.-Kohlm.
Koralionastes Kohlm. & Volkm.-Kohlm. •
Pontogeneia Kohlm. •

Lulworthiales Kohlm. et al.
Lulworthiaceae Kohlm. et al.
Cumulospora I. Schmidt •
Halazoon Abdel-Aziz et al. •
Haloguignardia A. Cribb & J. Cribb •
Hydea K.L. Pang & E.B.G Jones •
Kohlmeyeriella E.B.G. Jones et al. •
Lindra I. Wilson •
Lulwoana Kohlm. et al. •
Lulwoidea Kohlm. et al. •
Lulworthia G.K. Sutherl •
Matsusporium E.B.G. Jones & K.L. Pang •
Moleospora Abdel-Wahab et al. •
Moromyces Abdel-Wahab et al. •
Orbimyces Linder •
Rostrupiella Jørg Koch et al. •
Spathulospora A.R. Caval. & T.W. Johnson •

Pisorisporiales Réblová & J. Fourn.
Pisorisporiaceae Réblová & J. Fourn.
Achroceratosphaeria Réblová et al. •
Pisorisporium Réblová & J. Fourn.

Subclass *Meliolomycetidae* P.M. Kirk & K.D. Hyde

Meliolales Gäum. ex D. Hawksw. & O.E. Erikss.[#]
Armatellaceae Hosag.
Armatella Theiss. & Syd.

Meliolaceae G.W. Martin ex Hansf.
Amazonia Theiss.
Appendiculella Höhn. •
Asteridiella McAlpine •
Cryptomeliola S. Hughes & Piroz. •
Endomeliola S. Hughes & Piroz. •
Irenopsis F. Stevens •
Meliola Fr. •

Subclass *Sordariomycetidae* O.E. Erikss & Winka

Boliniales P.F. Cannon
Boliniaceae Rick
Apiocamarops Samuels & J.D. Rogers
Apiorhynchostoma Petr. •
Bolinia (Nitschke) Sacc.
Camaropella Lar.N. Vassiljeva •
Camarops P. Karst. •
Cornipulvina Huhndorf et al. •
Endoxyla Fuckel •
Mollicamarops Lar.N. Vassiljeva
Neohypodiscus J.D. Rogers et al. •
Pseudovalsaria Spooner •

Chaetosphaeriales Huhndorf et al.
Chaetosphaeriaceae Réblová et al.
Ascochalara Réblová
Brunneodinemasporium Crous & R.F. Castañeda •
Catenularia Grove
Chaetosphaeria Tul. & C. Tul. •
Chloridium Link •
Codinaea Maire •
Codinaeopsis Morgan-Jones •
Craspedodidymum Hol-Jech.

Cryptophiale Piroz.
Dendrophoma Sacc. •
Dinemasporium Lév. •
Dictyochaeta Speg. •
Dictyochaetopsis Aramb. & Cabello
Exserticlava S. Hughes •
Gonytrichum Nees & T. Nees
Hemicorynespora M.B. Ellis
Infundibulomyces Plaingam et al. •
Kionochaeta P.M. Kirk & B. Sutton •
Lecythothecium Réblová & Winka •
Melanopsammella Höhn. •
Menispora Pers. •
Miyoshiella Kawam.
Neopseudolachnella A. Hashim. & Kaz. Tanaka •
Phaeostalagmus W. Gams
Phialogeniculata Matsush.
Pseudobotrytis Krzemien. & Badura •
Pseudodinemasporium A. Hashim. & Kaz. Tanaka •
Pseudolachnea Ranoj. •
Pyrigemmula D. Magyar & R. Shoemaker •
Rattania Prabhug. & Bhat •
Sporoschisma Berk. & Broome •
= *Melanochaeta* E. Müll. et al.
Striatosphaeria Samuels & E. Müll. •
Tainosphaeria F.A. Fernández & Huhndorf •
Thozetella Kuntze •
Umbrinosphaeria Réblová •
Zanclospora S. Hughes & W.B. Kendr.
Zignoëlla Sacc. •

Helminthosphaeriaceae Samuels et al.
Echinosphaeria A.N. Mill. & Huhndorf •
Endophragmiella B. Sutton
Helminthosphaeria Fuckel •
Hilberina Huhndorf & A.N. Mill. •
Ruzenia O. Hilber •
Synaptospora Cain •
Tengiomyces Réblová

Chaetosphaeriales* genera *incertae sedis
Caudatispora J. Fröhl. & K.D. Hyde •
Erythromada Huhndorf et al. •
Lasiosphaeriella Sivan. •
Leptosporella Penz. & Sacc. •
Nawawia Marvanová •
Rimaconus Huhndorf et al. •

Phyllachorales M.E. Barr
Phaeochoraceae K.D. Hyde et al.
Cocoicola K.D. Hyde
Phaeochora Höhn.
Phaeochoropsis K.D Hyde & P.F. Cannon
Serenomyces Petr. •

Phyllachoraceae Theiss. & H. Syd.
Acerviclypeatus Hanlin
Apiosphaeria Höhn.
Ascovaginospora Fallah et al. •
Brobdingnagia K.D. Hyde & P.F. Cannon
Camarotella Theiss. & Syd.
Coccodiella Hara •
Cyclodomus Höhn.
Deshpandiella Kamat & Ullasa
Diachora Müll. Arg.
= *Diachorella* Höhn.
Diatractium Syd. & P. Syd. •
Erikssonia Penz. & Sacc.
Fremitomyces P.F. Cannon & H.C. Evans
Geminispora Pat.
Gibellina Pass. Ex Roum.
Imazekia Tak. Kobay. & Y. Kawabe
Isothea Fr.
Lichenochora Hafellner
Lindauella Rehm
Linochora Höhn.
Lohwagia Petr.
Maculatifrondes K.D. Hyde
Malthomyces K.D. Hyde & P.F. Cannon
Muelleromyces Kamat & Anahosur
Mycohypallage B. Sutton
Neoflageoletia J. Reid & C. Booth
Ophiodothis Sacc.
Ophiodothella (Henn.). Höhn. •
Orphnodactylis Malloch & Mallik
Oswaldina Rangel
Oxodeora K.D. Hyde & P.F. Cannon
Parberya C.A. Pearce & K.D. Hyde
Petrakiella Syd.
Phaeochorella Theiss. & Syd.
Phycomelaina Kohlm.
Phyllachora Nitschke ex Fuckel •
Phylleutypa Petr.
Phyllocrea Höhn.
Polystigma DC. •
= *Polystigmina* Sacc.
Pseudothiella Petr.
Pseudothiopsella Petr.
Pterosporidium W.H. Ho & K.D. Hyde
Rehmiodothis Theiss. & Syd.
Retroa P.F. Cannon
Rhodosticta Woron.
Rikatlia P.F. Cannon
Schizochora Syd. & P. Syd.
Sphaerodothella C.A. Pearce & K.D. Hyde
Sphaerodothis (Sacc. & P. Syd.) Shear •

Stigmatula (Sacc.) Syd. & P. Syd.
Stigmochora Theiss. &Syd.
Stromaster Höhn.
Telimena Racib.
Telimenella Petr.
Telimenochora Sivan.
Trabutia Sacc. & Roum.
Tribulatia J.E. Taylor et al.
Uropolystigma Maubl.
Vitreostroma P.F. Cannon
Zimmermanniella Henn.

Phyllachorales genera *incertae sedis*
Marinosphaera K.D. Hyde •
Mangrovispora K.D. Hyde & Nakagiri •
Phycomelaina Kohlm. •

Sordariales Chad. ex D. Hawksw. & O.E. Erikss.
Chaetomiaceae G. Winter
Achaetomium J.N. Rai et al. •
Bommerella Marchal
Boothiella Lodhi & Mirza
Botryotrichum Sacc. & Marchal •
Chaetomidium (Zopf) Sacc. •
Corynascella Arx & Hodges •
Chaetomiopsis Mustafa & Abdul-Wahid
Chaetomium Kunze •
Crassicarpon Y. Marín et al. •
Emilmuelleria Arx •
Farrowia D. Hawksw. •
Guanomyces M.C. Gonzáles et al. •
Humicola Traaen •
Madurella Brumpt •
Myceliophthora Costantin •
= *Corynascus* Arx
Staphylotrichum J.A. Mey. & Nicot •
Subramaniula Arx
Taifanglania Z.Q. Liang et al. •
Thielavia Zopf •

Lasiosphaeriaceae Nannf.
Angulimaya Subram & Lodha
Anopodium Lundq. •
Apiosordaria Arx & W. Gams •
Apodospora Cain & J.H. Mirza •
Apodus Malloch & Cain •
Arniella Jeng & J.C. Krug
Arnium Nitschke ex G. Winter •
Bellojisia Réblová •
Biconiosporella Schaumann
Bombardia (Fr.) P. Karst. •
Bombardioidea C. Moreau ex N. Lundqv. •
Camptosphaeria Fuckel
Cercophora Fuckel •
Cladorrhinum Sacc. & Marchal •
Diffractella Guarro et al.
Emblemospora Jeng & J.C. Krug
Eosphaeria Höhn.
Fimetariella N. Lundq. •
Immersiella A.N. Mill. & Huhndorf •
Jugulospora N. Lundq. •
Lacunospora Cailleux
Lasiosphaeria Ces. & De Not. •
Mammaria Ces. ex Rabenh. •
Melanocarpus Arx •
Periamphispora J.C. Krug
Podospora Ces. •
Pseudocercophora Subram. & Sekar
Rinaldiella Deanna A. Sutton et al. •
Schizothecium Corda •
Strattonia Cif. •
Thaxteria Sacc.
Triangularia Boedijn •
Tripterosporella Subram. & Lodha
Zygopleurage Boedijn •
Zygospermella Cain •

Sordariaceae G. Winter
Copromyces N. Lundq. •
Effetia Bartoli et al.
Gelasinospora Dowding •
Guilliermondia Boud.
Neurospora Shear & B.O. Dodge •
= *Chrysonilia* Arx
Pseudoneurospora Dania García et al. •
Sordaria Ces & De Not. •
Stellatospora T. Ito & A. Nakagiri

Sordariales, genera *incertae sedis*
Abyssomyces Kohlm
Acanthotheciella Höhn.
Ascolacicola Ranghoo & K.D. Hyde •
Asterosporium Kunze •
Bombardiella Höhn.
Cancellidium Tubaki •
Coronatomyces Dania García et al. •
Corylomyces Stchigel et al. •
Cuspidatispora A. Mill. •
Globosphaeria D. Hawksw.
Isia D. Hawksw & Manohar
Lasiosphaeris Clem. •
= *Lasiadelphia* Réblová & W Gams
Lockerbia K.D. Hyde
Madurella Brumpt •
Nitschkiopsis Nannf. & R. Sant.
Onygenopsis Henn.

Phaeosporis Clem.
Ramophialophora M. Calduch et al. •
Reconditella Matzer & Hafellner
Rhexodenticula W.A. Baker & Morgan-Jones •
Rhexosporium Udagawa & Furuya
Roselliniomyces Matzer & Hafellner
Roselliniopsis Matzer & Hafellner
Sporidesmiopsis Subram. & Bhat •
Utriascus Réblova
Ypsilonia Lév.

Sordariomycetidae, families *incertae sedis*

Batistiaceae Samuels & K.F. Rodrigues[$]
Acrostroma Seifert
Batistia Cif. •
= *Acrostroma* Seifert

Sordariomycetidae, genera *incertae sedis*
Arecacicola Joanne E. Taylor et al.
Barbatosphaeria Réblová
Bullimyces A. Ferrer et al. •
Ceratolenta Réblová •
Ceratostomella Sacc. •
Chaetosphaerides Matsush.
Conlarium F. Liu & L. Cai •
Hanliniomyces Raja & Shearer
Hydromelitis A. Ferrer et al. •
Lentomitella Höhn. •
Mirannulata Huhndorf et al. •
Menisporopascus Matsush.
Merugia Rogerson & Samuels
Mycomedusiospora G.C. Carroll & Munk
Nigromammilla K.D. Hyde & J. Fröhl.
Phaeotrichosphaeria Sivan.
Phragmodiscus Hansf.
Plagiosphaera Petr.
Rhodoveronaea Arzanlou et al. •
Riomyces A. Ferrer et al. •
Spadicoides S. Hughes •
Xylomelasma Réblová •
Woswasia Jaklitsch et al.

Subclass *Xylariomycetidae* O.E. Erikss & Winka
Xylariales Nannf.

Amphisphaeriaceae G. Winter
Amphisphaeria Ces & De Not. •
Lepteutypa Petr. •

Apiosporaceae K.D. Hyde et al.
Appendicospora K.D. Hyde •
Arthrinium Kunze •
Dictyoarthrinium S. Hughes •
Endocalyx Berk. & Broome •
Scyphospora L.A. Kantsch. •
Spegazzinia Sacc. •

Bartaliniaceae Wijayawardene et al.
Bartalinia Tassi •
Broomella Sacc •
Dyrithiopsis L. Cai et al. •
Hyalotiella Papendorf •
Truncatella Steyaert •
Zetiasplozna Nag Raj •

Beltraniaceae Nann.
Beltrania Penz. •
Beltraniella Subram. •
Beltraniomyces Manohar.
Beltraniopsis Bat. & J.L. Bezerra •
Parapleurotheciopsis P.M. Kirk •
Porobeltraniella Gusmão
Pseudobeltrania Henn. •
Subramaniomyces Varghese & V.G. Rao •

Cainiaceae J.C. Krug
Amphibambusa D.Q. Dai & K.D. Hyde •
Arecophila K.D. Hyde •
Atrotorquata Kohlm. & Volkm.-Kohlm. •
Cainia Arx & E. Müll. •
Seynesia Sacc. •

Clypeosphaeriaceae G. Winter
Apioclypea K.D. Hyde •
Brunneiapiospora K.D. Hyde et al. •
Clypeosphaeria Fuckel •
Crassoascus Checa et al. •
Palmomyces K.D. Hyde et al. •

Coniocessiaceae Asgari & Zare
Coniocessia Dania García et al. •

Diatrypaceae Nitschke
Anthostoma Nitschke •
Cryptosphaeria Ces & De Not. •
Cryptovalsa Ces & De Not. ex Fuckel •
Diatrype Fr. •
Diatrypella (Ces & De Not.) De Not. •
Diatrypasimilis J.J. Zhou & Kohlm. •
Echinomyces Rappaz
Eutypa Tul. & C. Tul. •
Eutypella (Nitschke) Sacc. •
Leptoperidia Rappaz
Monosporascus Pollack & Uecker
Pedumispora K.D. Hyde & E.B.G. Jones •

Peroneutypa Berl. •
Quaternaria Tul. & C. Tul.

Hyponectriaceae Petr.
Apiothyrium Petr.
Arecomyces K.D. Hyde
Arwidssonia B. Erikss.
Cesatiella Sacc.
Chamaeascus L. Holm et al.
Charonectria Sacc.
Discosphaerina Höhn. •
Exarmidium P. Karst.
Frondicola K.D. Hyde
Hyponectria Sacc. •
Micronectria Speg.
Papilionovela Aptroot
Pellucida Dulym. et al. •
Physalospora Niessl •
Phragmitensis M.K.M. Wong et al.
Rhachidicola K.D. Hyde & J. Fröhl.
Xenothecium Höhn.

Iodosphaeriaceae O. Hilber
Iodosphaeria Samuels •

Lopadostomataceae Daranagama & K.D. Hyde
Creosphaeria Theiss. •
Lopadostoma (Nitschke) Traverso •

Melogrammataceae G. Winter
Melogramma Fr. •

Microdochiaceae Hern.-Restr., Crous & J.Z. Groenew.
Idriella P.E. Nelson & S. Wilh. •
Microdochium Syd. •
Selenodriella R.F. Castañeda & W.B. Kendr. •

Myelospermataceae K.D. Hyde & S.W. Wong
Myelosperma Syd. & P. Syd.

Pestalotiopsidaceae Maharachch. & K.D. Hyde
Ciliochorella Syd. •
Monochaetia (Sacc.) Allesch. •
Neopestalotiopsis Maharachch. et al. •
Pestalotiopsis Steyaert •
Pseudopestalotiopsis Maharachch. et al. •
Seiridium Nees •
Phlogicylindriaceae Senan. & K.D. Hyde
*Ciferriascosea*Senanayake et al. •
Phlogicylindrium Crous et al. •
Pseudomassariaceae Senan. & K.D. Hyde
Leiosphaerella Hohn. •
Pseudomassaria Jacz. •
Requienellaceae Boise
Acrocordiella O.E. Erikss. •
Requienella Fabre •
Robillardaceae Crous
Robillarda Sacc. •
Sporocadaceae Corda
= *Discosiaceae* Maharachch. & K.D. Hyde
Adisciso Kaz. Tanaka •
Discosia Lib. •
Discostroma Clem. •
Sarcostroma Cooke •
Seimatosporium Corda •
Strickeria Körb •

Vialaeaceae P.F. Cannon
Vialaea Sacc. •

Xylariaceae Tul. & C. Tul.
"Hypoxyloideae"
Annulohypoxylon Y.M. Ju et al.•
Anthocanalis Daranagama et al. •
Biscogniauxia Kuntze •
Calceomyces Udagawa & S Ueda •
Camillea Fr. •
Daldinia Ces. & De Not. •
Durotheca Læssøe et al. •
Entonaema Möller •
Graphostroma Piroz. •
Hypoxylon Bull. •
Induratia Samuels et al. •
Nodulisporium Preuss •
Obolarina Pouzar •
Phylacia Lév. •
Pyrenomyxa Morgan •
Rhopalostroma D. Hawksw. •
Rostrohypoxylon J. Fourn. & M. Stadler •
Ruwenzoria J. Fourn. et al. •
Thamnomyces Ehrenb. •
Theissenia Maubl. •
Thuemenella Penz. & Sacc. •
Vivantia J.D. Rogers et al.

"Xylarioideae"
Amphirosellinia Y.M. Ju et al.•
Arthroxylaria Seifert & W Gams •
Ascotricha Berk. •
Astrocystis Berk. & Broome •
Coniolariella Dania García et al. •
Collodiscula I. Hino & Katum. •
Emarcea Duong et al. •

Entoleuca Syd. •
Euepixylon Füisting •
Halorosellinia Whalley et al. •
Helicogermslita Lodha & D. Hawksw.
Hypocopra (Fr) J. Kickx f •
Hypocreodendron Henn.
Kretzschmaria Fr. •
Leprieuria Laessøe et al.
Nemania Gray •
Ophiorosellinia J.D. Rogers et al.
Podosordaria Ellis. & Holw. •
Poroleprieuria M.C. González et al. •
Poronia Willd. •
Rosellinia De Not. •
Stilbohypoxylon Henn. •
Xylaria Hill ex Schrank •
Xylotumulus J.D. Rogers et al.

Other *Xylariaceae* genera with conidial states not belong to nodulisporium–like or geniculosporium–like or with unkown conidial states

Anthostomella Sacc. •
Appendixia B.S. Lu & K.D. Hyde
Areolospora S.C. Jong & E.E. Davis
Barrmaelia Rappaz •
Brunneiperidium Daranagama et al. •
Cannonia J.E. Taylor & K.D. Hyde
Chaenocarpus Rebent.
Chlorostroma A.N. Mill. et al.
Cyanopulvis J. Fröhl. & K.D. Hyde •
Engleromyces Henn.
Fasciatispora K.D. Hyde •
Gigantospora B.S. Lu & K.D. Hyde
Guestia G.J.D. Sm. & K.D. Hyde
Jumillera J.D. Rogers et al. •
Kretzschmariella Viégas
Leptomassaria Petr.
Libertella Desm. •
Lunatiannulus Daranagama et al. •
Myconeesia Kirschst
Nipicola K.D. Hyde
Occultitheca J.D. Rogers & Y.M. Ju
Pandanicola K.D. Hyde
Paramphisphaeria F.A. Fernández et al.
Paucithecium Lloyd
Pyriformiascoma Daranagama et al. •
Sabalicola K.D. Hyde
Sarcoxylon Cooke•
Seynesia Sacc.
Spirodecospora B.S. Lu et al.
Squamotubera Henn.
Steganopycnis Syd. & P. Syd.
Striatodecospora D.Q. Zhou et al.
Stromatoneurospora S.C. Jong & E.E. Davis
Virgaria Nees •
Wawelia Namysl.
Whalleya J.D. Rogers et al. •
Xylocrea Möller

Xylariales, genera *incertae sedis*

Adomia S. Schatz
Ascotrichella Valldos. & Guarro
Castanediella Hern.-Restr. & Crous •
Diamantinia A.N. Mill. et al. •
Fassia Dennis
Idriellopsis Hern.-Restr. & Crous •
Lanceispora Nakagiri et al. •
Lasiobertia Sivan. •
Leiosphaerella Höhn. •
Linocarpon Syd. & P. Syd. •
Muscodor Worapong et al. •
Neoidriella Hern.-Restr. & Crous •
Neolinocarpon K.D. Hyde •
Oxydothis Penz. & Sacc. •
Palmicola K.D. Hyde
Paraidriella Hern.-Restr. & Crous •
Pidoplitchkoviella Kiril. •
Plectosphaera Theiss. •
Polyancora Voglmayr & Yule •
Pulmosphaeria Joanne E. Taylor et al.
Sporidesmina Subram. & Bhat
Tristratiperidium Daranagama et al. •
Subramaniomyces Varghese & V.G. Rao •
Yuea O.E. Erikss.

Sordariomycetes, orders *incertae sedis*

Amplistromatales D'souza et al.
Amplistromataceae Huhndorf et al.
Acidothrix Hujslová & M. Kolařík •
Amplistroma Huhndorf et al. •
Wallrothiella Sacc. •
= *Pseudogliomastix* W. Gams
= *Zignoina* Cooke

Catabotrydaceae Petr. ex M.E. Barr
Catabotrys Theiss. & Syd. •

Coniochaetales Huhndorf et al.
Coniochaetaceae Malloch & Cain
Barrina A.W. Ramaley •
Coniochaeta (Sacc.) Cooke •

Cordanales M. Hern.-Rest. & Crous

Cordanaceae Nann.
Cordana Preuss •
= *Porosphaerella* E. Müll. & Samuels

Spathulosporales Kohlm.
Hispidicarpomycetaceae Nakagiri
Hispidicarpomyces Nakagiri

Spathulosporaceae Kohlm.
Retrostium Nakagiri & Tad Ito
Spathulospora A.R. Caval. & T.W. Johnson • (only in part)

Sordariomycetes, families *incertae sedis*
Cephalothecaceae Höhn.
Albertiniella Kirschst. •
Cephalotheca Fuckel •
Cryptendoxyla Malloch & Cain •
Phialemonium W. Gams & McGinnis •

Lautosporaceae Kohlm. et al.
Lautospora K. D. Hyde & E.B.G. Jones

Sordariomycetes, genera *incertae sedis*
Acerbiella Sacc.
Acrospermoides Miller & G.E. Thomps.
Ameromassaria Hara
Amphisphaerellula Gucevič
Amphisphaerina Höhn.
Amphorulopsis Petr.
Amylis Speg.
Anaexserticlava T.S. Santa Izabel et al.
Anthostomaria (Sacc.) Theiss. & Syd.
Anthostomellina L.A. Kantsch.
Apharia Bonord.
Apodothina Petr.
Apogaeumannomyces Matsush.
Aquadulciospora Fallah & Shearer
Aquasphaeria K.D. Hyde
Aropsiclus Kohlm. & Volkm.-Kohlm.
Ascorhiza Lecht.-Trnka
Ascoyunnania L. Cai & K.D. Hyde
Assoa Urries
Atrogeniculata J.S. Monteiro et al.
Aulospora Speg.
Azbukinia Lar.N. Vassiljeva
Bactrodesmiastrum Hol.-Jech. •
Bactrosphaeria Penz. & Sacc.
Biflua J.Koch & EBG Jones
Biporispora J.D. Rogers et al.
Bombardiastrum Pat.
Brenesiella Syd.
Byrsomyces Cavalc.
Byssotheciella Petr.
Caleutypa Petr.
Calosphaeriopsis Petr.
Caproniella Berl.
Chaetoamphisphaeria Hara
Ciliofusospora Bat. & J.L. Bezerra
Calcarisporium Preuss
Clypeoceriospora Sousa da Câmara
Clypeosphaerulina Sousa da Câmara
Crinigera Schmidt
Cryptoascus Petri
Cryptomycella Höhn.
Cryptomycina Höhn.
Cucurbitopsis Bat. & Cif.
Curvatispora V.V. Sarma & K.D. Hyde
Dasysphaeria Speg.
Delpinoëlla Sacc.
Diacrochordon Petr.
Digicatenosporium S.M. Leão et al.
Dryosphaera Jørg. Koch & E.B.G. Jones
Duradens Samuels & Rogerson•
Endoxylina Romell
Esfandiariomyces Ershad
Frondisphaera K.D. Hyde
Glabrotheca Chardón
Hapsidascus Kohlm. & Volkm.-Kohlm.
Heliastrum Petr.
Hyaloderma Speg.
Hydronectria Kirschst.
Hypotrachynicola Etayo
Immersisphaeria Jaklitsch.
Iraniella Petr.
Imicles Shoemaker & Hambl.
Konenia Hara
Kravtzevia Schwartzman
Kurssanovia Kravtzev
Lecythiomyces Doweld
= *Lecythium* Zukal
Leptosacca Syd.
Leptosphaerella Speg.
Leptosporina Chardón
Liberomyces Pažoutová et al. •
Linocarpon Syd. & P. Syd. •
Lyonella Syd.
Mangrovispora K.D. Hyde & Nagakiri
Marisolaris Jørg. Koch & E.B.G. Jones
Melanographium Sacc.
Melomastia Nitschke ex Sacc.
Microcyclephaeria Bat.
Monotosporella S. Hughes •
Mycothermus D.O. Natvig et al.
Naumovela Kravtzev
Natantiella R blová •
Neocryptospora Petr.

Neoeriomycopsis Crous & M.J. Wingf. •
Neolamya Theiss. & Syd.
Neolinocarpon K.D. Hyde •
Neophysalospora Crous & M.J. Wingf. •
Neothyridaria Petr.
Nigrospora Zimm. •
Ophiomassaria Jacz.
Orcadia GK Sutherl
Paoayensis Cabanela et al.
Paramicrodochium Hern.-Restr. & Crous •
Pareutypella Y.M. Ju & J.D. Rogers
Phialemoniopsis Perdomo et al. •
Phomatosporella Tak. Kobay & K. Sasaki
Phyllocelis Syd.
Pleocryptospora J. Reid & C. Booth
Pleosphaeria Speg.
Porodiscus Lloyd
Protocucurbitaria Naumov
Pulvinaria Bon.
Pumilus Viala & Marsais
Rehmiomycella E. Müll.
Rhamphosphaeria Kirschst.
Rhizophila K.D. Hyde & E.B.G. Jones
Rhopographella (Henn.) Sacc. & Trotter
Rhynchosphaeria (Sacc.) Berl.
Rivulicola K.D. Hyde
Romellina Petr.
Saccardoëlla Speg.
Sarcopyrenia Nyl.
Sartorya Vuill.
Scharifia Petr.
Scoliocarpon Nyl.
Scotiosphaeria Sivan.
Selenosporella G. Arnaud ex MacGarvie
Servazziella J. Reid & C. Booth
Sporoctomorpha J.V. Almeida & Sousa da Câmara
Stanjehughesia Subram. •
Stearophora L. Mangin & Viala
Stegophorella Petr.
Stellosetifera Matsush.
Stereosphaeria Kirschst. •
Stomatogenella Petr.
Stromatographium Höhn.
Sungaiicola Fryar & K.D. Hyde
Synsphaeria Bon.
Tamsiniella S.W. Wong et al.
Tectonidula Réblová
Teracosphaeria R blová & Seifert •
Thelidiella Fink.
Thyridella (Sacc.) Sacc.
Thyrotheca Kirschst.
Trichospermella Speg.
Trichosphaeropsis Bat. & Nasc.
Tunstallia Agnihothr.
Vleugelia J. Reid & C. Booth
Zalerion R.T. Moore & Meyers •

Descriptions and notes on families

Amphisphaeriaceae G. Winter [as 'Amphisphaerieae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 259 (1885)

Facesoffungi number: FoF 00673

Saprobic, *hemibiotrophic* or *necrotrophic* on leaves, twigs and branches of deciduous shrubs and trees, conifers or monocotyledons, appearing as slightly raised, black dots on host surface, often surrounded by a darkened area. **Sexual morph**: *Pseudostromata* when present made up of host cells and brown to black fungal hyphae, solitary, uni- to bi-loculate, hemisphaerical, initially appearing as raised, pale brown areas, with small, black dots at the center, becoming dark at maturity, glabrous. *Ascomata* perithecial, scattered to clustered, immersed in host cortex, becoming raised, subglobose to lenticular, glabrous, dark brown to black, vegetative hyphae surrounding the locules, ostioles individual, central. *Papilla* erumpent through host surface, internally covered by hyaline, filamentous periphyses. *Peridium* of unequal thickness, thinner at the base, thicker towards the mid-upper section of the ascomata, comprising several layers of dark brown pseudoparenchymatous cells, outer layer of thick-walled, brown cells of *textura prismatica*, inner layer of flattened, hyaline cells of *textura prismatica. Hamathecium* comprising numerous, septate, filamentous paraphyses. *Asci* 8-spored, unitunicate, cylindrical, short pedicellate, apex rounded, with J+ or J- apical ring. *Ascospores* overlapping uniseriate, light to dark brown, ellipsoidal to fusiform, 1-septate. **Asexual morph**: Coelomycetous. *Conidiomata* solitary or aggregated, globose, dark brown. *Peridium* comprising thick-walled, septate, brown mycelium. *Conidiophores* dichotomously branched, septate, thick-walled, smooth, hyaline. *Conidiogenous cells* phialidic, elongated, wide at the base and narrow at the tip, thin-walled, hyaline. *Conidia* hyaline, 1-celled, smooth-walled, elongate to fusiform, narrow at both ends.

Type: ***Amphisphaeria*** Ces. & De Not.

Notes: The family *Amphisphaeriaceae* was introduced by Winter (1885) as 'Amphisphaerieae' and later established as *Amphisphaeriaceae* to accommodate the type genus *Amphisphaeria* (typified by *A. umbrina*. Ces. & De Not) and similar genera, viz. *Ohleria*, *Trematosphaeria*, *Caryospora*, *Winteria* and *Strickeria* (Winter 1887) The family is characterized by partially immersed or erumpent, perithecial ascomata, unitunicate, cylindrical asci, with J+ or J- apical rings and pale to dark brown, 1-septate ascospores (Kang et al. 1998; Senanayake et al. 2015). The species of the family were subsequently included in various other families (Clements and Shear 1931; von Arx and Müller 1954;

Müller and von Arx 1973), leading to a doubt about its exact taxonomic position (Munk 1957; Kang et al. 1999a). Hence, *Amphisphaeriaceae* was reintroduced by Müller and von Arx (1962) based on the presence of a small iodine positive ring or disc in the apex of the asci and in having ascomata immersed under a clypeus (Kang et al. 1999a; Maharachchikumbura et al. 2015). Samuels et al. (1987) suggested that the genera linked to *Pestalotia*-like asexual morphs, *Amphisphaeria*, *Broomella*, *Discostroma*, *Lepteutypa* and *Pestalosphaeria* should be kept as *Amphisphaeriaceae* (*sensu stricto*). Hawksworth et al. (1995) listed *Amphisphaeriaceae* as a heterogeneous sexual morph family with 36 genera. Of these, Kang et al. (1999a) accepted only *Amphisphaeria*, *Broomella*, *Discostroma*, *Ellurema*, *Griphosphaerioma*, *Neobroomella*, *Blogiascospora*, *Lepteutypa*, *Paracainiella* and *Pestalosphaeria* based on a study of molecular and morphological data. As a result of various studies, previously included genera in *Amphisphaeriaceae* have been moved to other taxonomic groups such as *Cainiaceae Clypeosphaeriaceae*, *Phyllachoraceae*, *Pleurotremataceae* and *Xylariaceae* (Krug 1977; Kang et al. 1998, 1999b). Senanayake et al. (2015) accepted only the type genus *Amphisphaeria* excluding all the other genera based on their morphology and phylogeny. Some were transferred to *Bartaliniaceae*, *Discosiaceae*, *Iodosphaeriaceae*, *Pestalotiopsidaceae* and *Phlogicylindriaceae*, while most genera were listed as *Amphisphaeriales* genera *incertae sedis*. *Amphisphaeriaceae* is currently classified in the order *Xylariales* and is known to share a close relationship with *Cainiaceae*, *Clypeosphaeriaceae*, and *Hyponectriaceae* (Jeewon 2001), as well as with *Apiosporaceae* (Crous and Groenewald 2013; Senanayake et al. 2015). As the family is presently monotypic, a family description only is provided.

Amphisphaeria Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 223 (1863)

Facesoffungi number: FoF 02099; Figs 3, 4

Type species: ***Amphisphaeria umbrina*** (Fr.) De Not., Sfer. Ital.: 69 (1863)

Notes: *Amphisphaeria* was introduced by Cesati and De Notaris (1863), with no generic type designated (Wang et al. 2004). Later Petrak (1923) proposed *A. umbrina* (previously introduced as *Sphaeria umbrina*) as the lectotype of this genus. The characterization of *Amphisphaeria* and subsequent epitypification of the generic type *A. umbrina*, and its current phylogenetic status has been reviewed in Senanayake et al. (2015). Most of the confusion regarding the genus arises from the lack of sexual-asexual morph connections (Kang et al. 1998). The asexual morph *Bleptosporium* has been linked to *Amphisphaeria* (Nag Raj 1977; Hyde et al. 2011), but has not been proven based on sequence data. However, Senanayake et al. (2015) illustrated the sexual and asexual morphs of *Amphisphaeria sorbi*, the former being introduced in Liu et al. (2015).

Amphisphaeria species are thought to be widely distributed among both tropical and temperate regions having mostly been recorded in Europe, and others across the Americas, South East Asia and South India (Liu et al. 2015; Farr and Rossman 2016). However, since the genus is quite confused, its distribution needs to be confirmed by species identifications supported by molecular data.

Amplistromataceae Huhndorf et al., Mycologia 101(6): 905 (2009).

Facesoffungi number: FoF 00618

Saprobic on bark or wood. **Sexual morph**: *Stromata* superficial, turbinate, obovoid to irregularly pulvinate, texture soft or firm; or stromata absent and perithecia separate to clustered, with hyphal subiculum or absent. *Ascomata* globose or subglobose, polystichous or monostichous, with long necks. *Hamathecium* comprising hyaline, abundant, filamentous paraphyses. *Asci* 8–spored, numerous, unitunicate, cylindrical to clavate, apical ring not bluing in Melzer's reagent. *Ascospores* uniseriate, hyaline, globose. **Asexual morph**: Undetermined.

Type: ***Amplistroma*** Huhndorf et al.

Notes: This family was introduced by Huhndorf et al. (2009) to accommodate *Amplistroma* and *Wallrothiella*. Two genera were recognized in the family based on molecular and morphological data (Huhndorf et al. 2009). *Wallrothiella congregata* (Wallr.) Sacc., and species of *Amplistroma* share cylindro-clavate, stipitate asci, minute, globose ascospores and wide paraphyses that are long-tapering above the asci. *Amplistroma* and *Wallrothiella* differ mainly in the size amount and texture of stromatal structures (Huhndorf et al. 2009). Phylogenetic analyses of 28S rDNA group these taxa in a well-supported clade distinct from known orders within Sordariomycetidae. *Amplistromataceae* resolves as a monophyletic clade with strong bootstrap and Bayesian support with LSU data, but its sister relationship with *Chaetosphaeriales* is not supported. The family was placed within Sordariomycetidae *incertae sedis* (Huhndorf et al. 2009). Maharachchikumbura et al. (2015) showed that *Amplistroma* clustered with *Wallrothiella* as a sister group to *Catabotrys deciduum* in *Catabotrydaceae*, thus they introduced a new order *Amplistromatales* to accommodate these families. Hujslová et al. (2014) included *Acidothrix*, an acidophilic, asexual, soil fungus into this family. The morphology of *Acidothrix acidophila* Hujslová & M. Kolařík and the acrodontium-like asexual morphs occurring in *Amplistroma* species have similar characters. However

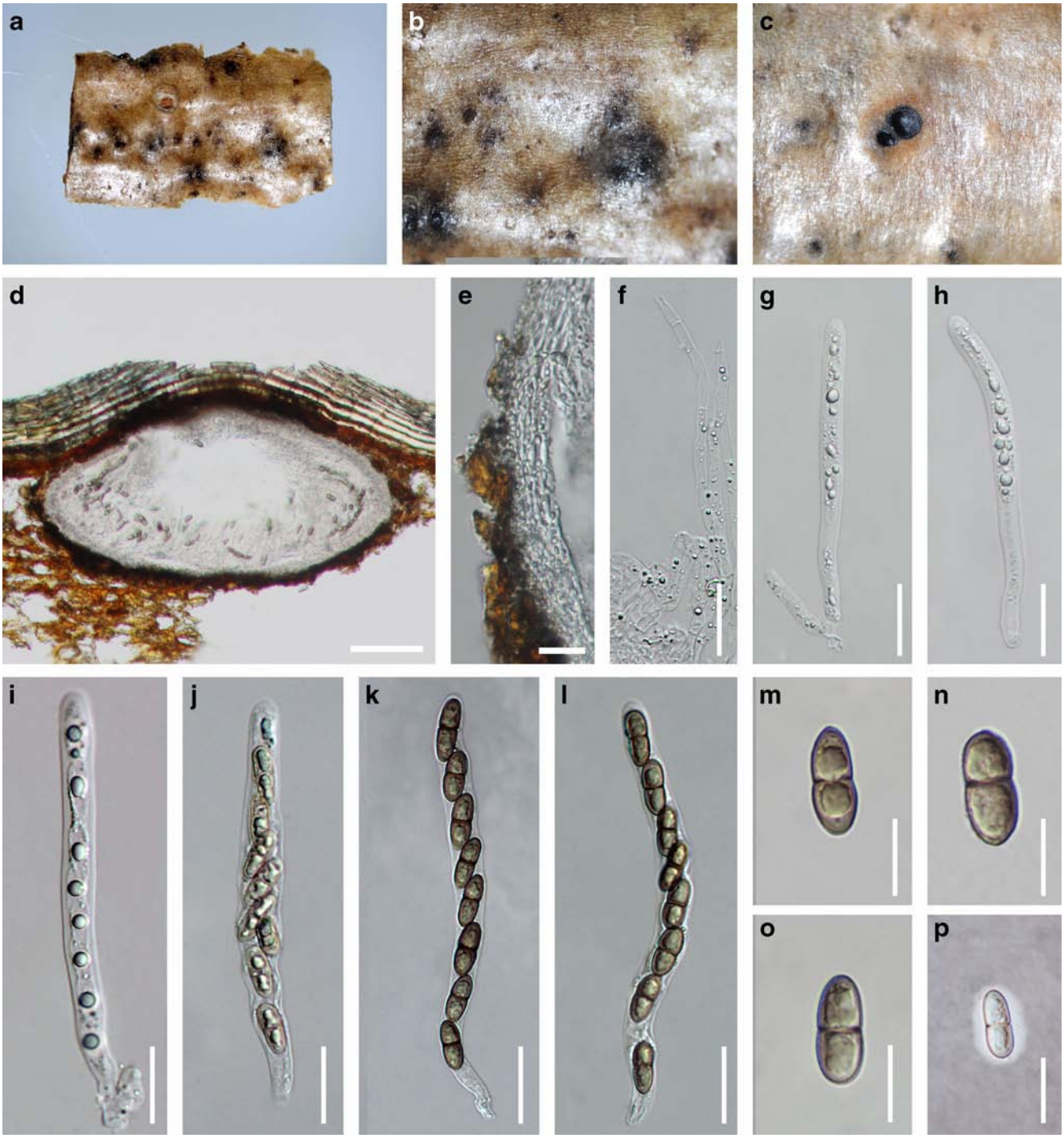


Fig. 3 ***Amphisphaeria sorbi*** (Material examined: ITALY, Province of Trento [TN], Dimaro, Folgarida, on branch of *Sorbus aucuparia* (*Rosaceae*), 2 August 2013, Erio Camporesi IT 1400 (MFLU 14-0797, **holotype**) **a** Appearance of pseudostroma on host **b** Close up of pseudostroma with ostioles **c** Biloculate pseudostromata **d** Section of ascoma **e** Peridium **f** Paraphyses **g**–**i** Immature asci **j**–**l** Mature asci **m**–**o** Ascospores **p** Sheath surrounding ascospore. Scale bars: **a**–**c** = not to scale, **d**, **e** = 10 μm, **f** = 20 μm, **g**–**p** = 50 μm

in the phylogenetic analysis *Acidothrix acidophila* placed outside both *Amplistroma* and *Wallrothiella*, therefore Hujslová et al. (2014) introduced this as a new genus.

Amplistroma Huhndorf et al., Mycologia 101(6): 907 (2009)

Facesoffungi number: FoF 00618; Fig. 5

Saprobic on bark or wood. **Sexual morph**: *Stromata* superficial, turbinate, obovoid to irregularly pulvinate, texture soft or firm. *Ascomata* globose or subglobose, arranged in multiple layers, with long necks. *Peridium* outwardly comprising thin-walled, light brown cells of *textura intricata* and

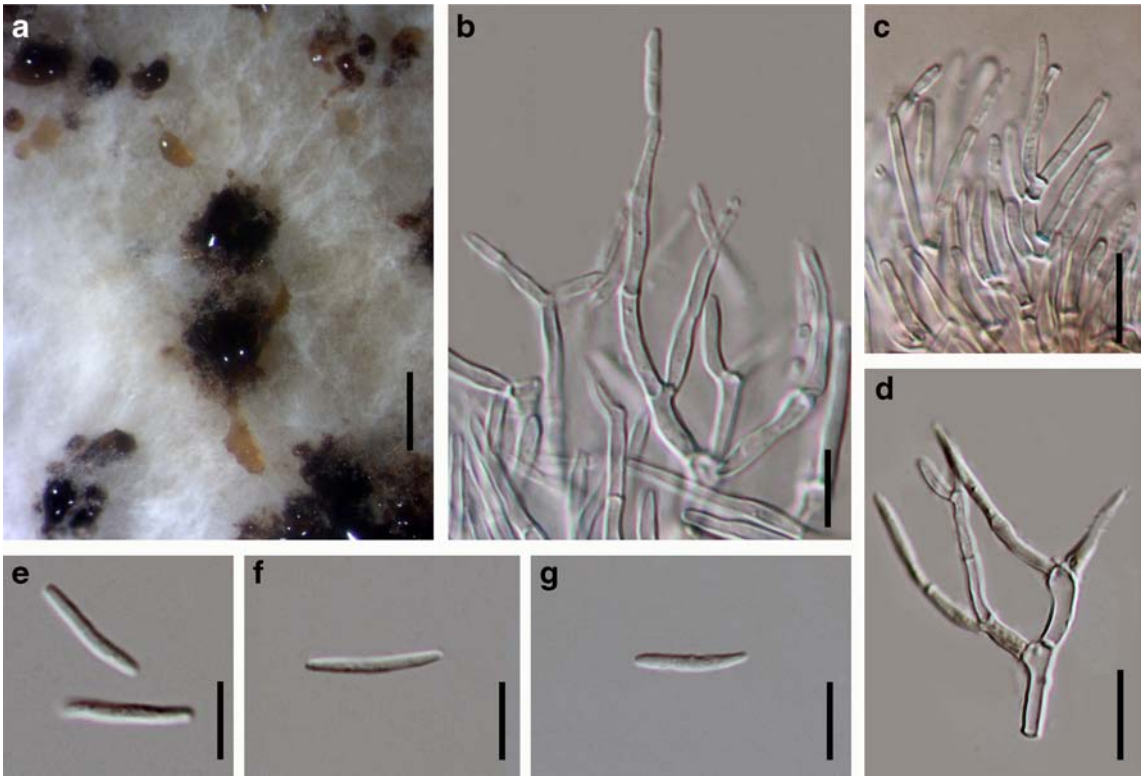


Fig. 4 Asexual morph of ***Amphisphaeria sorbi*** (introduced in Senanayake et al. 2015) **a** Conidiomata on MEA **b–d** Conidia attached to conidiophores **e-g** Conidia. Scale bars: **a** = 1000 μm, **b–g** = 20 μm

inwardly comprising thin-walled, hyaline cells of *textura intricata*. *Hamathecium* comprising hyaline, abundant, filamentous paraphyses. *Asci* 8-spored, unitunicate, cylindrical to clavate, pedicellate, ascus apical ring minute to inconspicuous, not staining in Melzer's reagent. *Ascospores* uniseriate, hyaline, globose, thick-walled. **Asexual morph**: Hyphomycetous, acrodontium-like in culture and occurring on young stromata and near base of older stromata. *Conidiophores* arising vertically, sometimes horizontally, hyaline to light brown, not strongly differentiated, with whorls of secondary and tertiary branching, arising vertically along the length. *Conidiogenous cells* arising in verticils or whorls on the branches, lageniform to ampulliform, apex forming elongate rachis, proliferating sympodially, flexuous, with denticulate, blunt, conidiogenous pegs. *Conidia* light brown, pyriform to obovoid, with basal frill (Huhndorf et al. 2009).

Type species: ***Amplistroma carolinianum*** Huhndorf et al., Mycologia 101(6): 907 (2009).

Notes: *Amplistroma* was described as a new genus for *A. carolinianum* Huhndorf et al. as the type along with *A. diminutisporum* Huhndorf et al., *A. guianense* Huhndorf et al., *A. hallingii* Huhndorf et al., *A. ravum* Huhndorf et al., *A. tartareum* Huhndorf & Samuels and *A. xylarioides* (Pat.) Huhndorf & Samuels (Huhndorf et al. 2009). *Amplistroma erinaceum* Checa et al. was recently added (Checa et al. 2014). Species of *Amplistroma* are distinguished by large stromata of *textura intricata* with polystichous ascomata and long necks, that are either erumpent from the stromatal surface or form bumps or protuberances. *Amplistroma* was placed in *Amplistromataceae* by Huhndorf et al. (2009) based on molecular and morphological data.

Other genera included

Acidothrix Hujslová & M. Kolařík, in Hujslova et al., Mycol. Progr. 13(3): 824 (2014)

Type species: ***Acidothrix acidophila*** Hujslová & M. Kolařík in Hujslova et al., Mycol. Progr. 13(3): 824 (2014)

Wallrothiella Sacc., Syll. fung. (Abellini) 1: 455 (1882).

Type species: ***Wallrothiella congregata*** (Wallr.) Sacc., Syll. fung. (Abellini) 1: 455 (1882).

Fig. 5 ***Amplistroma carolinianum*** (Material examined: USA, North Carolina, Macon County, Ellicott Rock Trail, off Bull Pen Road, on bark, 14 October 1990, Y. Doi, A.Y. Rossman, G.J. Samuels (BPI 878925, **holotype**) **a** Herbarium package **b** Stromata **c** Black ostiolar necks in stromata surface **d** Cross section through stromata **e** Arrangement of perithecia into layers in stromatal tissue **f** Embedded perithecia in stromatal tissue **g** Ascoma **h** Peridium **i**, **j** Mature asci **k** Ascospores **l** Apex of the asci lacking apical ring **m**, **n** Dried culture.**1**, **o** Conidia **p**, **q** Dried culture 2 **s** Conidia **t** Culture details. Scale bars: **b** = 2000 μm, **c**, **d** = 1000 μm **e**, **f** = 300 μm, **g** = 100 μm, **h–j** = 20 μm, **k**, **o**, **s** = 5 μm **l** = 10 μm ▶

Key to genera of *Amplistromataceae*

1. Reported with only asexual morph …….. ***Acidothrix***

1. Reported with sexual morph …….. 2

1. Ascomata arranged in multiple layers with long necks, that are either erumpent from the stromatal surface or form

protuberances, forming large stromata of *textura intricata* ……..……..……..…….. ***Amplistroma***

2. Ascomata with long-necks and develop individually or are gregarious on the substrate, but do not form large stromata ……..……..……..……..……..……... ***Wallrothiella***

Annulatascaceae S.W. Wong et al., Syst. Ascom. 16(1–2): 18 (1998)

Facesoffungi number: FoF 01212

Saprobic on submerged wood, sometimes on bamboo and on other substrates in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, solitary or gregarious, superficial, erumpent, semi-immersed or immersed, black, pale brown to brown, or reddish brown, unilocular, rarely clypeate, globose to subglobose, ellipsoidal. *Necks* black or hyaline, glabrous, rarely with setae, hyphae or hairs. *Peridium* coriaceous or membranous composed of *textura angularis*, *textura intricata*, *textura epidermoidea*, *textura prismatica* or pseudoparenchymatous cells or compressed cells. *Hamathecium* with numerous, septate, branched or unbranched, tapering paraphyses. *Asci* 8-spored, unitunicate, cylindrical, pedicellate, usually with a massive J-, refractive, discoid, or wedge-shaped, apical ring. *Ascospores* usually uniseriate, sometimes overlapping, hyaline to brown, unicellular or septate, septa mostly transverse, sometimes with longitudinal and transverse septa. Appendages, mucilaginous sheath and germ pores may be present. **Asexual morph**: Hyphomycetous. taeniolella-like for *Chaetorostrum* where *Conidiophores* are micronematous, mononematous. *Conidia* monoblastic, elongate cylindrical, trans-septate, euseptate, brown, paler near apex. *Conidial secession* schizolytic

Type: ***Annulatascus*** K.D. Hyde

Notes: The family *Annulatascaceae* was introduced by Wong et al. (1998) to accommodate saprobic, lignicolous, freshwater genera of ascomycetes viz. *Annulatascus*, *Ascotaiwania*, *Clohiesia*, *Frondicola*, *Proboscispora* and *Submersisphaeria*. Wong et al. (1998) considered that *Annulatascus* could be best placed in *Lasiosphaeriaceae* due to the presence of tapering paraphyses and within the order *Sordariales*. The family is characterized by immersed or superficial, coriaceous, usually dark-walled ascomata, long, cylindrical asci with a relatively massive, J-, refractive, apical ring. Using LSU rDNA molecular data, Ranghoo et al. (1999) showed that *Annulatascaceae* is a separate family, which has relationships with *Sordariales*. Ho and Hyde (2000) reviewed the ultrastructural studies on *Annulatascaceae* and concluded that more taxa need to be sequenced and analyzed to strengthen data for this family, and that the ultrastructural data supports descriptions of new genera. Based on LSU rDNA sequence data, Réblová and Winka (2001) showed that that *Annulatascaceae* had affinities outside *Sordariales*. Kirk et al. (2001, 2008) placed *Annulatascaceae* in Sordariomycetidae families *incertae sedis*, which was further supported by molecular analyses using LSU rDNA datasets (Campbell and Shearer 2004; Huhndorf et al. 2004a). The family *Annulatascaceae* is polyphyletic (Raja et al. 2003; Campbell and Shearer 2004; Huhndorf et al. 2004a; Vijaykrishna et al. 2005). *Clohiesia* was placed in *Annulatascaceae* by Tsui et al. (1998) based on morphology, but was shown to have phylogenetic affinity with *Lasiosphaeriaceae* and *Sordariaceae* (Raja et al. 2003; Duong et al. 2004). The genus *Chaetorostrum* produces a taeniolella-like asexual morph in culture and is the first record of an asexual morph for *Annulatascaceae* (Zelski et al. 2011). The family currently comprises 18 genera and members of this family are reported from temperate and tropical regions and in both terrestrial as well as freshwater habitats. All genera need further study at the molecular level to clarify phylogenetic relatedness and possibly determine their evolution.

Annulatascus K.D. Hyde, Aust. Syst. Bot. 5(1): 118 (1992)

Facesoffungi number: FoF 01213; Figs 6, 7

Saprobic on submerged wood. **Sexual morph**: *Ascomata* clustered or separate, brown to black, superficial, semi-immersed or immersed, solitary or gregarious, globose or subglobose, immersed or semi-immersed, carbonaceous or coriaceous, ostiolate, periphysate. *Peridium* comprising several layers of cells of *textura angularis*, or pseudoparenchymatous, or melanized angular cells. *Hamathecium* comprising paraphyses which are hyaline, septate and taper distally. *Asci* 8-spored, unitunicate, cylindrical, pedicellate, with a massive bipartite apical ring. *Ascospores* unicellular to multi-septate, uniseriate to overlapping biseriate, ellipsoidal or fusiform or lunate or citriform, hyaline to pale brown, verrucose or smooth, guttulate or non-guttulate, with or without sheath and appendages. **Asexual morph**: Undetermined.

Type species: ***Annulatascus velatispora*** K.D. Hyde, Aust. Syst. Bot. 5(1): 118 (1992).

Notes: This genus is cosmopolitan, and has been described on submerged substrata, such as submerged decaying wood, stems of *Phragmites australis*, and dead petioles of *Licuala ramsayi* and bamboo. Currently *Annulatascus* comprises 16 species. *Annulatascus* is known to be polyphyletic according to LSU rDNA sequence data (Raja et al. 2003; Campbell and Shearer 2004; Abdel-Wahab et al. 2011). Tsui and Hyde (2003) provided a key to species and a synoptic table of 12 *Annulatascus* species based on morphological characteristics. Boonyuen et al. (2012) provided comparative table of morphological features for 16 *Annulatascus* species.

Other genera included

Annulusmagnus J. Campb. & Shearer, Mycologia 96(4): 826 (2004)

Fig. 6 ***Annulatascus velatispora*** (Material examined: AUSTRALIA. North Queensland: Milaa Milaa Falls, on submerged wood in a river, July 1990, K.D. Hyde, (BRIP 17373, **holotype**) **a** Herbarium label and specimen of *Annulatascus velatispora* **b** Host material **c** Ascomata on substrate **d**, **e** Vertical section **f** Section showing peridium and neck region **g** Squash mount of asci **h**, **i** asci **j** Apical ring **k** Apical ring in Melzer's reagent **l** Ascospores. Scale bars: **d-e** = 100 μm, **f-i** = 50 μm, **l** = 10 μm, **j**–**k** = 5 μm

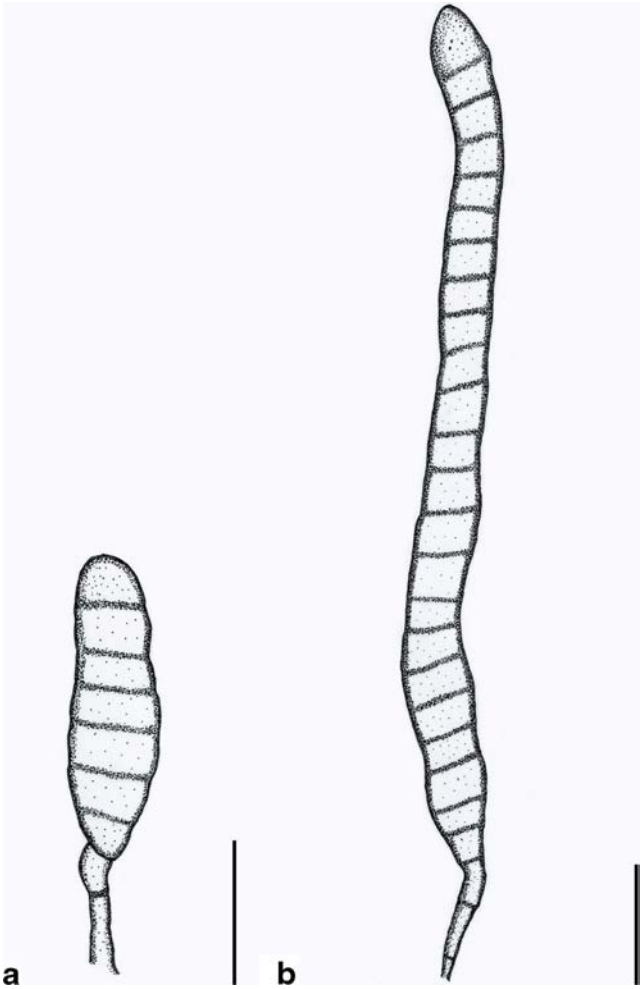


Fig. 7 *Taeniolella*-like asexual morph of *Chaetorostrum quincemilensis*. (Redrawn from Zelski et al. 2011) **a**, **b** Conidia. Scale bars: **a**, **b** = 20 μm

Type species: ***Annulusmagnus triseptatus*** (S.W. Wong et al.) J. Campb. & Shearer, Mycologia 96 (4): 826 (2004)

Aqualignicola Ranghoo et al., Mycol. Res. 105(5): 628 (2001)

Type species: ***Aqualignicola hyalina*** Ranghoo et al., Mycol. Res. 105 (5): 628 (2001)

Aquaticola W.H. Ho, et al., Fungal Diversity Res. Ser. 3: 88 (1999)

Type species: ***Aquaticola hyalomura*** W.H. Ho et al., Fungal Diversity 3: 88 (1999)

Ascitendus J. Campb. & Shearer, Mycologia 96(4): 829 (2004)

Type species: ***Ascitendus austriacus*** (Réblová et al.) J. Campb. & Shearer, Mycologia 96 (4): 829 (2004)

Ayria Fryar & K.D. Hyde, Cryptog. Mycol. 25(3): 248 (2004)

Type species: ***Ayria appendiculata*** Fryar & K.D. Hyde, Cryptog. Mycol. 25: 248 (2004)

Cataractispora K.D. Hyde et al., Mycol. Res. 103(8): 1019 (1999)

Type species: ***Cataractispora aquatica*** K.D. Hyde et al., Mycol. Res. 103 (8): 1020 (1999)

Chaetorostrum Zelski et al., Mycosphere 2(5): 594 (2011)

Type species: ***Chaetorostrum quincemilensis*** Zelski et al., Mycosphere 2 (5): 595 (2011)

Clohiesia K.D. Hyde, Nova Hedwigia 61(1–2): 125 (1995)

Type species: ***Clohiesia corticola*** K.D. Hyde, Nova Hedwigia 61 (1–2): 126 (1995)

Cyanoannulus Raja et al., Mycotaxon 88: 8 (2003)

Type species: ***Cyanoannulus petersenii*** Raja et al., Mycotaxon 88: 11 (2003)

Dictyosporella Abdel-Aziz, in Ariyawansa et al., Fungal Diversity: 10.1007/s13225-015-0346-5, [117] (2015)

Type species: ***Dictyosporella aquatica*** Abdel-Aziz, in Ariyawansa et al., Fungal Diversity: 10.1007/s13225-015-0346-5, [119] (2015)

Diluviocola K.D. Hyde et al., Fungal Diversity Res. Ser. 1: 141 (1998)

Type species: ***Diluviicola capensis*** K.D. Hyde et al., Fungal Diversity 1: 134 (1998)

Fusoidispora Vijaykr. et al., Sydowia 57(2): 272 (2005)

Type species: ***Fusoidispora aquatica*** Vijaykr. et al., Sydowia 57 (2): 272 (2005)

Longicollum Zelsk et al., in Zelski et al., Mycosphere 2(5): 540 (2011)

Type species: ***Longicollum biappendiculatum*** Zelski et al., Mycosphere 2 (5): 540 (2011)

Pseudoannulatascus Z.L. Luo et al., in Z.L. Luo et al. Phytotaxa 239(2): 179 (2015)

Type species: ***Pseudoannulatascus biatriisporus*** (K.D. Hyde) Z.L. Luo et al., in Z.L. Luo et al. Phytotaxa 239(2): 179 (2015)

Pseudoproboscispora Punith., Kew Bull. 54(1): 234 (1999)

Type species: ***Pseudoproboscispora aquatica*** (S.W. Wong & K.D. Hyde) Punith., Kew Bulletin 54 (1): 234 (1999)

Rhamphoria Niessl, Verh. nat. Ver. Brünn 14: 204, 206 (1876)

Type species: ***Rhamphoria delicatula*** Niessl, Verh. nat. Ver. Brünn 14: 206 (1876)

Submersisphaeria K.D. Hyde, Nova Hedwigia 62(1–2): 172 (1996)

Type species: ***Submersisphaeria aquatica*** K.D. Hyde, Nova Hedwigia 62: 172 (1996)

Torrentispora K.D. Hyde et al., Mycol. Res. 104(11): 1399 (2000)

Type species: ***Torrentispora fibrosa*** K.D. Hyde et al., Mycol. Res. 104 (11): 1399 (2000)

Vertexicola K.D. Hyde et al., Mycologia 92(5): 1019 (2000)

Type species: ***Vertexicola caudatus*** K.D. Hyde et al., Mycologia 92: 1020 (2000)

Key to the genera of *Annulatascaceae*

1. Ascospores muriform ……..…….. ***Rhamphoria***
1. Ascospores lacking longitudinal septa …… 2
2. Ascomata formed under a clypeus …… ***Clohiesia***
2. Ascomata without clypeus…….…….. 3
3. Necks possessing setae or hyphae or hairs ..…….. 4
3. Necks glabrous ……..…….. 6
4. Necks hyaline, with stiff hairs …… ***Chaetorostrum***
4. Necks black, setae present on necks ...…… 5
5. Peridium membranous, ascospores 1-celled, lacking sheaths or sheath on one end of ascospore ...…… ***Aqualignicola***
5. Peridium coriaceous, ascospores 3-septate, sheath present ……..……..… ***Annulusmagnus***
6. Ascospores thick-walled, distoseptate ……..... ***Vertexicola***
6. Ascospores not distoseptate ……..…….. 7
7. Ascospores brown except in *Annulatascus aquatorba*…….…….…….…….....…..…….. 8
7. Ascospores hyaline …….....…… 9
8. Ascospores with brown central cells, end cells hyaline, with longitudinal striations ……....…. ***Ascitendus***
8. Ascospores with polar pad-like appendages ……..…….. ***Submersisphaeria***
9. Ascomata pale reddish brown with long necks ……..... ***Cyanoannulus***
9. Ascomata not as above ……..…….. 10
10. Ascomata membranous ……..... 11
10. Ascomata coriaceous or carbonaceous …….....…… 12
11. Necks long, ascospores uniseriate with bipolar appendages ……..…..…… ***Longicollum***
11. Necks short, ascospores overlapping uniseriate or biseriate, lacking appendages ….. ***Ayria***
12. Ascospores without appendages ……...……. 13
12. Ascospores with or without appendages ….…....…. 14
13. Ascospores aseptate or septate, guttulate ……..…..... ***Aquaticola***
13. Ascospores aseptate, eguttulate …….....…..… ***Torrentispora***
14. Ascospores ellipsoid .....…… ***Pseudoproboscispora***
14. Ascospores fusoid …….....…… 15
15. Ascomata ampulliform ……..…… ***Fusoidispora***
15. Ascomata not as above ….....……. 16
16. Ascospore appendages unfurling in water …….....… ***Cataractispora***
16. Ascospore appendages not as above …….....…… 17
17. Ascospores with polar conical caps attached at each end ……..…… ***Diluviocola***
17. Ascospores without polar conical caps ……..…..... ***Annulatascus***

Apiosporaceae K.D. Hyde et al., in Hyde et al., Sydowia 50(1) 23 (1998)

Facesoffungi number: FoF 01364

Pathogenic or *saprobic* on leaves, stems and roots of *Arecaceae* (palms), *Cyperaceae* (sedges) and *Poaceae* (grasses and bamboo), or e*ndophytic* on plant tissues, lichens, and marine algae, occasionally infecting humans, or isolated from soil. **Sexual morph**: *Pseudostromata* immersed or semi-immersed in host epidermis, becoming erumpent, through a longitudinal split in the host. *Ascomata* perithecial, globose, densely arranged, immersed in *Pseudostromata*, with papillate ostioles. *Peridium* composed of small, brown cells of *textura angularis Asci* 8-spored, unitunicate, clavate to broadly cylindrical, short pedicellate. *Paraphyses* hyphae-like, broad, septate, branched. *Ascospores* overlapping 1–3-seriate to irregularly arranged, 1-septate, apiosporous, ellipsoidal, in equilateral, straight or curved, hyaline, smooth-walled, with or without gelatinous sheath. **Asexual morph**: Coelomycetous or hyphomycetous. *Conidiomata* sporodochial, solitary to gregarious, immersed, erumpent from host tissue when mature, irregular, black, carbonaceous, coriaceous. *Conidiomata basal stroma* composed of several layers of dark brown to hyaline thick-walled cells at the side, thin upper wall cells of *textura angularis. Setae* lacking, or present occasionally, if present intermingled among conidiophores. *Conidiophores* arising from hyphae or aggregated in a brown stroma, forming black sporodochia, forming conidia terminally and laterally, brown to dark brown. *Setae* present or absent, erect, sparsely septate, pale brown to brown, smooth-walled. *Conidiogenous cells* discrete, basauxic, doliiform to ampulliform or cylindrical, brown, smooth to finely verruculose. *Conidia* unicellular, brown to dark brown, smooth-walled or with minute wall ornamentations, with a truncate basal scar, guttulate to granular, frequently with an equatorial germ slit.

Type: ***Arthrinium*** Kunze

Notes: This family was introduced by Hyde et al. (1998) with *Apiospora montagnei* Sacc. as the type species. Earlier the genus *Apiospora* had been assigned to *Lasiosphaeriaceae* by Barr (1990). Hyde et al. (1998) considered that the sexual and asexual morphs (*Arthrinium*, *Cordelia* and *Pteroconium*) of *Apiospora* differed from those in *Lasiosphaeriaceae* and proposed the family *Apiosporaceae* to accommodate *Apiospora*. Hyde et al. (1998) did not suggest any order placement for *Apiosporaceae*. Smith et al. (2003) analyzed LSU and SSU sequence data and showed that members of *Apiosporaceae* cluster within the order *Xylariales*, but

relationships to other families of *Xylariales* was uncertain. Lumbsch and Huhndorf (2010) listed *Apiosporaceae* in *Sordariomycetes* family *incertae sedis*. Crous and Groenewald (2013) used phylogenetic analysis to confirm *Apiosporaceae* as a family within *Xylariales*, and sister to *Amphisphaeriaceae*. Hyde et al. (1998) considered *Dictyoarthrinium*, *Endocalyx*, *Scyphospora* and *Spegazzinia* as other possible genera of this family, but molecular data is lacking to confirm this (Crous and Groenewald 2013). *Arthrinium* was confirmed as the asexual morph of *Apiospora* by molecular data (Crous and Groenewald 2013; Senanayake et al. 2015) and *Apiospora*, *Cordella* and *Pteroconium* were reduced to synonymy with *Arthrinium* (Crous and Groenewald 2013). Maharachchikumbura et al. (2015) listed six genera under *Apiosporaceae*.

Arthrinium Kunze, in Kunze & Schmidt, Mykologische Hefte (Leipzig) 1: 9 (1817)

Facesoffungi number: FoF 02100; Figs 8, 9

Saprobic or *pathogenic* on monocotyledons, especially grasses, or endophytic on plant tissues, lichens, and marine algae, occasionally infecting humans, or isolated from soil. **Sexual morph**: *Pseudostromata* visible as raised, linear, blackened areas on the host surface, with neck and upper surface visible through slits in the host tissue, mostly gregarious, fusiform, ellipsoid to irregular, black, cells between ascomata and darkened layer above usually thick, composed of brown cells of *textura angularis. Ascomata* solitary or usually gregarious in linear groups, immersed in pseudostromata, subglobose to globose, membranous, papillate, ostiolate. *Ostiole* periphysate. *Peridium* composed of several layers, of small, brown or reddish brown to hyaline cells of *textura angularis. Hamathecium* composed of dense, hypha-like, long, broad, septate, branched, paraphyses. *Asci* 8-spored, unitunicate, broad cylindrical to clavate or subglobose, short pedicellate, without an apical ring. *Ascospores* overlapping 1–3-seriate to irregularly arranged, hyaline, apiosporous, with a large, straight or curved, upper cell and smaller lower cell, usually surrounded by a gelatinous sheath**. Asexual morph**: Coelomycetous or hyphomycetous. *Conidiomata* sporodochial, solitary to gregarious, immersed, erumpent from host tissue when mature, irregular, black, carbonaceous, coriaceous. *Conidiomata* basal stroma composed of several layers of dark brown to hyaline cells of *textura angularis*, with thick side wall, thin at upper and lower walls. *Setae* lacking, or occasionally present, intermingled among conidiophores. *Conidiophore* verrucose, flexuous. *Conidiophore mother cells* ampulliform, with a verrucose wall, producing a single hyphoid, cylindrical, 1–2-septate. *Conidiogenous cells* basauxic, cylindrical, smooth-walled or verrucose. *Conidia* subglobose to globose, dark brown, smooth-walled or with minute wall ornamentations, with a truncate basal scar.

Type species: ***Arthrinium caricicola*** Kunze & J.C. Schmidt, Mykologische Hefte (Leipzig) 1: 9 (1817)

Notes: *Apiospora* was identified as a genus in the family *Amphisphaeriaceae* based on morphology by Müller and von Arx (1962). Later it was transferred to *Hyponectriaceae* by Barr (1976a). Barr (1990) moved *Apiospora* to *Lasiosphaeriaceae* and this was followed by Barr and Cannon (1994) and Hawksworth et al. (1995). Hyde et al. (1998) introduced a new family *Apiosporaceae* to accommodate the genus *Apiospora*, with *A. montagnei* as the type species. Phylogenetic analyses by many authors accepted *Apiospora* as a distinct group in the order *Xylariales* (Huhndorf et al. 2004a; Zhang et al. 2006; Jaklitsch and Voglmayr 2012; Dai et al. 2014a). Index Fungorum (2016) lists 55 epithets under genus *Apiospora*. Crous and Groenewald (2013) synonymized the sexual name *Apiospora* under the asexual name *Arthrinium*, since *Arthrinium* is the older and more commonly encountered, and more frequently used name in the literature. The link between *Arthrinium* and *Apiospora* has also been confirmed by molecular data by Crous and Groenewald (2013), and this was followed by Maharachchikumbura et al. (2015) and Senanayake et al. (2015). Crous and Groenewald (2013) synonymised *Pteroconium* and *Cordella* under *Arthrinium*.

Other genera included

Appendicospora K.D. Hyde, Sydowia 47(1): 31 (1995)

Type species: ***Appendicospora coryphae*** (Rehm) K.D. Hyde, Sydowia 47(1): 32 (1995)

Dictyoarthrinium S. Hughes, Mycol. Pap. 48: 29 (1952)

Type species: ***Dictyoarthrinium quadratum*** S. Hughes, Mycol. Pap. 48: 30 (1952)

Endocalyx Berk. & Broome, J. Linn. Soc., Bot. 15(1): 84 (1876) [1877]

Type species: ***Endocalyx thwaitesii*** Berk. & Broome, J. Linn. Soc., Bot. 15(1): 84 (1876) [1877]

Scyphospora L.A. Kantsch., Bolêz. Rast. 17: 87 (1928)

Type species: ***Scyphospora phyllostachydis*** Kantsch. [as 'phyllostachidis'], Bolêz. Rast. 17: 88 (1928)

Spegazzinia Sacc., Spegazzinia: [1] (1879)

Type species: ***Spegazzinia ornata*** Sacc., Michelia 2(no. 6): 172 (1880)

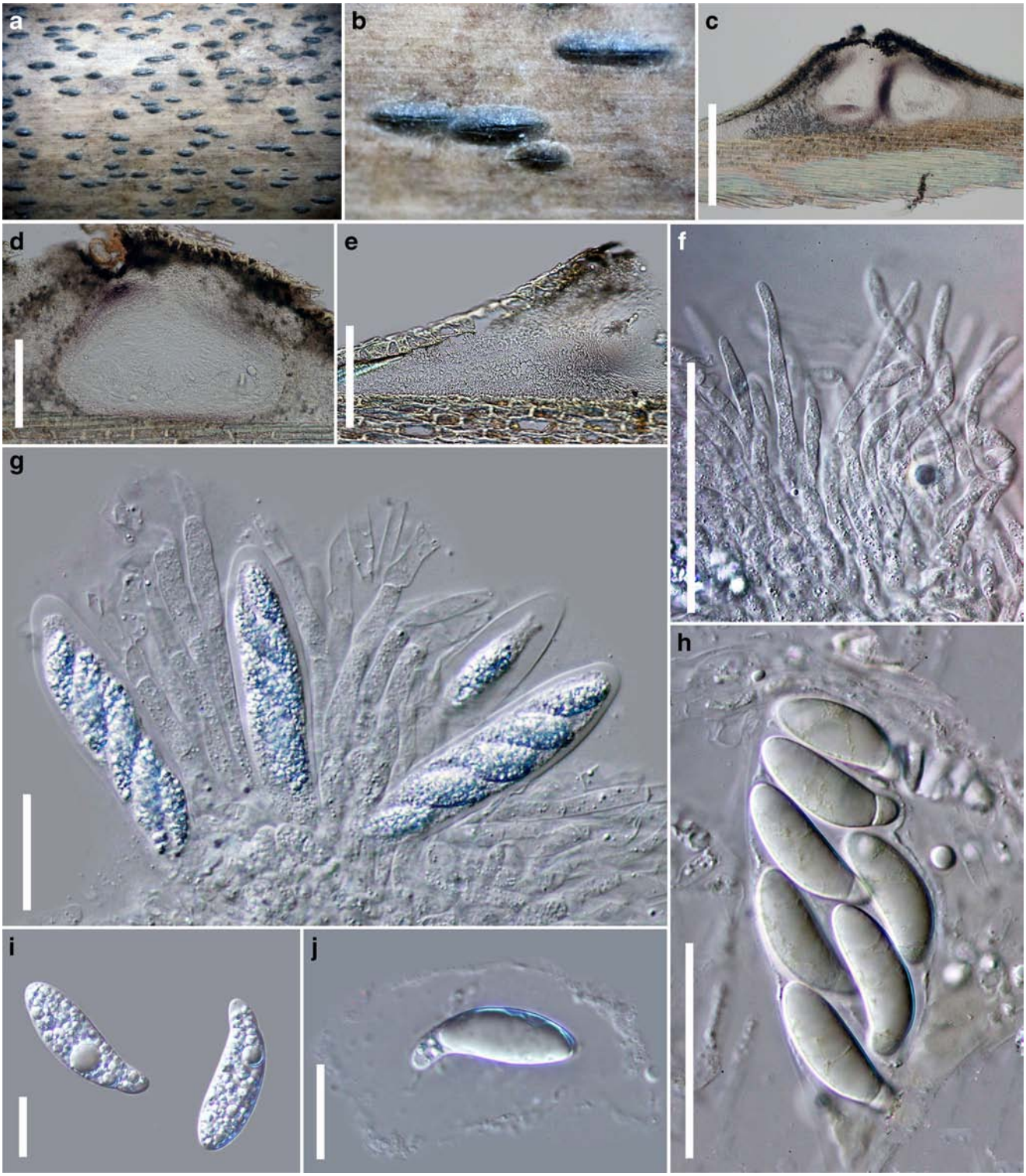


Fig. 8 ***Arthrinium yunnanum*** (Material examined: CHINA, Yunnan, Kunming, Kunming Institute of Botany, Chinese Academy of Science, on dead culm of *Phyllostachys nigra* (*Poaceae*), 7 July 2014, Dong-Qin Dai DDQ00279 (MFLU 15-0382, **holotype**) **a**, **b** Pseudostromata on host surface **c-e** Vertical section through pseudostroma **f** Paraphyses **g**, **h** Asci **i** Ascospores **j** Ascospore with sheath. Scale bars: c = 200 μm, **d**, **e** = 100 μm, **f**–**i** = 5 μm

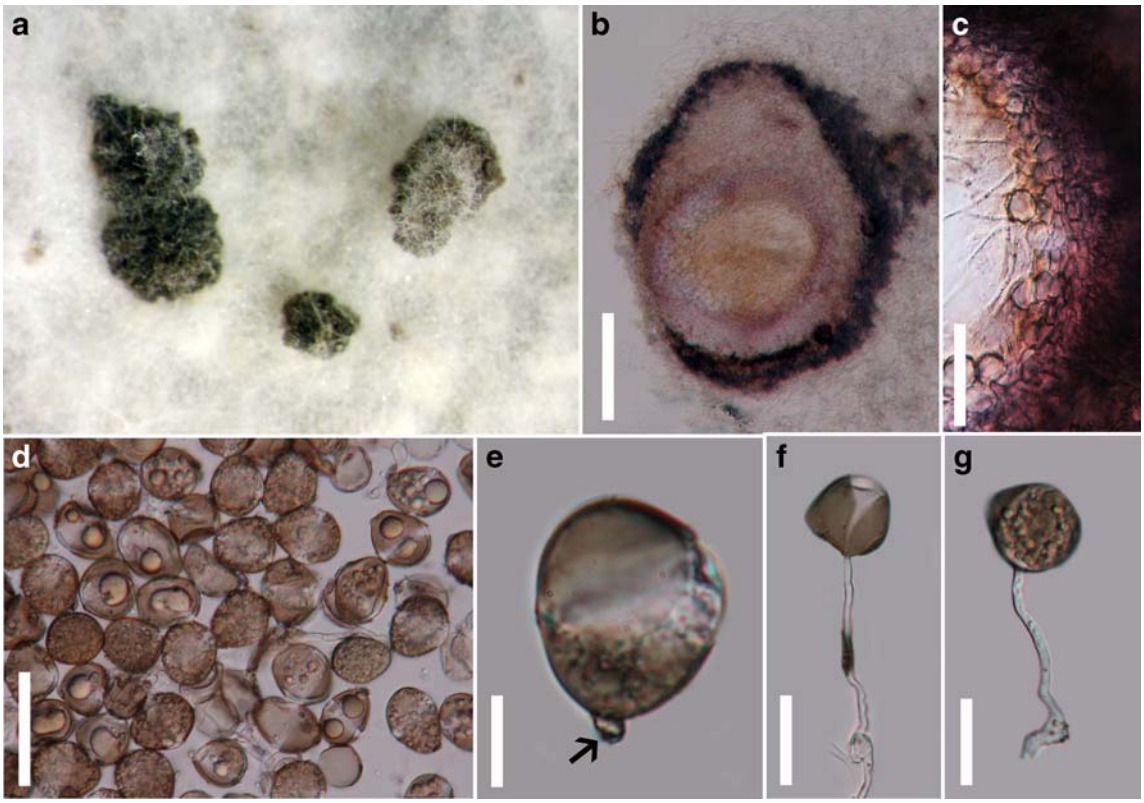


Fig. 9 *Arthrinium yunnanum* (asexual morph, **holotype**) **a** Conidiomata on PDA **b** Vertical section through conidioma **c** Conidiomatal wall **d** Conidia **e** Conidium **f**, **g** Conidia with basauxic conidiogenous cells. Scale bars: **b** = 200 μm, **c**, **d** = 50 μm, **e** = 20 μm, **f**, **g** = 50 μm

Key to the genera with sexual morph

1. Ascomata stromatic, asci clavate to broadly cylindrical, ascospores ellipsoidal without appendages ……..... ***Apiospora***
1. Ascomata astromatic, asci clavate, ascospores clavate with appendages at one end ..... ***Appendicospora***

Key to the genera with asexual morph

1. Coelomycetous or hyphomycetous, conidiomata acervular, pycnidial, sporodochial or synnematous, conidia 1-celled ……. 2
1. Hyphomycetous, conidiomata synnematous or sporodochial, conidia 4 or 16-celled, muriform or often septate ……..... 3
3. Conidia 4-celled, smooth to spinose …….. ***Spegazzinia***
3. Conidia 4 or16-celled, conidiomata verrucose or tuberculate …… ***Dictyoarthrinium***
4. Conidiomata acervular, conidia, smooth-walled ……..... ***Scyphospora***
4. Conidiomata, smooth, verrucose, ornamented or with minute wall ornamentations ……..... 5
5. Conidiomata cup-shaped to funnel-shaped, surrounded by setae, conidia dark brown, smooth-walled or with minute wall ornamentations ……..... ***Endocalyx***
5. Conidiomata not cupulate or funnel-shaped, setae absent or occasionally present, conidia hyaline becoming dark brown at maturity, smooth, verrucose, ornamented …….... ***Arthrinium***

Armatellaceae Hosag., Sydowia 55(2): 165 (2003)

Facesoffungi number: FoF 00723

Epiphytes on the surface of leaves. *Superficial hyphae* dense, branched, septate, brown to reddish, with hyphopodia, hyphal setae lacking. *Hyphopodia* single stellate to sublobate on stalk cells, alternate on hyphae, 2-celled, brown to reddish. **Sexual morph**: *Ascomata* superficial on surface of hosts, scattered, flattened when immature, globose to subglobose at maturity, developing on hyphae, surface verrucose, covered with tuberculate projections, ascomatal setae and appendages lacking. *Peridium* comprising two strata, outer stratum amorphous and black, inner stratum, comprising reddish to brown, scleroparenchymatous cells of *textura angularis* to *globulosa*. *Hamathecium* with paraphyses, evanescent. *Asci* 4–8-spored, unitunicate, ovoid to clavate. *Ascospores* 2–3-seriate, hyaline to light brown, ellipsoidal to oblong, 1-septate. **Asexual morph**: Undetermined.

Type: ***Armatella*** Theiss. & Syd.

Notes: The family *Armatellaceae* was introduced by Hosagoudar (2003), with the generic type *Armatella*, which is a monotypic genus (Hosagoudar 2003; Hosagoudar et al. 2012; Hongsanan et al. 2015). Hongsanan et al. (2015) accepted *Armatellaceae* as a separate family from *Meliolaceae*, which is followed in this study because it has superficial hyphae without phialides, ascomata covered with tuberculate projections, and comprising scleroparenchymatous cells, aseptate to 1-septate, hyaline to light brown ascospores, while *Meliolaceae* has superficial hyphae mostly with phialides, ascomata with raised conoid cells, and 3–4-septate, hyaline to dark brown ascospores (Hongsanan et al. 2015).

Armatella Theiss. & Syd., Annls mycol. 13(3/4): 235 (1915)

Facesoffungi number: FoF 00723; Fig. 10

Epiphytes on the surface of leaves. *Superficial hyphae* dense, branched, septate, brown to reddish, with hyphopodia, hyphal setae lacking. *Hyphopodia* single stellate to sublobate on stalk cells, alternate on hyphae, 2-celled, brown to reddish. **Sexual morph**: *Ascomata* superficial on surface of hosts,

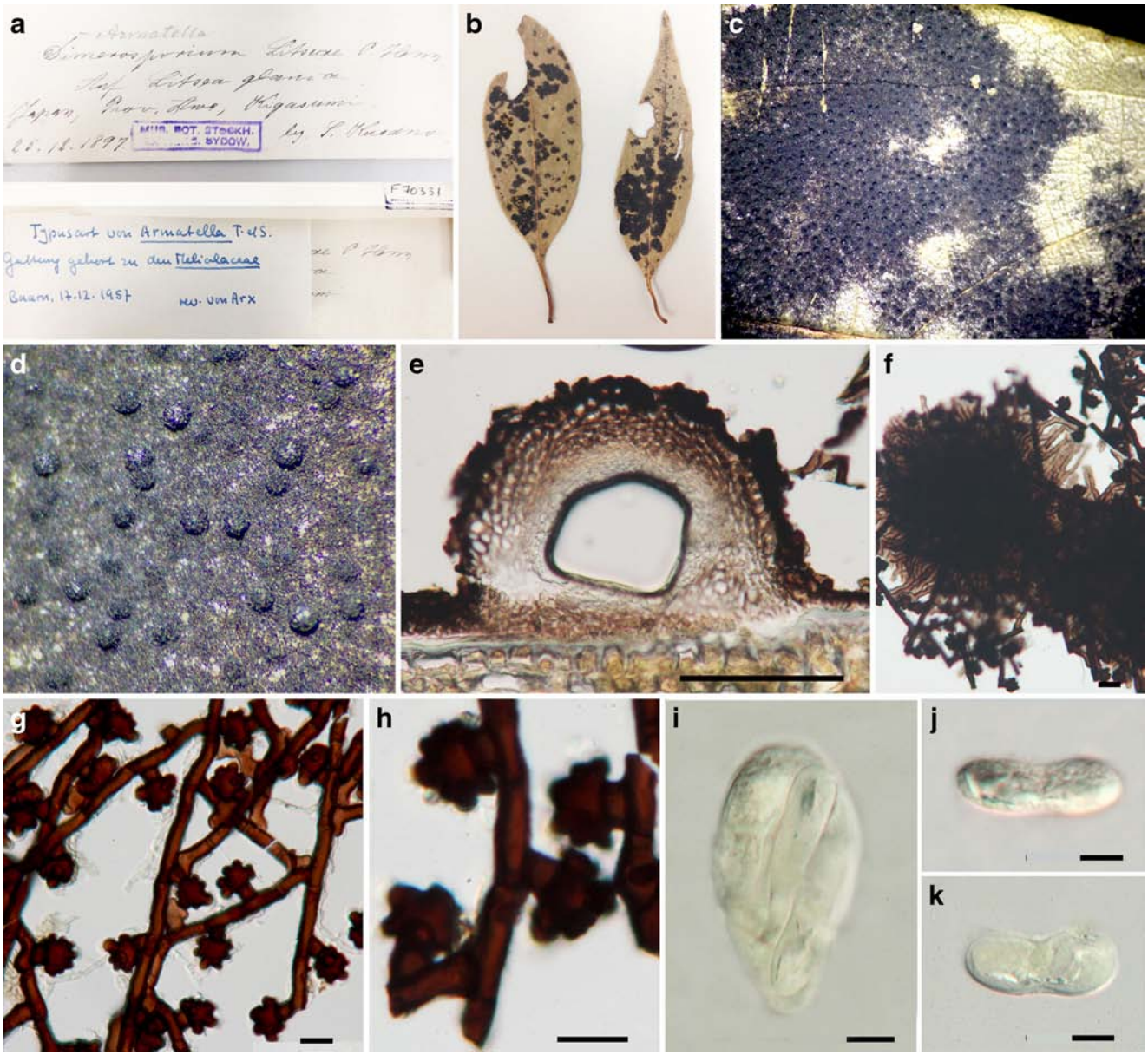


Fig. 10 ***Armatella litseae*** (Material examined: JAPAN, Province Awa, Tokushima, Kigasumi, on leaves of *Litsea glauca* (*Lauraceae*), 25 December 1897, S. Kusano, (SF70331, **holotype**). **a** Herbarium packet **b-d** Colony on leaves **e** Vertical section through ascoma **f** Upper cell walls of young ascomata when viewed in squash mounts **g**, **h** Hyphopodia on hyphae **i** Immature ascus in Melzer's reagent **j**, **k** Mature ascospores in Melzer's reagent. Scale bars: **e** = 100 μm, **f** = 20 μm, **i**–**k** = 10 μm, **g**, **h** = 10 μm

scattered, flattened when immature, globose to subglobose at maturity, developing on hyphae, surface verrucose, covered with tuberculate projections, ascomatal setae and appendages lacking. *Peridium* comprising two strata, outer stratum amorphous and black, inner stratum, comprising reddish to brown, scleroparenchymatous cells of *textura angularis* to *globulosa*. *Hamathecium* with paraphyses, evanescent. *Asci* 4–8-spored, unitunicate, ovoid to clavate. *Ascospores* 2–3-seriate, hyaline to light brown, ellipsoidal to oblong, aseptate when immature and 1-septate at maturity, constricted at the septum, ends rounded, smooth-walled. **Asexual morph**: Undetermined.

Type species: ***Armatella litseae*** (Henn.) Theiss. & Syd., Annls mycol. 13(3/4): 235

Notes: No *Armatellaceae* species have been obtained in culture and no sequence data is available in GenBank (Hongsanan et al. 2015). Index Fungorum (2016) lists 19 epithets in *Armatella*. However most of these species need to be re-evaluated.

Australiascaceae Réblová & W. Gams, in Réblová et al., Stud. Mycol. 68(1): 171 (2011)

Facesoffungi number: FoF 01110

Pathogenic and *saprobic* on terrestrial plant leaves, branches, spathes and stipes. **Sexual morph**: *Stromata* absent. *Ascomata* gregarious to solitary, brown to black, conical to obpyriform, glabrous or with setae, ostiole periphysate. *Setae* scant, acute, thick-walled, septate, dark brown. *Peridium* 18–22 μm wide, becoming thick towards the base, 2-layered, fragile, of *textura epidermoidea* to *prismatica* in surface view. *Hamathecium* comprising septate, persistent, branching paraphyses. *Asci* 8-spored, unitunicate, cylindrical to clavate, short-pedicellate, apex truncate, with a distinct, shallow, J- apical ring. *Ascospores* overlapping biseriate, hyaline, oblong to ellipsoidal, apiculate at both ends, septate, smooth-walled. **Asexual morph**: Hyphomycetous, *Conidiophores* macronematous, pale to dark brown or black, unbranched, septate. *Conidiogenous cells* monophialidic, ampulliform to cylindrical, subhyaline, with a minute, flared collarette. *Conidia* ellipsoid to cylindrical–ellipsoidal, smooth-walled, hyaline to greenish, septate, aggregated in slime or in straight to curled pseudo-chains.

Type: ***Monilochaetes*** Halst. ex Harter

Notes: This family was established by Réblová et al. (2011) to accommodate the holomorphic genus *Australiasca* and asexual morph *Monilochaetes* (Maharachchikumbura et al. 2015). The sexual morph of this family mimics *Chaetosphaeria* which have almost indistinguishable ascomata. The asexual morph is also similar to the asexual morphs of *Chaetosphaeria* (Réblová et al. 2011). *Monilochaetes* was established for a single dematiaceous hyphomycete species *M. infuscans* Harter (Halsted 1890). Rong and Gams (2000) added *M. guadalcanalensis* to this genus. This addition was later confirmed by Réblová et al. (2011) with the use of molecular data. Rong and Gams (2000) used the branching of the conidiophores and the shapes and dimensions of conidia to distinguish *Monilochaetes* from the similar genera *Dischloridium* and *Exochalara*. ITS and LSU phylogenies confirmed that *Dischloridium* and *Monilochaetes* are congeneric, hence *Dischloridium* became a generic synonym of *Monilochaetes*. The connection between the sexual (*Australiasca*) and the asexual (*Monilochaetes*) morph has been experimentally established (Sivanesan and Alcorn 2002; Réblová et al. 2011).

Monilochaetes Halst. ex Harter, J. Agric. Res., Washington 5: 791 (1916)

Facesoffungi number: FoF 01093; Fig. 11

Type species: ***Monilochaetes infuscans*** Harter, J. Agric. Res., Washington 5: 791 (1916)

Notes: The asexual genus *Monilochaetes* comprises seven species (Index Fungorum 2016). *Dischloridium* and *Monilochaetes* are similar in morphology and molecular phylogenies confirm that these two genera are congeneric. *Monilochaetes infuscans* causes scurf disease or soil stain of sweet potato in many countries (Rong and Gams 2000). *Monilochaetes basicurvata* (Matsush.) Réblová & Seifert, *M. dimorphospora* Réblová & W. Gams, *M. laeénsis* (Matsush.) Réblová, W. Gams & Seifert and *M. regenerans* (Bhat & W.B. Kendr.) Réblová & Seifert are reported as saprobes while *M. camelliae* (Alcorn & Sivan.) Réblová, W. Gams & Seifert has been recorded as a pathogen (Rong and Gams 2000; Réblová et al. 2011). Rong and Gams (2000) proposed the combination of *M. guadalcanalensis*, which was also accepted in Réblová et al. (2011). A recent study by Martínez-Rivera et al. (2014) also has accepted this concept. However, in Index Fungorum (http://www.indexfungorum.org/Names/Names.asp2016), *M. guadalcanalensis* has been synonymised under *Exochalara guadalcanalensis* (Matsush.) W. Gams & Hol.-Jech. Further clarification of this species taxonomic placement is required. The sexual-asexual connections of *Australiasca queenslandica* with *Monilochaetes camelliae* and *Australiasca laeénsis* with *Monilochaetes laeénsis* have been experimentally established (Sivanesan and Alcorn 2002; Réblová et al. 2011). *Australiasca* includes only two species, namely *A. laeénsis* Réblová & W. Gams and *A. queenslandica* Sivan & Alcorn. Although these species are morphologically similar, molecular analyses of ITS and LSU sequence data confirmed that they are distinct. The released ascospores in *Australiasca* were often observed to be 1–3-septate (Réblová et al. 2011). The ascospores of *Australiasca queenslandica* become muriform at maturity, but this character has not been observed in *Australiasca laeénsis* (Réblová et al. 2011). When it comes to the use of one name one fungus concept, we recommend the use of *Monilochaetes* as this generic name is

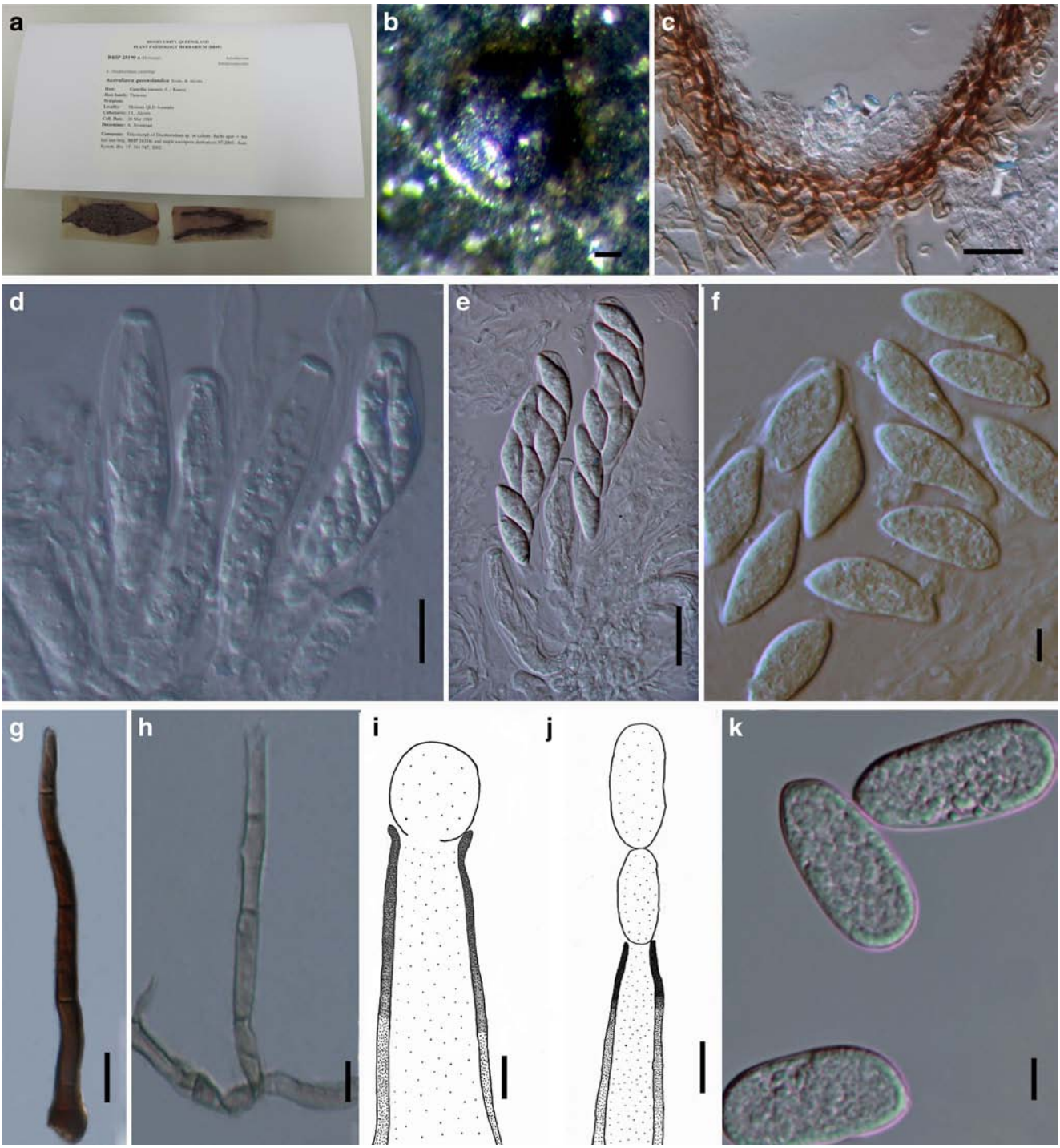


Fig. 11 ***Australiasca queenslandica*** (Material examined: AUSTRALIA, Queensland, Malanda, on branch of *Camellia sinensis* (L.) Kuntze (*Theaceae*), 26 March 1988, J. L. Alcorn, BRIP 25190a, **holotype**). **a** Label and herbarium material **b** Ascoma on the host **c** Cells of peridium **d** Immature asci **e** Asci with ascospores **f** Ascospores **g** Setae **h** Conidiophores **i** Conidiogenous cells **j** Chains of conidia **k** Conidia (conidiogenous cells and conidia chains of *Monilochaetes infuscans* redrawn from Rong and Gams 2000). Scale bars: **b-c** = 100 μm, **e–f**, **g** = 50 μm, **g**, **i–k** = 10 μm

older (introduced in 1916) than the generic name *Australiasca* (introduced in 2002). Also, *Monilochaetes* (7) has higher number of species than *Australiasca* (2). Furthermore, *Monilochaetes* is a well-established name in plant pathological community.

Bartaliniaceae Wijayawardene et al., in Senanayake et al., Fungal Divers. 73: 13 (2015)

Facesoffungi number: FoF 00667

Saprobic, *endophytic* or *pathogenic* on leaves, twigs and branches of a variety of hosts. **Sexual morph**: *Pseudostromata*

immersed, solitary, scattered. *Ascomata* black, immersed to semi-immersed, solitary or gregarious, globose to subglobose. *Ostiole* central, circular. *Papilla* periphysate. *Peridium* composed of an outer layer, of brown to dark brown cells of *textura angularis* or *textura prismatica*, with thin inner layer of hyaline cells of *textura angularis*. *Hamathecium* comprising numerous, hyaline, septate, filamentous paraphyses. *Asci* 8-spored, unitunicate, cylindrical, short pedicellate, apex rounded, with J+ or J-, subapical ring. *Ascospores* overlapping uniseriate, pale brown to brown, ellipsoid to fusiform, 3–4-septate. **Asexual morph**: Coelomycetous. *Conidiomata* acervular to pycnidial to irregular, solitary or gregarious, superficial to sub-immersed, unilocular, globose to subglobose, dark brown to black. *Ostiole* apapillate. *Conidiomata wall* comprising a thick outer layer of dark brown cells of *textura angularis*, and thin inner wall of hyaline to sub-hyaline cells of *textura angularis*. *Conidiophores* present or reduced to conidiogenous cells, when present cylindrical, hyaline, sparsely septate, smooth-walled. *Conidiogenous cells* holoblastic, ampulliform, integrated or discrete, determinate, hyaline, smooth-walled. *Conidia* fusiform, straight to slightly curved, subhyaline to brown, bearing an apical appendage or both apical and basal appendages.

Type: ***Bartalinia*** Tassi

Notes: The family *Bartaliniaceae* (order *Amphisphaeriales*) was introduced by Senanayake et al. (2015) to accommodate the genera *Bartalinia*, *Broomella*, *Dyrithiopsis*, *Hyalotiella*, *Truncatella* and *Zetiasplonza* based on both morphological characters and phylogenetic analysis. It is phylogenetically closely related to the families *Sporocadaceae*, *Pestalotiopsidaceae* and *Robillardaceae*.

Bartalinia Tassi, Bulletin Labor. Orto Bot. de R. Univ. Siena 3: 4 (1900)

Facesoffungi number: FoF 00659; Fig. 12

Endophytic or *saprobic* on plants. **Sexual morph**: Undetermined. **Asexual morph**: *Conidiomata* pycnidial or variable, solitary to gregarious, subepidermal, erumpent at maturity, globose, unilocular, brown to black. *Conidiomata wall* two layered, outer layer comprising dark brown to black cells of *textura angularis*, inner wall comprising thin, hyaline cells of *textura angularis*. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* ampulliform, holoblastic, discrete, determinate, hyaline, forming from the inner layer of the pycnidium wall. *Conidia* hyaline to pale brown, subcylindrical, trans-septate, with appendages, basal cell with truncate base, obconic, hyaline, with single unbranched appendage; 3 median cells subcylindrical, hyaline to pale brown, apical cell conical, almost hyaline, with three branched appendage.

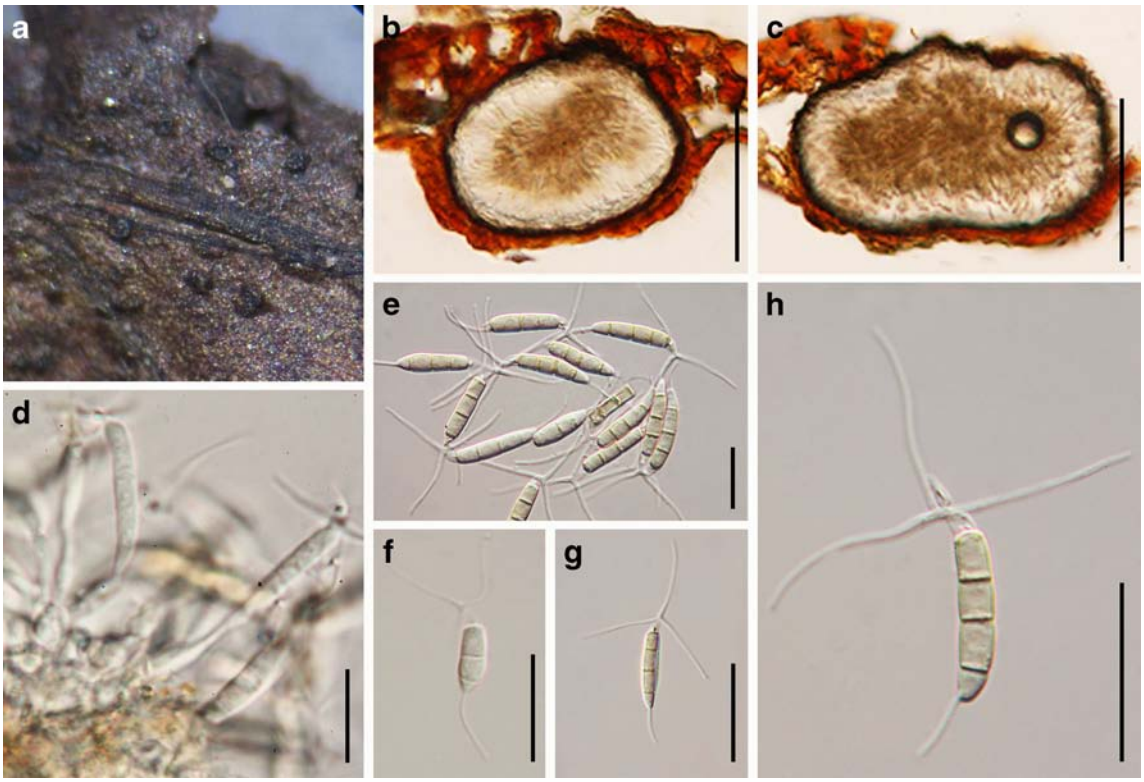


Fig. 12 ***Bartalinia robillardoides*** (Material examined: THAILAND, Chiang Rai, Mae Fah Luang University ground, on leaves of *Eucalyptus* sp., 30 June 2012, Nalin N. Wijayawardene, NNW 120630-1, MFLU 13-0084) **a** Conidiomata on host **b**, **c** Section of conidiomata **d** Conidia arising from conidiogenous cells **e**-**h** Conidia. Scale bars: **b**–**c** = 150 μm, **d** = 20 μm, **e**–**h** = 25 μm

Type species: ***Bartalinia robillardoides*** Tassi, Bulletin Labor. Orto Bot. de R. Univ. Siena 3: 4 (1900)

Notes: *Bartalinia* was introduced by Tassi (1900) with *Bartalinia robillardoides* as the type species. Morgan-Jones et al. (1972) and Sutton (1980) accepted nine species in the genus, while emphasizing the need for a taxonomic revision of the genus. von Arx (1981) listed *Bartalinia* under *Seimatosporium*. Nag Raj (1993) rejected this classification stating the differences in conidial appendages and retained the type *B. robillardoides* and five other species, *B. bischofiae* Nag Raj, *B. lateripes* (Ellis & Everh.) Nag Raj, *B. laurina* (Mont. ex Desm.) Nag Raj, *B. pistacina* (J.L. Maas) Nag Raj and *B. tamarindi* Nag Raj, as belonging to the genus *Bartalinia*. New *Bartalinia* species have been added as a result of various studies (Anderson and Bianchinotti 1996; Xi et al. 2000; Chi et al. 2002; Andrianova and Minter 2007; Marincowitz et al. 2010; Senanayake et al. 2015) and currently 19 epithets are listed in Index Fungorum (2016). *Bartalinia* species are characterized by having three to four septate conidia. A key to ten *Bartalinia* species, including the six listed by Nag Raj (1993), has been provided by Andrianova and Minter (2007). In a study of appendaged coelomycetes, Crous et al. (2014a) designated an epitype for *B. robillardoides*, collected on *Leptoglossus occidentalis*. *Bartalinia* species have been recorded on a wide range of hosts - especially flowering shrubs and trees, and causing leaf spots on economically important plants across Australia, China, Europe, India, South America and South East Asia (Wong et al. 2003; Farr and Rossman 2016).

Other genera included

Broomella Sacc., Syll. fung. (Abellini) 2: 557 (1883)

Facesoffungi number: FoF 00626; Fig. 13

Saprobic on various dicots, monocots such as bamboo and pine. **Sexual morph**: *Ascomata* solitary to gregarious, uniloculate, glabrous, globose to subglobose, papillate. *Ostiole* centrally located, comprising of longitudinal cells, internally lined with hyaline periphyses. *Peridium* composed of light brown, thick-walled cells of *textura prismatica* in the upper part, and thin-walled, hyaline to pale brown cells in other parts. *Hamathecium* comprising of cylindrical, septate, paraphyses. *Asci* 8-spored, unitunicate, cylindrical to cylindrical-clavate, short pedicel, apically rounded, with a J- apical ring. *Ascospores* biseriate or overlapping bi- or tri-seriate, fusiform, median cells pale yellowish brown to greyish brown, end cells grey or hyaline, glabrous, straight or inequilaterally curved, 3-septate, constricted at the mid septa, thick-walled, each end cell bearing a simple, centric, tubular appendage. **Asexual morph**: Coelomycetous. *Conidiomata* stromatic, pycnidioid, scattered to gregarious, immersed to semi-immersed, oval or elongated, black, uniloc-ular, papillate, glabrous. *Pycnidial wall* outer layers comprised of thick-walled, pale brown to brown cells of *textura globulosa* to *textura angularis*, inwardly merging with relatively thin-walled, colourless cells. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* integrated, cylindrical, phialidic, percurrently proliferating 1–2-times, hyaline, smooth. *Conidia* pale brown or brown, fusiform to aciculate, with acute ends, straight or slightly curved, 3-septate, constricted at septa, verruculose, thick walled, bearing up to 5 appendages at the apex and a single appendage at the base.

Type species: ***Broomella vitalbae*** (Berk. & Broome) Sacc., Syll. fung. (Abellini) 2: 558 (1883)

Notes: The genus *Broomella*, introduced by Saccardo (1883) and is characterized by having unitunicate, cylindrical-elongate asci, with a J-, discoid apical ring and 3-septate, ellipsoid-fusiform ascospores, with brown median cells and lighter terminal cells, bearing a single, centric appendage at each end (Shoemaker and Müller 1963; Li et al. 2015a). *Broomella* has been linked to a pestalotiod-like asexual morph (Shoemaker et al. 1989; Yuan and Zhao 1992; Kang et al. 1999b). Currently, 20 epithets are listed under *Broomella* in Index Fungorum (2016). However, they lack sequence data. *Broomella* species and their truncatella-like asexual morphs differ in many ways from the type *B. vitalbae* (Berk. & Broome) Sacc. and its asexual morph and therefore may not be congeneric. In a study based on both LSU sequence data and morphological data by Li et al. (2015a), *Broomella* appeared to be a distinct, natural group in *Amphisphaeriaceae*. Based on the phylogenetic analysis by Senanayake et al. (2015) *Broomella* was placed in *Bartaliniaceae*, *Amphisphaeriales* along with *Bartalinia*, *Dyrithiopsis*, *Hyalotiella*, *Truncatella* and *Zetiasplozna*. The asexual morph was described in Senanayake et al. (2015).

Dyrithiopsis L. Cai et al., in Jeewon et al., Mycologia 95(5): 912 (2003)

Type species: ***Dyrithiopsis lakefuxianensis*** L. Cai et al., in Jeewon et al., Mycologia 95(5): 913 (2003)

Hyalotiella Papendorf, Trans. Br. mycol. Soc. 50(1): 69 (1967)

Type species: ***Hyalotiella transvalensis*** Papendorf, Trans. Br. mycol. Soc. 50(1): 69 (1967)

Truncatella Steyaert, Bull. Jard. bot. État Brux. 19: 293 (1949)

Type species: ***Truncatella truncata*** (Lév.) Steyaert, Bull. Jard. bot. État Brux. 19: 295 (1949)

Zetiasplozna Nag Raj, Coelomycetous Anamorphs with Appendage-bearing Conidia (Ontario): 996 (1993)

Type species: ***Zetiasplozna caffra*** Matsush. [as 'caffera'], Matsush. Mycol. Mem. 9: 29 (1996)

Key to sexual genera of *Bartaliniaceae*

1. Asci with J-, apical ring, having 3-septate ascospores ..... ***Broomella***

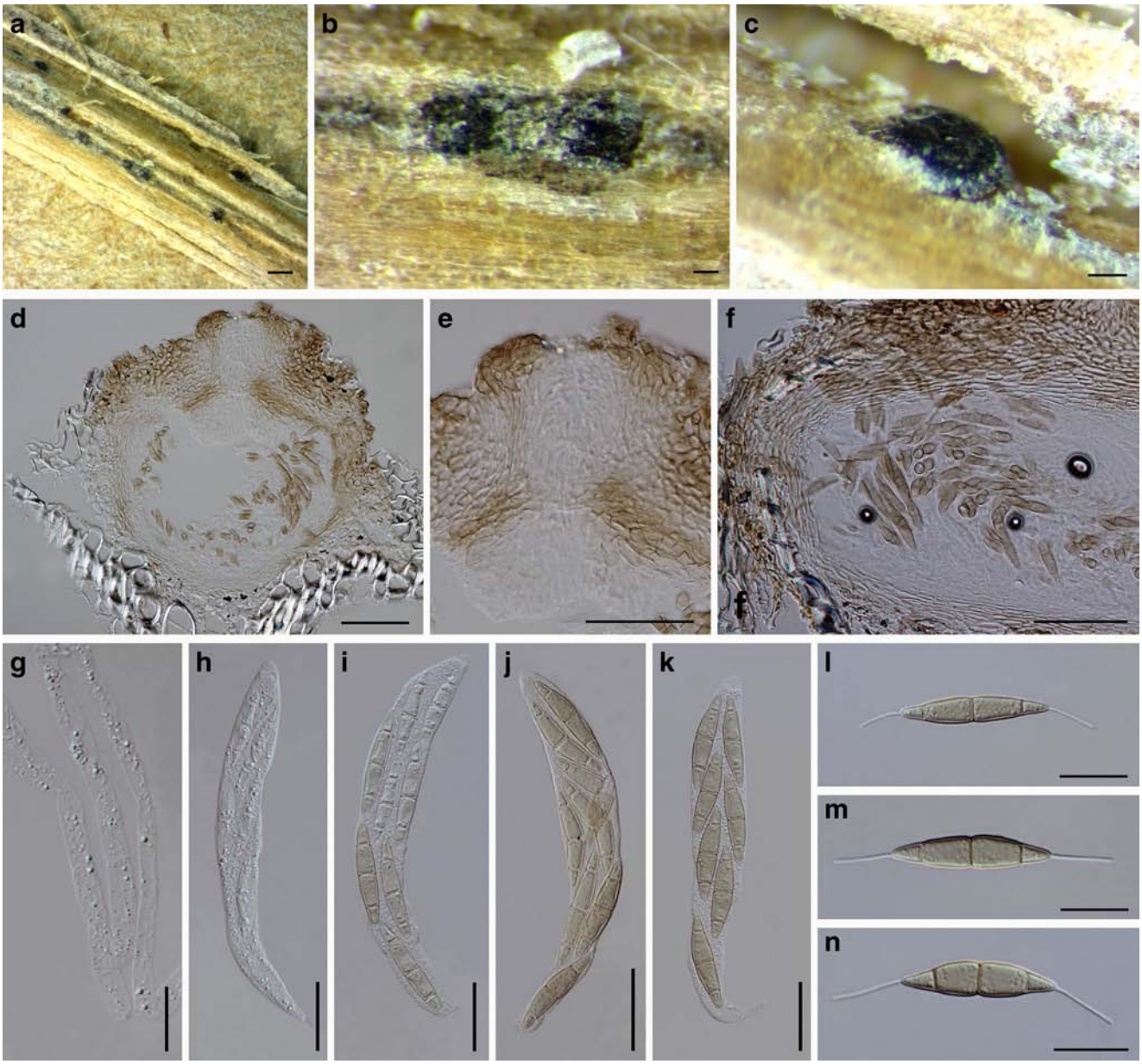


Fig. 13 ***Broomella vitalbae*** (Material examined: ITALY. Province of Forlì-Cesena [FC], Modigliana, Montebello, on dead stem of *Clematis vitalba* (*Ranunculaceae*), 23 February 2013, Erio Camporesi, IT-1079, MFLU 15-0065, **epitype**) **a** Appearance of ascomata on host **b**, **c** Close up of ascomata **d** Section of ascoma **e** Ostiole **f** Peridium **g** Paraphyses **h-k** Asci with ascospores **l-n** Ascospores. Scale bars: **a** = 500 μm, **b–c** = 200 μm, **d–f** = 50 μm, **g–n** = 20 μm

1. Asci with J+, subapical ring, having muriform ascospores (3-transverse, 1–2 longitudinal septa)…… ***Dyrithiopsis***

Key to asexual genera of *Bartaliniaceae*

1. Spores bearing single apical appendage, branched ……..... 2
1. Spores bearing several apical appendages, unbranched..…… ***Zetiasplozna***
2. Spores smooth-walled, median cells hyaline or almost hyaline to pale brown..... 3
2. Spores verruculose, median cells brown…….. ***Truncatella***
3. Conidia with single basal appendage…….....….. ***Bartalinia***
3. Conidia lacking a basal appendage…….... ***Hyalotiella***

Batistiaceae Samuels & K.F. Rodrigues, Mycologia 81(1): 54 (1989)

Facesoffungi number: FoF 01321

Saprobic on wood. **Sexual morph**: *Ascomata* cleistothecial, stipitate-capitate, solitary to gregarious, superficial, black, globose, long stipitate, carbonaceous, without an ostiole. *Peridium* cephalothecoid. *Asci* 8-spored, unitunicate, globose, lacking a visible discharge ring and deliquescent. *Ascospores* irregularly arranged, brown, ellipsoidal to oblong, 1-celled, without germ slits or germ pores, smooth-walled. **Asexual morph**: Hyphomycetous. *Synnemata* determinate, dark brown to black. *Hyphae of stipe* parallel, dark brown, septa simple. *Conidiophores* forming a compact, grey palisade. *Capitulum* terminal, globose, in vertical section composed of a darkly pigmented dome of angular cells giving rise to loose *textura intricata* of hyaline, more or less swollen hyphae, a compact subhymenium of similar hyphae and then a conidiogenous hymenium. *Conidiogenous cells* phialidic, single or in terminated pairs, light brown, cylindrical, with an abruptly terminated apex and cylindrical collarette smooth-walled. *Conidia* in dry chains without connectives, pale olivaceous, light brown to grey in mass, ellipsoidal, globose, subglobose or oblong, 1-celled, with thin, smooth-walls. (descriptions based on Seifert 1987; Samuels and Rodrigues 1989).

Notes: *Batistiaceae* was introduced by Samuels and Rodrigues (1989) as a monotypic family classified in *Sordariales*, and is typified by *Batistia*. Kirk et al. (2001) removed the family from the order *Sordariales* to Sordariomycetidae *incertae sedis* (Huhndorf et al. 2004a; Lumbsch and Huhndorf 2007b). Based on analysis of LSU sequence data, Huhndorf et al. (2004a) showed the genus to belong outside the perithecial ascomycetes and placed it in the Pezizomycotina *incertae sedis*. Lumbsch and Huhndorf (2010) and Wijayawardene et al. (2012) followed this classification. However, sequence data published by Huhndorf has been shown to be contaminated (Maharachchikumbura et al. 2015). *Batistiaceae* was classified in Sordariomycetidae family *incertae sedis* and there is presently no reliable sequence data available for this family in GenBank (Kirk et al. 2008; Maharachchikumbura et al. 2015; Index Fungorum 2016). This family is characterized by stipitate ascomata that form on wood and with a relatively thick peridium (Benny and Kimbrough 1980). *Batistia* and its asexual morph, *Acrostroma* are presently placed in the family (Wijayawardene et al. 2012; Maharachchikumbura et al. 2015).

Batistia Cif., Atti Ist. bot. Univ. Lab. crittog. Pavia, Ser. 5 15: 166 (1958)

Facesoffungi number: FoF 01322, Figs 14, 15

Saprobic on wood. **Sexual morph**: *Ascomata* cleistothecial, solitary to gregarious, superficial, stipitate-capitate, stipitate sinuous or straight, unbranched, with evenly spaced annellations, comprising thick, brown cells of *textura prismatica*, cap globose, black, carbonaceous, surface formed of thick polyhedral plates, plates in greatest dimension, dehiscing along the lines separating the plates. Opening widely as petals of a flower to expose the brown, powdery mass of ascospores, without an ostiole. *Peridium* cephalothecoid, composed of several layers of brown to dark brown, thick cells of *textura angularis*. *Asci* 8-spored, unitunicate, subglobose to globose, sessile, lacking a visible discharge apparatus and deliquescent. *Ascospores* irregularly arranged, translucent brown, ellipsoidal to oblong, 1-celled, without germ slits or germ pores, smooth-walled. **Asexual morph**: Hyphomycetous. *Synnemata*, determinate, caespitose or solitary, cylindrical-capitate, subulate-capitate, sinuous or straight, of medium stature, slender or very slender, unbranched, dark brown to black, slightly lighter immediately beneath the capitulum, smooth or appearing inconspicuously annellated when dry, annellations conspicuous when rehydrated. *Hyphae of stipe* parallel, dark brown, septa simple. *Conidiophores* forming a compact, grey palisade. *Capitulum* terminal, globose, in vertical section composed of a darkly pigmented dome of *angular cells* giving rise to loose *textura intricata* of hyaline, more or less swollen hyphae, a compact subhymenium of similar hyphae and then a conidiogenous hymenium. *Conidiogenous cells* phialidic, single or in terminated pairs, cylindrical, light brown, with an abruptly terminated apex and cylindrical, smooth-walled collarette. *Conidia* in dry chains without connectives, pale olivaceous, light brown to grey in mass, ellipsoidal, globose, subglobose or oblong, 1-celled, with thin, smooth wall (Seifert 1987; Samuels and Rodrigues 1989).

Type species: ***Batistia annulipes*** (Mont.) Cif., Atti Ist bot Univ Lab crittog Pavia, Ser. 5 15: 166 (1958)

Notes: *Batistia* is typified by *Batistia annulipes*, and was originally described as a species of *Thamnomyces* (*Xylariaceae*) by Montagne (1834) (Benny and Kimbrough 1980; Samuels and Rodrigues 1989). Samuels and Rodrigues (1989) provided a detailed description and illustration for *Batistia* and its asexual morph and linked to *B. annulipes* with the type species of *Acrostroma* (*A. annellosynnema*) by culture methods. Kirk et al. (2008), Seifert et al. (2011) and Wijayawardene et al. (2012) accepted this placement. We re-examined the type material of both *Acrostroma* and *Batistia*, and found the morphology matched that reported by Samuels and Rodrigues (1989). Thus, in this paper, we synonymize the genus *Acrostroma* under *Batistia*. The genus *Acrostroma* presently has three records in Index Fungorum (2016).

Beltraniaceae Nann., Repert. mic. uomo: 498. 1934. emend.

Facesoffungi number: FoF 01899

Saprobic on plant tissues. **Sexual morph**: *Ascomata* pale yellow, solitary to aggregated on OA and PDA, globose to

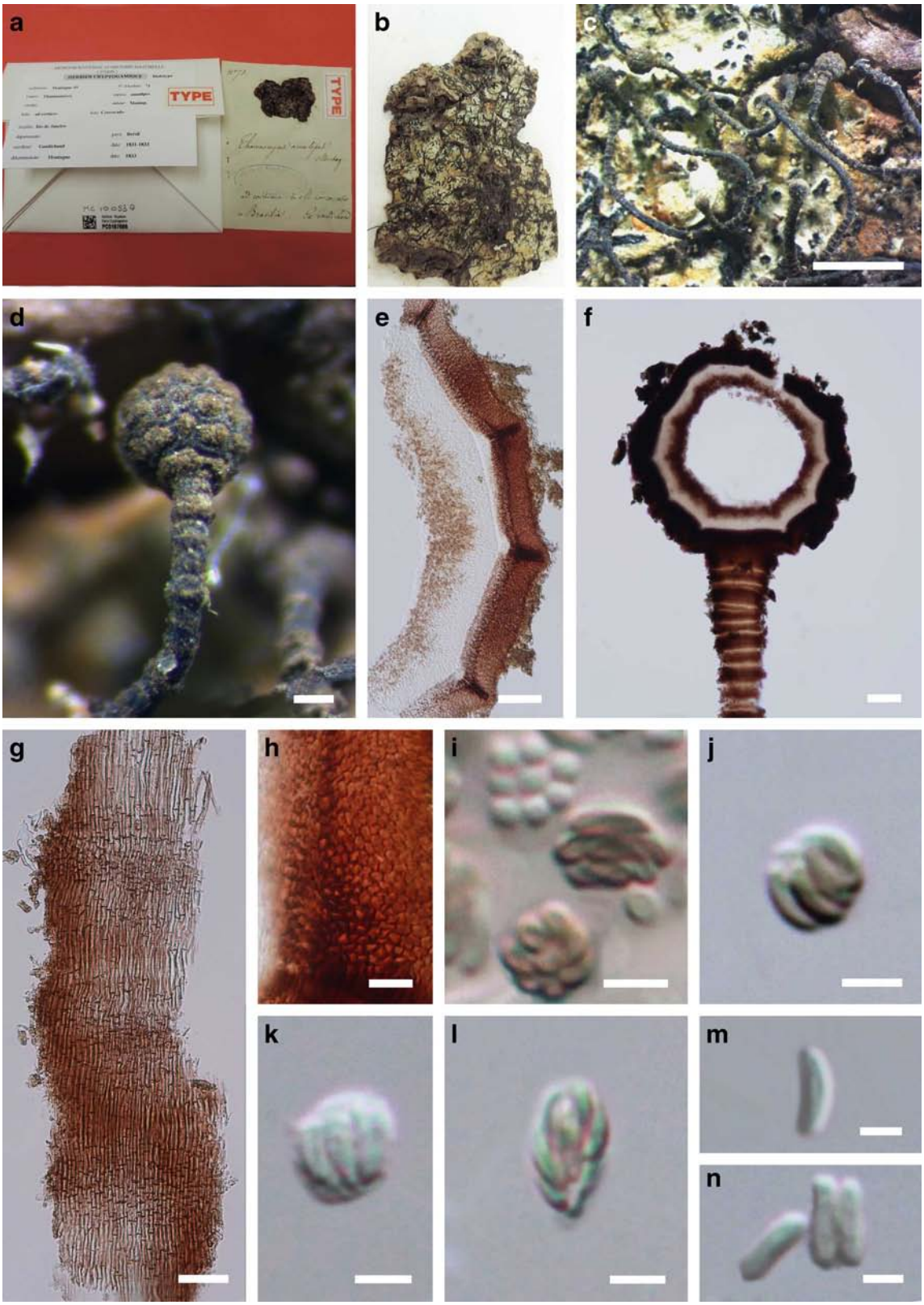


Fig. 14 ***Batistia annulipes*** (Material examined: BRAZIL, Rio de Janeiro, Corcovado, on bark, Montagne, 1831–1833, MNHN-PC-PC0167686, MC10053b, **holotype**) **a** Herbarium material **b** Host **c** Ascomata on the host **d** Ascoma **e** Peridium with asci **f** Ascoma in longitudinal section **g** Stipitate tissues from a longitudinal section **h** Peridium **i-l** Asci **m-n** Ascospores. Scale bars: **c** = 2000 μm, **d** = 200 μm, **e** = 50 μm, **f** = 100 μm, **g** = 30 μm, **h** = 10 μm, **i**–**l** = 3 μm, **m**–**n** = 2 μm

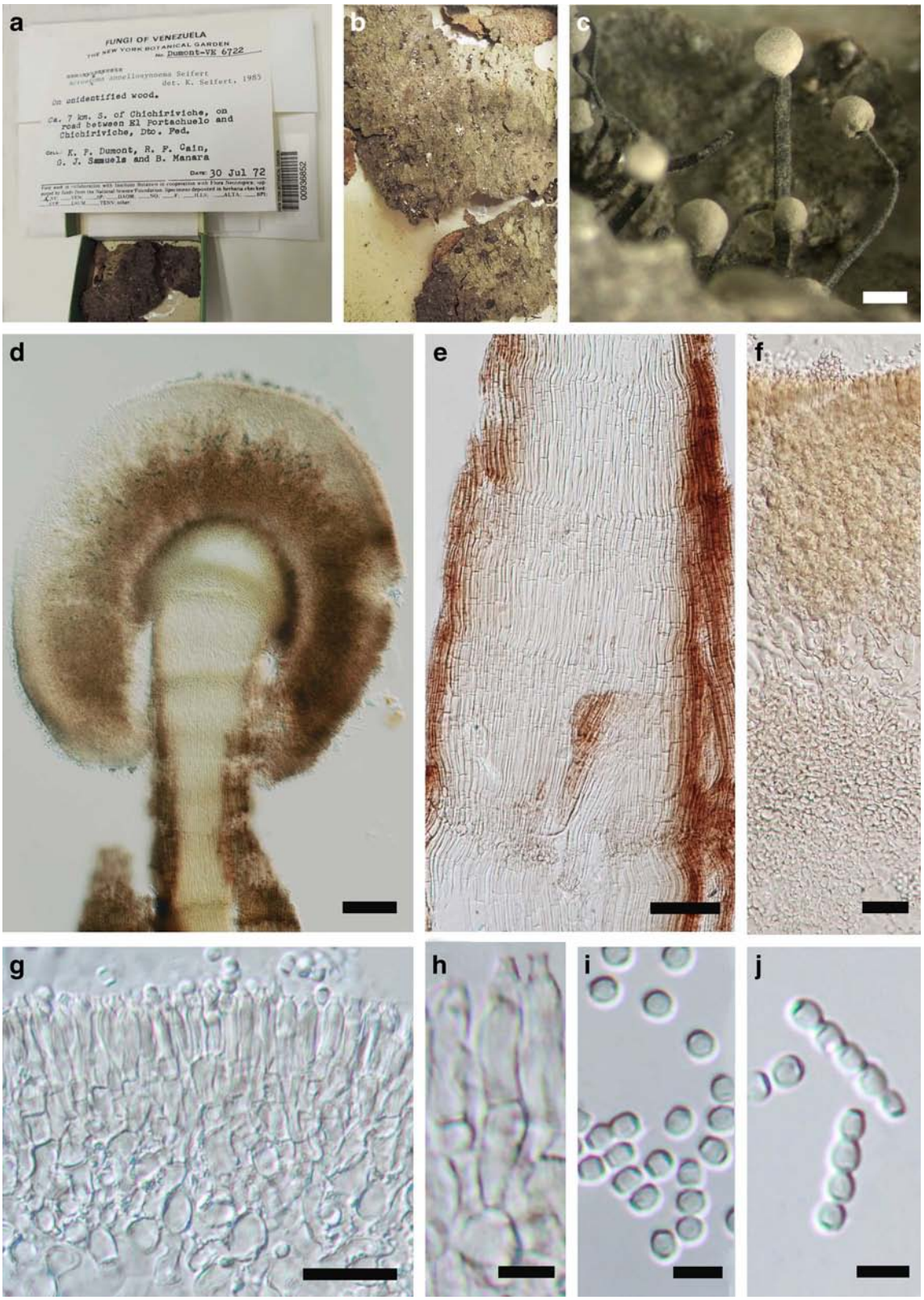


Fig. 15 ***Batistia annulipes*** (Material examined: VENEZUELA, Dto. Fed. Ca. 7 km. S. of Chichiriviche, on road between El Portachuelo and Chichiriviche, on unidentified wood, K.P. Dumont, R.F. Cain, G.J. Samuels and B. Manara, 30 July 1972, NY 00936852 (Dumont-VE 6722), **holotype**) **a** Herbarium material **b** Host **c** Synnemata on the host **d** Synnemata from longitudinal section **e** Stem tissues from a longitudinal section **f** Detail of capitulum tissues from longitudinal section **g** Conidiogenous cells **h–i** Conidia. Scale bars: **c** = 500 μm, **d** = 50 μm, **e** = 30 μm, **f** = 20 μm, **g** = 10 μm, **h–j** = 3 μm

somewhat papillate, with central ostiole; wall of 3–4 layers of subhyaline *textura angularis* to *intricata*. *Pseudoparaphyses* hyaline, septate, cellular, anastomosing, distributed among asci. *Asci* 8-spored, sessile, unitunicate, hyaline, subcylindrical. *Ascospores* tri- to multi-seriate, obovoid, hyaline, granular, smooth, aseptate with non-persistent mucoid sheath. **Asexual morph**: Hyphomycetous. *Mycelium* immersed to superficial, composed of subhyaline to brown, thin-walled hyphae. *Stromata* usually present, parenchymatous to pseudoparenchymatous, hyaline to brown, often confined to epidermal cells. Setae present or absent, straight, thick-walled, dark brown, smooth or verrucose, with radially lobed basal cell, tapering to acute apex. *Conidiophores* simple, erect, septate, pale brown, arising from the base of setae or separate. *Conidiogenous cells* pale brown, integrated, denticulate (based on Crous et al. 2015c).

Type: ***Beltrania*** Penz.

Notes: *Beltraniaceae* was introduced by Nannizzi in 1934, but, the family was not commonly used. Crous et al. (2015c) validated the family with the support of sequence data and also included *Beltraniella*, *Beltraniomyces*, *Beltraniopsis*, *Parapleurotheciopsis*, *Porobeltraniella*, *Pseudobeltrania* and *Subramaniomyces*. In earlier studies, based on sequence data, *Beltraniella*, *Pseudomassaria carolinensis* and allied hyphomycetes formed an independent clade in the *Xylariales* lineage, closely related to *Amphisphaeriaceae* (Shirouzu et al. 2010) Species in *Beltraniaceae* are generally hyphomycetous and commonly isolated as saprobes. Crous et al. (2015c) introduced *Pseudobeltrania ocoteae*, which was the first recorded sexual morph for the family.

Beltrania Penz., Nuovo G. bot. ital. 14: 72 (1882)

Facesoffungi number: FoF 02101; Fig. 16.

Saprobic on leaf litter. **Sexual morph**: Undetermined. **Asexual morph**: *Setae* erect, numerous, dark to medium brown, thick-walled, septate, straight or flexuous, tapering to an acute apex, septate, basal cell lobed. *Conidiophores* erect or mononematous, unbranched, medium brown, smooth, septate several times. *Conidiogenous cells* terminal, discrete, pale to dark brown, polyblastic, globe to subglobose, usually aseptate. *Conidia* solitary, biconic, colourless to dark brown, aseptate, with or without apical appendages.

Notes: This genus is typified by *Beltrania rhombica* Penz. which was isolated from *Citrus limonum* in Sicily. Generally in *Beltrania* and related genera, conidiogenous cells are integrated, polyblastic and often associated with almost colourless to pale brown separating cells that usually become detached with the conidia (Bhat and Kendrick 1993). Presently there are 18 epithets for *Beltrania* (Index Fungorum 2016).

Type species: ***Beltrania rhombica*** Penz., Michelia 2(no. 8): 474 (1882)

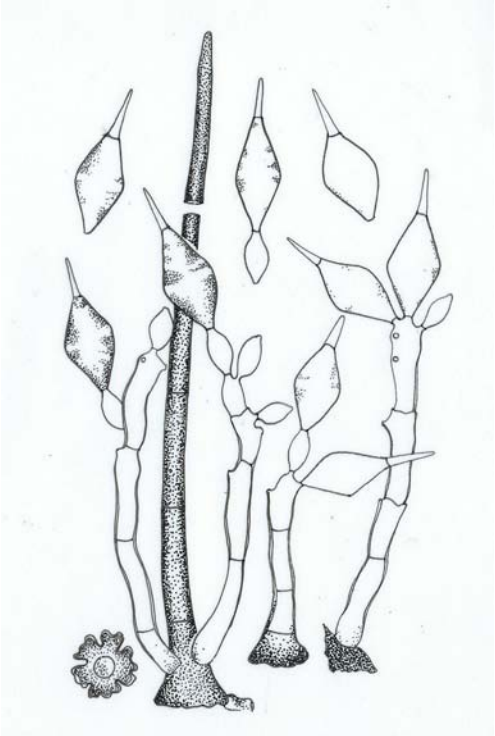


Fig. 16 *Beltrania rhombica* (redrawn from Seifert et al. 2011)

Other genera included

Beltraniella Subram., Proc. Indian Acad. Sci., Sect. B 36: 227 (1952)

Type species: ***Beltraniella odinae*** Subram., Proc. Indian Acad. Sci., Pl. Sci. 36: 224 (1952)

Beltraniomyces Manohar., D.K. Agarwal & Rao, Indian Phytopath. 56(4): 418 (2003)

Type species: ***Beltraniomyces lignicola*** Manohar. et al., Indian Phytopath. 56(4): 420 (2003)

Beltraniopsis Bat. & J.L. Bezerra, Publicações Inst. Micol. Recife 296: 4 (1960)

Type species: ***Beltraniopsis esenbeckiae*** Bat. & J.L. Bezerra, Publicações Inst. Micol. Recife 296: 7 (1960)

Parapleurotheciopsis P.M. Kirk, Trans. Br. mycol. Soc. 78(1): 63 (1982)

Type species: ***Parapleurotheciopsis inaequiseptata*** (Matsush.) P.M. Kirk, Trans. Br. mycol. Soc. 78(1): 65 (1982)

Porobeltraniella Gusmão, Mycologia 96(1): 151 (2004)

Type species: ***Porobeltraniella porosa*** (Piroz. & S.D. Patil) Gusmão, Mycologia 96(1): 151 (2004)

Pseudobeltrania Henn., Hedwigia 41: 310 (1902)

Type species: ***Pseudobeltrania cedrelae*** Henn., Hedwigia 41: 310 (1902)

Subramaniomyces Varghese & V.G. Rao, Kavaka 7: 83 (1980) [1979]

Type species: ***Subramaniomyces indicus*** Varghese & V.G. Rao, Kavaka 7: 83 (1980) [1979]

Key to genera of *Beltraniaceae*

1. Conidiophores lacking radial lobes at base ..... ***Beltraniomyces***
1. Conidiophores with radially lobed basal cells…….....2
2. Conidia lacking transverse, pale band 3
2. Conidia with transverse, pale band.....4
3. Conidiogenous cells ellipsoidal, not integrated in conidiophores..... ***Porobeltraniella***
3. Conidiogenous cells cylindrical, integrated.....***Subramaniomyces***
4. Setae absent ..... ***Pseudobeltrania***
4. Setae present ……...5
5. Conidiophores septate, or arriving from, basal cells of setae…….. 6
5. Conidiophores arising from all cells of setae……....7
6. Conidia biconic……..… ***Beltrania***
6. Conidia fusoid…..……. ***Parapleurotheciopsis***
7. Conidia biconic, proximal end rounded, distal free end rostrate…….. ***Beltraniopsis***
7. Conidia lageniform, proximal end rostrate, distal free end truncate..... ***Beltraniella***

Bertiaceae Smyk, Ukr. bot. Zh. 38(6): 47 (1981)

Facesoffungi number: FoF 01111

Saprobic on wood in freshwater and terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, dark brown to black, solitary or in small to large groups, superficial to erumpent, cupuliform, globose to subglobose, carbonaceous to membranaceous, turbinate or tuberculate or smooth, collabent or collapsing laterally or not collapsing, ostiolate. *Peridium* thick, munk pores present or absent, outer layer (pseudoparenchymatic cells) hard, composed of dark tissues, basal part mixed with host cells; inner layer composed of brown to dark brown to hyaline cells of *textura angularis*. *Hamathecium* composed of few, inflated, branched and hyaline paraphyses. *Asci* 8-spored, unitunicate, clavate, long pedicellate, apical ring indistinct or absent. *Ascospores* 2–3-seriate or irregularly arranged, hyaline to brown, cylindrical to fusiform, aseptate to multi-septate, smooth-walled, mostly with guttules. **Asexual morph**: Undetermined.

Type: ***Bertia*** De Not., G. bot. ital. 1(1): 334 (1844)

Notes: The family *Bertiaceae* was introduced by Smyk (1981) based on superficial, black, turbinate ascomata and clavate asci with hyaline, fusiform ascospores, irregularly arranged in the upper region of ascus, and typified by *Bertia* (De Notaris 1844). Nannfeldt (1975) concluded that *Nitschkiaceae* was composed of three separate groups, but that the differences between them were not distinct enough for separate families. However, he expected that *Bertia* should have an distinct position in the family. Smyk (1981) agreed with this perspective and introduced the family *Bertiaceae* based on morphology. Mugambi and Huhndorf (2010) reevaluated the order *Coronophorales* based on multi-gene analysis and transferred the genus *Gaillardiella* (typified by *G. pezizoides* Pat.) to this family. *Gaillardiella* has superficial, brown ascomata with roughened papulose peridium (Miller and Huhndorf 2009). Maharachchikumbura et al. (2015), used a multigene sequence dataset to confirm the placement of *Bertia* and *Gaillardiella* in *Bertiaceae* in a highly supported clade in the *Coronophorales*.

Bertia De Not., G. bot. ital. 1(1): 334 (1844)

Facesoffungi number: FoF 01112; Fig. 17

Saprobic on wood in freshwater and terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, solitary or gregarious, superficial or erumpent, globose to subglobose, dark brown to black, carbonaceous to membranaceous, tuberculate or smooth, collabent or collapsing laterally or not collapsing, with a short papilla. *Peridium* thick (100–250 μm), composed of three layers, outer layer comprising dark tissues, thin, carbonaceous; middle layer comprising dark brown to brown cells of *textura angularis*, thick, membranaceous, munk pores present and the inner layer comprising hyaline cells of *textura prismatica*, thin, membranaceous. *Hamathecium* composed of few, inflated, branched and hyaline paraphyses. *Asci* 8-spored, unitunicate, clavate, with long tapering pedicel, apical ring indistinct or absent. *Ascospores* irregularly arranged, hyaline to brown, cylindrical or fusiform, aseptate to multi-septate, slightly curved, smooth-walled, mostly with guttules. **Asexual morph**: Undetermined.

Type species: ***Bertia moriformis*** (Tode) De Not., G. bot. ital. 1(1): 335 (1844)

Notes: The genus *Bertia* was introduced by De Notaris (1844) and 47 epithets are listed in Index Fungorum (2016). The type species, *B. moriformis*, is characterized by tuberculate ascomata, clavate asci and hyaline ascospores. The ascomata are mostly tuberculate, when ascomata are smooth the ascospores are consistently brown (Mugambi and Huhndorf 2010).

Other genus included

Gaillardiella Pat., in Patouillard & Lagerheim, Bull. Soc. mycol. Fr. 11(4): 226 (1895)

Type species: ***Gaillardiella pezizoides*** Pat., in Patouillard & Lagerheim, Bull. Soc. mycol. Fr. 11(4): 226 (1895)

Key to genera of *Bertiaceae*

1. Ascomata tuberculate, ascospores hyaline (if the ascomata smooth, ascospores brown) ……..... ***Bertia***

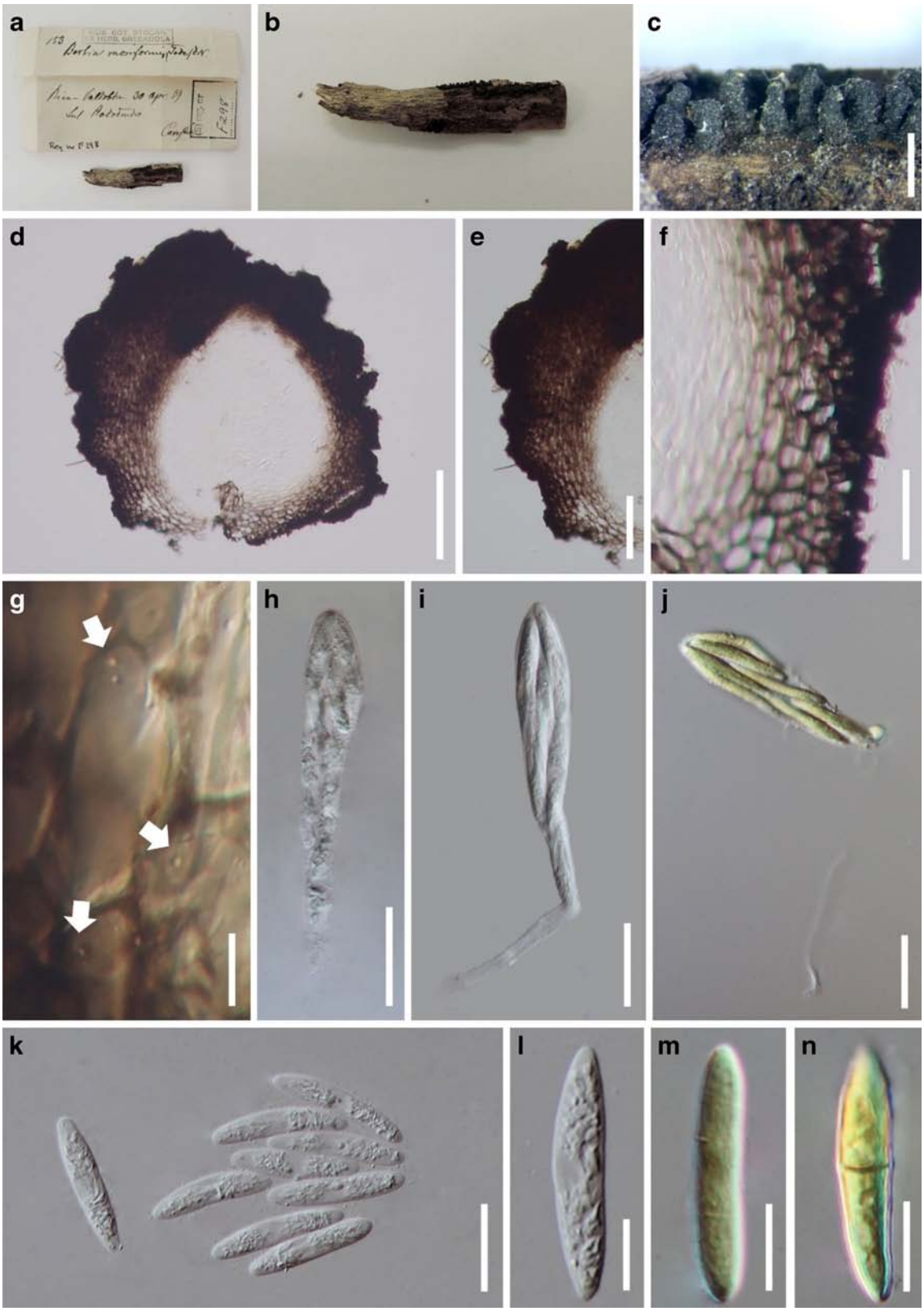


Fig. 17 ***Bertia moriformis*** (Material examined: ITALY, Riva Valdobbia, on dead wood of *Rhododendron* sp., 30 April 1859, Carestia, S F298) **a** Label and herbarium material **b** Herbarium material **c** Black ascomata on host surface **d** Ascoma in vertical section **e-f** Peridium **g** Munk pores arrowed **h-j** Asci **k-n** Ascospores. Notes: j, m, n stained in Melzer's reagent, f, i, k, l in KOH. Scale bars: **c** = 1 mm, **d** = 200 μm, **e** = 100 μm, **f** = 50 μm, **h**–**k** = 20 μm, **g. l**–**n** = 10 μm

1. Ascomata tuberculate, ascospores brown ..... ***Gaillardiella***

Bionectriaceae Samuels & Rossman, Stud. Mycol. 42: 15 (1999)

Facesoffungi number: FoF 01367

Herbicolous, *corticolous*, *lichenicolous* or *fungicolous*, found in terrestrial, freshwater and marine habitats. **Sexual morph**: *Ascomata* embedded in a weakly or well-developed erumpent stroma, or superficial on the substratum, solitary or densely aggregated, crowded, *Ascomata* perithecial, rarely cleistothecial, if perithecial, globose, subglobose to pyriform, if cleistothecial, globose, white, yellow, orange, reddish brown, greenish or purple to violet, without changing colour in KOH or lactic acid, smooth to rough, or warted, ostiolate or non-ostiolate. *Peridium* composed of 1–3 layers. *Periphyses* present or absent. *Asci* (2–)8-spored, uniseriate, biseriate, multi-seriate or irregular, unitunicate, clavate, saccate, cylindrical, sessile or short pedicellate, rarely evanescent, apex simple or with an inconspicuous or distinct, J-, apical ring. *Ascospores* unicellular to multi-septate, sometimes muriform, globose, fusiform, ellipsoid or broadly ellipsoid, hyaline, smooth-walled, spinulose to tuberculate or striate. **Asexual morph**: Hyphomycetous, acremonium- or gliocladium-like. *Conidiophores* dimorphic or monomorphic, commonly sporodochial or synnematous, [?] hyaline, subhyaline to brown or blackish brown, smooth-walled to finely echinulate. *Conidiogenous cells* phialidic. *Phialides* mostly cylindrical to flask-shaped. *Conidia* unicellular to multi-septate, ellipsoidal, fusiform to subfusiform, sometimes with papillate or truncate ends, hyaline to greenish hyaline or olivaceous grey, smooth or striate walled.

Type: ***Bionectria*** Speg. (= ***Clonostachys*** Corda)

Notes: The family *Bionectriaceae* was introduced by Rossman et al. (1999) to accommodate 26 genera including five cleistothecial genera and with *Bionectria* Speg. as the type genus. Although it included five cleistothecial genera, four of them were accepted in the family according to analysis of molecular data (Rossman et al. 2001). Rossman et al. (2013) suggested synonymizing *Spicariaceae*, which has rarely been cited, under *Bionectriaceae*. This family is characterized by uniloculate perithecial or rarely cleistothecial ascomata, that are white, yellow, orange to tan or brown, not changing colour in KOH or lactic acid, and are generally superficial, lacking a stroma, or immersed in the substratum (Rossman et al. 1999). Many of the genera were based on species initially described in *Nectria* (Rossman et al. 1999). Phylogenetic analysis by Rossman et al. (2001) including those genera and related asexual morph taxa has confirmed that *Bionectriaceae* is monophyletic within *Hypocreales*. Currently 39 genera are listed under this family (Maharachchikumbura et al. 2015).

Clonostachys Corda, Pracht-Fl. Eur. Schimmelbild.: 31 (1839)

= *Bionectria* Speg., Boln Acad. nac. Cienc. Córdoba 23(3–4): 563 (1919) [1918]

Facesoffungi number: FoF 02102; Figs 18, 19

Herbicolous, corticolous or *fungicolous*. **Sexual morph**: *Ascomata* forming on a well-developed, erumpent stroma, rarely superficial on the substratum, densely crowded in large numbers, sometimes solitary, perithecial, globose, in orange hues (yellowish orange, pale orange, light orange, brownish orange), without changing colour in KOH or lactic acid, slightly papillate, without a neck, smooth to rough or warted. *Peridium* composed of two or three strata, outer strata composed of angular to subglobose cells, merging into the stroma and into the cells of warts (when present), central strata consisting of intertwined hyphae forming a *textura intricata* in surface view, inner strata composed of layers of lobed cells, with conspicuous pseudopores in the cell wall. *Periphyses* persisting or not. *Asci* 8-spored, unitunicate, clavate, apex rounded, flat, or with prominent edges, with or without a refractive ring. *Ascospores* 0–1-septate, ellipsoid, not disarticulating into part-spores, hyaline, smooth-walled, spinulose to tuberculate or striate. **Asexual morph**: Hyphomycetous. *Conidiophores* dimorphic or monomorphic, mononematous or forming sporodochia, hyaline, smooth-walled, generally differentiated into a stipe and a branched part (penicillus). *Stipes* arise erect from a submerged supporting hypha, a solitary aerial hypha or aerial hyphal fascicles, ropes or strands, consisting of one to several cells and is always delimited by a septum near the base. *Penicillus* consists of single whorl of phialides (monoverticillate), several whorls of phialides arising from intercalary cells of the main axis (2– or more-level verticillate, or consists of successive branches that form whorls of additional supporting cells or whorls of phialides (biverticillate, terverticillate). *Conidiogenous cells* phialidic. *Phialides* cylindrical to flask-shaped, with or without truncate apex in secondary conidiophores. *Conidial masses* hyaline, salmon, yellowish, green or hardly pigmented, arrange in imbricate chains. *Conidia* aseptate or 1-septate, ellipsoidal to subfusiform, slightly curved, frequently having a somewhat flattened side, and a laterally displaced hilum, rarely straight with an almost median hilum or entirely symmetrical without a visible hilum, hyaline or greenish hyaline, smooth or very rarely ornamented.

Type species: ***Clonostachys araucaria*** Corda, in Lombard, van der Merwe, Groenewald & Crous 2015

Notes: Spegazzini (1919) proposed the genus *Bionectria* (based on characters of the asexual morph) for species of *Nectria* that occur on living plant material. He originally included one species based on a single specimen, which was characterized by flesh-coloured to orange perithecia, crowded on a well-developed stroma, and fusiform, apically rounded asci, with 1-septate ascospores. Subsequent authors considered *Bionectria* a synonym of *Nectria* (Müller and von Arx

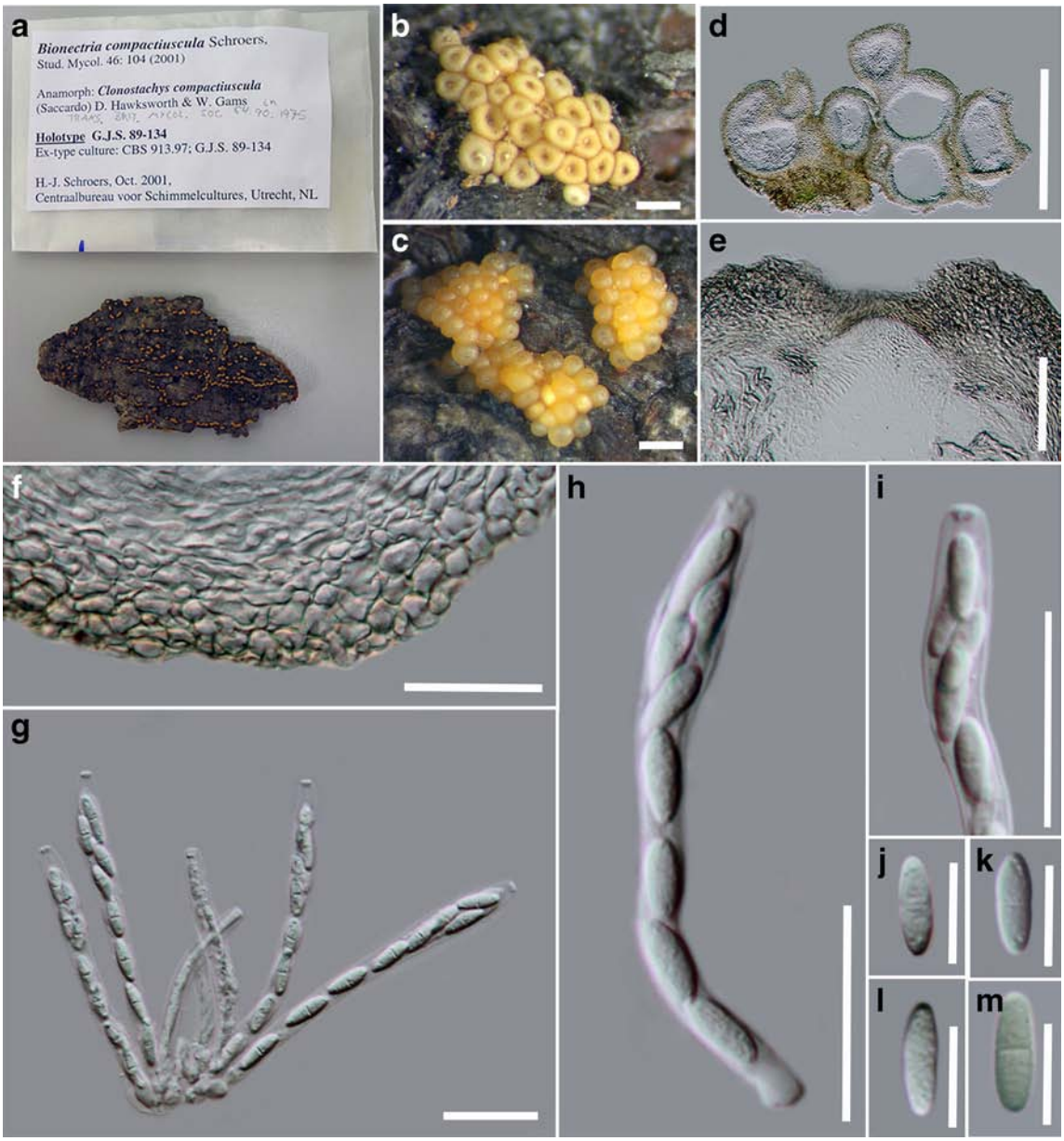


Fig. 18 ***Clonostachys compactiuscula*** (sexual morph) (Material examined: USA, North Carolina, Jackson Co., Nantahala Natl. Forest, Bull Pen Rd. to Chattooga River, Ellicott Rock Trail from Fowler Creek, on bark of recently dead *Fagus* sp., 28 Sept 1989, G.J. Samuels, C.T. Rogerson, R.C. Harris, W.R. Buck, Det. G.J. Samuels, NY 00966769, **holotype**). **a** Herbarium material **b**, **c** Ascomata on host substrate **d**, **e** Transverse section through ascomata **f** Peridium **g**, **h** Asci **i** Ascus in Melzer's reagent **j**-**l** Ascospores **m** Ascospore in Melzer's reagent. Scale bars: **b**–**d** = 500 μm, **e** = 50 μm, **f** = 100 μm, **g**–**h** = 20 μm, **i** = 20 μm, **j**–**m** = 10 μm

1962; Samuels 1988). *Bionectria* forms a monophyletic clade based on analyses of DNA sequence data (Schroers 2001; Maharachchikumbura et al. 2015).

The asexual morphs of species in *Bionectria* are characterized by penicillate, frequently sporodochial, and, in many cases, dimorphic conidiophores (Schroers 2001). Schroers (2001) reported a possible link between *Clonostachys* and *Bionectria*, and Rossman et al. (2013) have synonymized *Bionectria* under *Clonostachys*. This link was followed in Maharachchikumbura et al. (2015). *Clonostachys* has been given priority because it is the older asexual genus and the name *Clonostachys rosea* (the generic type) is commonly used in biocontrol studies (Rossman et al. 2013; Maharachchikumbura et al. 2015).

Other genera included

Acremonium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 15 (1809)

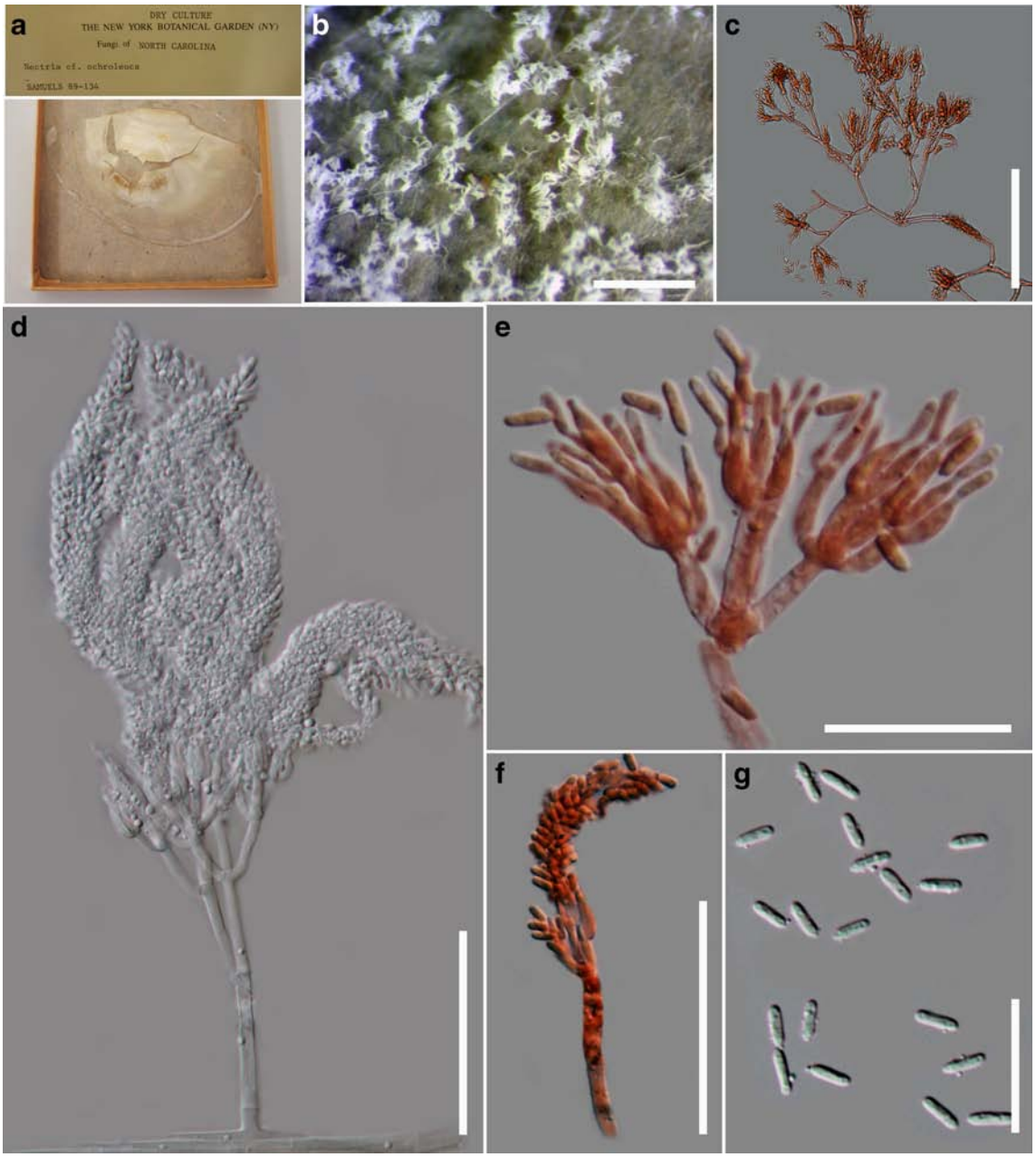


Fig. 19 ***Clonostachys compactiuscula*** (asexual morph) (Material examined: Dry culture on CMA, NY 00966769) **a** Dry culture **b** Sporulation on CMA **c** Conidiophores stained in Congo red **d** Conidiophores with multiple conidial columns **e** Conidiophores in Congo red **f** Conidial column stained with Congo red **g** Conidia Scale bars: **b** = 500 μm, **c** = 100 μm, **d** = 50 μm, **e** = 20 μm, **f** = 50, **g** = 20 μm

Type species: ***Acremonium alternatum*** Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 15 (1809)

Anthonectria Döbbeler, Mycologia 102(2): 405 (2010)

Type species: ***Anthonectria mammispora*** Döbbeler, Mycologia 102(2): 405 (2010)

Aphanotria Döbbeler, Mycol. Res. 111(12): 1408 (2007)

Type species: ***Aphanotria paradoxa*** Döbbeler, Mycol. Res. 111(12): 1408 (2007)

Battarrina (Sacc.) Clem. & Shear, Gen. fung., Edn 2 (Minneapolis): 279 (1931)

Type species: ***Battarrina inclusa*** (Berk. & Broome) Clem. & Shear, Gen. fung., Edn 2 (Minneapolis): 279 (1931)

Bryocentria Döbbeler, Mycol. Progr. 3(3): 247 (2004)

Type species: ***Bryocentria brongniartii*** (P. Crouan & H. Crouan) Döbbeler, Mycol. Progr. 3(3): 248 (2004)

Clibanites (P. Karst.) P. Karst., Bidr. Känn. Finl. Nat. Folk 19: 14, 167 (1871)

Type species: ***Clibanites paradoxa*** (P. Karst.) P. Karst., Bidr. Känn. Finl. Nat. Folk 19: 14 (1871)

Didymostilbe Henn., Hedwigia 41: 148 (1902)

Type species: ***Didymostilbe coffeae*** Henn., Hedwigia 41: 148 (1902)

Dimerosporiella Speg., Revta Mus. La Plata 15: 10 (1908)

Type species: ***Dimerosporiella paulistana*** Speg., Revta Mus. La Plata 15(2): 11 (1908)

Gliomastix Guég., Bull. Soc. mycol. Fr. 21: 240 (1905)

Type species: ***Gliomastix chartarum*** (Cooke) Guég., Bull. Soc. mycol. Fr. 21: 240 (1905)

Globonectria Etayo, Biblthca Lichenol. 84: 47 (2002)

Type species: ***Globonectria cochensis*** Etayo, Biblthca Lichenol. 84: 47 (2002)

Gracilistilbella Seifert, Stud. Mycol. 45: 18 (2000)

Type species: ***Gracilistilbella clavulata*** (Mont.) Seifert, in Seifert & Samuels, Stud. Mycol. 45: 18 (2000)

Halonectria E.B.G. Jones, Trans. Br. Mycol. Soc. 48(2): 287 (1965)

Type species: ***Halonectria milfordensis*** E.B.G. Jones, Trans. Br. Mycol. Soc. 48(2): 287 (1965)

Heleococcum C.A. Jørg., Bot. Tidsskr. 37: 417 (1922)

Type species: ***Heleococcum aurantiacum*** C.A. Jørg., Bot. Tidsskr. 37: 417 (1922)

Hydropisphaera Dumort., Comment. bot. (Tournay): 89 (1822)

Type species: ***Hydropisphaera peziza*** (Tode) Dumort., Comment. bot. (Tournay): 90 (1822)

Ijuhya Starbäck, Bih. K. svenska VetenskAkad. Handl., Afd. 3 25(no. 1): 30 (1899)

Type species: ***Ijuhya vitrea*** Starbäck, Bih. K. svenska Vetensk Akad. Handl., Afd. 3 25(no. 1): 30 (1899)

Kallichroma Kohlm. & Volkm.-Kohlm., Mycol. Res. 97(6): 759 (1993)

Type species: ***Kallichroma tethys*** (Kohlm. & E. Kohlm.) Kohlm. & Volkm.-Kohlm., Mycol. Res. 97(6): 759 (1993)

Lasionectria (Sacc.) Cooke, Grevillea 12(no. 64): 111 (1884)

Type species: ***Lasionectria mantuana*** (Sacc.) Cooke, Grevillea 12(no. 64): 112 (1884)

Mycocitrus Möller, Bot. Mitt. Trop. 9: 297 (1901)

Type species: ***Mycocitrus aurantium*** Möller, Bot. Mitt. Trop. 9: 297 (1901)

Nectriella Nitschke ex Fuckel, Jb. nassau. Ver. Naturk. 23–24: 175 (1870) [1869–70]

Type species: ***Nectriella fuckelii*** Nitschke ex Fuckel, Jb. nassau. Ver. Naturk. 23–24: 176 (1870) [1869–70]

Nectriopsis Maire, Annls mycol. 9(4): 323 (1911)

Type species: ***Nectriopsis violacea*** (J.C. Schmidt ex Fr.) Maire, Annls mycol. 9(4): 323 (1911)

Ochronectria Rossman & Samuels, in Rossman et al., Stud. Mycol. 42: 53 (1999)

Type species: ***Ochronectria calami*** (Henn. & E. Nyman) Rossman & Samuels, in Rossman et al., Stud. Mycol. 42: 53 (1999)

Ovicuculospora Etayo, Bull. Soc. linn. Provence 61: 83–128 (2010)

Type species: ***Ovicuculospora parmeliae*** (Berk. & M.A. Curtis) Etayo, Bull. Soc. linn. Provence 61: 83–128 (2010)

Paranectria Sacc., Michelia 1(no. 3): 317 (1878)

Type species: ***Paranectria affinis*** (Grev.) Sacc., Michelia 1(no. 3): 317 (1878)

Peristomialis (W. Phillips) Boud., Hist. Class. Discom. Eur. (Paris): 116 (1907)

Type species: ***Peristomialis berkeleyi*** Boud., Hist. Class. Discom. Eur. (Paris): 116 (1907)

Pronectria Clem., in Clements & Shear, Gen. fung., Edn 2 (Minneapolis): 78, 282 (1931)

Type species: ***Pronectria lichenicola*** (Cooke) Clem., in Clements & Shear, Gen. fung., Edn 2 (Minneapolis): 282 (1931)

Protocreopsis Yoshim. Doi, Kew Bull. 31(3): 551 (1977)

Type species: ***Protocreopsis zingibericola*** Yoshim. Doi, Kew Bull. 31(3): 552 (1977)

Rhopalocladium Schroers et al., in Schroers et al., Mycologia 91(2): 375 (1999)

Type species: ***Rhopalocladium myxophilum*** Schroers et al., in Schroers et al., Mycologia 91(2): 375 (1999)

Roumegueriella Speg., in Roumeguère, Revue mycol., Toulouse 2(no. 1): 18 (1880)

Type species: ***Roumegueriella muricospora*** Speg., in Roumeguère, Revue mycol., Toulouse 2(no. 1): 18 (1880)

Selinia P. Karst., Meddn Soc. Fauna Flora fenn. 1: 57 (1876)

Type species: ***Selinia pulchra*** (G. Winter) Sacc., in Saccardo, Syll. fung. (Abellini) 2: 457 (1883)

Spicellum Nicot & Roquebert, Revue Mycol., Paris 39(4): 272 (1976) [1975]

Type species: ***Spicellum roseum*** Nicot & Roquebert, Revue Mycol., Paris 39(4): 272 (1976) [1975]

Stephanonectria Schroers & Samuels, in Schroers et al., Sydowia 51(1): 116 (1999)

Type species: ***Stephanonectria keithii*** (Berk. & Broome) Schroers & Samuels, Sydowia 51(1): 116 (1999)

Stilbocrea Pat., Bull. Soc. mycol. Fr. 16: 188, 186 (1900)

Type species: ***Stilbocrea dussii*** Pat., Bull. Soc. Mycol. Fr. 16: 186 (1900)

Stromatocrea W.B. Cooke, Mycologia 44(2): 248 (1952)

Type species: ***Stromatocrea cerebriformis*** W.B. Cooke [as 'cerebriforme'], Mycologia 44(2): 248 (1952)

Stromatonectria Jaklitsch & Voglmayr, Mycologia 103(2): 435 (2011)

Type species: ***Stromatonectria caraganae*** (Höhn.) Jaklitsch & Voglmayr, Mycologia 103(2): 435 (2011)

Trichonectria Kirschst., Verh. bot. Ver. Prov. Brandenb. 48: 60 (1907) [1906]

Type species: ***Trichonectria aculeata*** Kirschst., Verh. bot. Ver. Prov. Brandenb. 48: 60 (1907) [1906]

Vesicladiella Crous & M.J. Wingf., in Crous et al., Mycotaxon 50: 454 (1994)

Type species: ***Vesicladiella capitata*** (B. Sutton) Crous & M.J. Wingf. [as 'capitatum'], Mycotaxon 50: 456 (1994)

Verrucostoma Hirooka et al., in Hirooka et al., Mycologia 102(2): 422 (2010)

Type species: ***Verrucostoma freycinetiae*** Hirooka et al., in Hirooka et al., Mycologia 102(2): 422 (2010)

Virgatospora Finley, Mycologia 59(3): 538 (1967)

Type species: ***Virgatospora echinofibrosa*** Finley, Mycologia 59(3): 538 (1967)

Key to the sexual/ and asexual morph genera of *Bionectriaceae*

1. Ascomata cleistothecial, globose, asci clavate …… 2
1. Ascomata perithecial, subglobose to pyriform, asci elongate, very rarely clavate ..…..…..…..…..…..… 4
2. Ascospores ellipsoid, 1-septate, smooth to ornamented with wings ……..…… ***Heleococcum***
2. Ascospores globose, aseptate, ornamented with sharp, pointed spines ……..……...……..… 3
3. Ascomata on dung and well-rotten debris, ascospores with sparse echinulations, asexual morph *Gliocladium*-like …..…..…..…..…….....***Roumegueriella***
3. Ascomata on fruiting bodies of *Tuber*, ascospores densely echinulate, asexual morph Undetermined ..…..…..…..…..…..… ***Battarrina***
4. Ascomata immersed in the substratum or in a stroma that may itself be immersed in the substratum.…..…..… 5
4. Ascomata superficial or immersed in a hyphal subiculum or thin stromata 13
5. Ascomata immersed in a stromata that may itself be immersed in the substratum, on dung, corticolous, herbicolous, not lichenicolous or fungicolous, ascospores 0–1-septate …….. 6
5. Ascomata immersed in substratum, non stromatic, corticolous, herbicolous, lichenicolous, fungicolous or bryophilous, not on dung, ascospores non to multiseptate or muriform …… 8
6. Ascospores aseptate, on dung …… ***Selinia***
6. Ascospores 1-septate, corticolous or herbicolous …….7
7. Stromata yellow orange to red or purple, asci fusoid or clavate …… ***Stromatonectria***
7. Stromata buff to rufous, asci cylindrical . . . ***Mycocitrus***
8. On algae or wood in marine habitats, ascomata with a long neck. . . . . ***Halonectria***
8. Terrestrial or in freshwater habitats, ascomata without a long neck. 9
9. Ascomata immersed in thalli of terrestrial lichens, rarely on algae or fungi, asexual morphs where known, Acremonium-like or Kutilakesa-like. 10
9. Ascomata immersed in thalli of bryophytes, herbaceous tissue, bark or wood, rarely fungicolous, asexual morphs where known, Acremonium-like 11
10. Ascospores subsphaerical, with granulose ornamentation . . . . . .***Globonectria***
10. Ascospores fusiform, ovoid or ellipsoid, verruculose or smooth walled . . . . . ***Pronectria***
11. Ascomata immersed in herbaceous tissue, bark or wood, rarely fungicolous . . . . . ***Nectriella***
11. Ascomata immersed in thalli of liverworts or mosses, not fungicolous 12
12. Ascomata immersed in leaves of *Polytrichadelphus* sp., globose with an apical papilla, or pyriform, pale to golden-yellow or pale orange, ascospores composed of two parts, fertile and sterile . . . . . ***Anthonectria***
12. Ascomata immersed in perianth of *Drepanolejeunea*, colourless, ascospores fusiform, colourless, with five transverse septa . . . . . .***Aphanotria***
13. Ascospores with long attenuated ends, on lichens or algae . . . . . .***Paranectria***
13. Ascospores with rounded ends, on lichens, algae, bryophytes, fungi or other substrata. 14
14. Ascomata with erect solitary hairs, ascospores 1–multiseptate . . . . . ***Trichonectria***
14. Ascomata without hairs, or if present, hairs fasciculate or flexuous, sometimes with few short setae or tooth like structures surrounding ostiolar region, ascospores generally 1-septate 15
15. Ascomata superficial on a thin stroma 16
15. Ascomata superficial on the substratum or immersed in a stroma 18
17. Ostiolum surrounded by a crown-like structure made up of angular to oblong, tooth-like or sometimes hypha-like cells, asexual morph Myrothecium-like . . . . . .***Stephanonectria***
17. Ostiolum not surrounded by a crown-like structure, asexual morph Acremonium-like. . . . . ***Verrucostoma***
18. Ascomata immersed in a stroma or superficial with white to tan or green hyphae covering the ascomatal wall. 19
18. Ascomata superficial, seated directly on the substratum, and without white to tan hyphae covering the ascomatal wall 22
19. Ascomata immersed, loosely united in a thin, pseudoparenchymatous stroma, ascospores narrowly cylindrical, smooth walled. . . . . ***Clibanites***
19. Ascomata immersed in an effused hyphal stroma or superficial with a covering of white to tan or green hyphae, ascospores ellipsoid to fusiform, occasionally obovoid, smooth, striate, spinulose, verruculose or tuberculate. 20
20. Ascomata pale to medium cream or pink orange, asci with dimorphic, 1(−2)-septate spores . . . . . .***Ovicuculospora***
20. Ascomata hyaline, pale yellow to orange, Asci with monomorphic 1-septate spores. 21

21 Ascomata immersed in an effused hyphal stroma, ascospores generally striate, less often smooth or tuberculate, asexual morph Acremonium-like, usually on monocotyledonous plant debris. . . . . ***Protocreopsis***

21. Ascomata immersed in an effused hyphal stroma or superficial with tan hyphae covering the ascomatal wall, ascospores spinulose or verrucose, asexual morphs synnematous (Stilbella-like) or Acremonium-like, corticolous or sometimes on other ascomycetes . . . . . ***Stilbocrea***

22. Ascomata white to pale yellow or orange, smooth, or covered with white hyphae or flexuous hairs, ascospores smooth to spinulose, rarely striate, fungicolous or on liverworts and mosses. 23

22. Ascomata white to orange, sometimes with white warts, with or without hyphal or fasciculate hairs, ascospores smooth, spinulose or striate, corticolous, less often fungicolous or herbicolous 25

23. Ascomata on liverworts or mosses . . . . . ***Bryocentria***

23. Ascomata on myxomycetes, pyrenomycetes or dematiaceous hyphomycetes, rarely on *Aphyllophorales* 24

24. Ascomata on *Asterina*, *Meliola*, *Schnifferula*, growing on superficial, black hyphae covering living leaves. . . . . ***Dimerosporiella***

24. Ascomata on other fungi, including myxomycetes, not on *Meliola* or similar fungi on living leaves . . . . . ***Nectriopsis***

25. Ascomata globose to subglobose, occasionally doliiform, becoming cupulate upon drying, ascomatal wall of globose, thin walled cells, ascospores often striate 26

25. Ascomata globose to subglobose or ovoid, generally not cupulate upon drying, ascomatal wall of thick walled cells, ascospores smooth, spinulose or striate. 27

26. Ascomata of three regions, with orange oil droplets in the middle region of the wall . . . . . ***Ochronectria***

26. Ascomata of two regions, without orange oil droplets. . . . . ***Hydropisphaera***

27. Ascomata with a flattened apex, often with solitary or fasciculate hairs forming an apical fringe, ascospores striate or spinulose 28

27. Ascomata without distinct hairs, smooth to warted or with short hyphal hairs, ascospores smooth, spinulose or rarely striate. . . . . ***Clonostachys***

28. Ascomata yellow-brown to dark brown, globose to subglobose, with solitary stiff or hyphal hairs, not forming a distinct fringe, ascospores striate or spinulose, herbicolous or corticolous . . . . . ***Lasionectria***

28. Ascomata white to pale yellow, globose to ovoid, with a flattened apical disk, often with a fringe of fasciculate hairs, ascospores striate, rarely spinulose, herbicolous. . . . . ***Ijuhya***

Key to the asexual morph genera of *Bionectriaceae*

1. Conidiophores monomorphic, neither sporodochial nor synnematous, conidia ellipsoidal, polysymmetrical, sometimes slightly curved, on living myxomycetes . . . . . ***Rhopalocladium***

1. Conidiophores sporodochial, synnematous or simple, conidia spherical, ellipsoidal, ovate or fusiform, not on myxomycetes 2

2. Conidiophores simple, septate, unbranched, with terminal phialides. . . . . ***Spicellum***

2. Conidiophores sporodochial, synnematous. 3

3. Synnemata, cylindrical-capitate . . . . . ***Didymostilbe***

3. Sporodochia cerebriform . . . . . ***Stromatocrea***

(This key is a modification of the key of Rossman et al. 1999)

Boliniaceae Rick, Brotéria, sér. bot. 25: 65 (1931)

Facesoffungi number: FoF 01129

Saprobic on decorticated wood or decaying wood in terrestrial habitats. **Sexual morph**: *Ascostromata* absent or present, immersed, erumpent to superficial, clypeate to irregular in shape, light brown to black, coriaceous, membranaceous or powdered (or furaceous), with or without brown, septate interwoven hyphae, if present surrounding the apex of the ascomata. *Ascomata* perithecial, solitary to gregarious, brown to black, immersed, erumpent to superficial, globose, cylindrical to obpyriform, coriaceous or membranaceous, smooth, papillate or papilla absent, if present with periphysate ostiole, stellate or not. *Peridium* thick (20–150 μm), outer layer hard, composed of brown, thick-walled cells of *textura angularis* or *textura intricata*; inner layer soft, composed of hyaline, thin-walled cells of *textura prismatica*. *Hamathecium* composed of abundant, persistent, filamentous, tapering, septate, branched paraphyses. *Asci* 8-spored, unitunicate, cylindrical to clavate, long pedicellate, some with an apical ring. *Ascospores* 2–3-seriate, hyaline to brown, versicolored or concolourous (hyaline or brown), ellipsoid to cylindrical, straight to slightly curved to suballantoid, 0–2-septate, smooth-walled, mostly with guttules. **Asexual morph**: Undetermined.

Type: ***Bolinia*** (Nitschke) Sacc

Notes: The family *Boliniaceae* was introduced by Rick (1931) based on black ascostromata and cylindrical asci with smooth ascospores, and is typified by *Camarops* (Karsten 1873). Earlier, this family was placed in *Xylariales* based on morphological similarity (Barr 1990; Romero and Samuels 1991). Andersson et al. (1995) concluded that *Boliniaceae* was more closely related to *Sordariales* based on SSU rDNA sequence data. This family was subsequently placed in *Boliniales* by Kirk et al. (2001).

Based on phylogenetic and morphological data six genera were accepted in *Boliniaceae* (Lumbsch and Huhndorf 2010). Untereiner et al. (2013) added *Apiorhynchostoma* and *Pseudovalsaria* based on the LSU rDNA sequence data of *Apiorhynchostoma curreyi* and *Pseudovalsaria ferruginea*.

Bolinia (Nitschke) Sacc., Syll. fung. (Abellini) 1: 352 (1882)

Facesoffungi number: FoF 01130, Fig. 20

Saprobic on decorticated wood or decaying wood in terrestrial habitats. **Sexual morph**: *Ascostromata* immersed, erumpent to superficial, irregular in shape, black, coriaceous, membranaceous. *Ascomata* perithecial, gregarious, brown to dark brown, immersed, erumpent through bark of host substrate at maturity, globose to subglobose, coriaceous to membranaceous, smooth, papillate, with periphysate ostiole. *Peridium* thick, outer layer coriaceous, thick-walled, composed of brown to dark brown cells of *textura intricata*; inner layer membranaceous, composed of hyaline cells of *textura prismatica. Hamathecium* composed of abundant, persistent, filamentous, septate, branched paraphyses. *Asci* 8-spored, unitunicate, cylindrical, slightly curved, blunt apex with barely visible apical ring, long pedicellate. *Ascospores* 2–3-seriate, pale brown when young, dark brown at maturity, subglobose to ellipsoid, aseptate, smooth, with guttulate. **Asexual morph**: Undetermined.

Type species: ***Bolinia tubulina*** (Alb. & Schwein.) Sacc., Syll. fung. (Abellini) 1: 352 (1882)

Notes: The name *Bolinia* was first introduced as a subgenus by Nitschke (1867), and later raised to generic rank by Saccardo (1882). Karsten (1873) introduced the genus *Camarops* based on the single species *C. hypoxyloides* P. Karst. Rehm (1904) and Theissen (1999) considered *Bolinia tubulina* to be a synonym of *Camarops hypoxyloides*, but Miller (1930) disagreed based on a re-evaluation of specimens. Miller (1930) however, accepted *C. polyspermum* (Mont.) J.H. Mill as a synonym of *C. hypoxyloides*. Nannfeldt (1972) reviewed the taxonomy of these taxa and concluded that *Camarops* and *Bolinia* were two different genera, but having similar morphological characters. However, Lumbsch and Huhndorf (2010) excluded *Bolinia* and included it as the synonym of *Camarops* (Index Fungorum 2016). *Bolinia tubulina* (current name *Camarops tubulina*) is the type of *Bolinia* (Index Fungorum 2016). In our opinion, *Bolinia tubulina* should be accepted as the type species and *Camarops* should be regarded as an independent genus.

Other genera included

Apiocamarops Samuels & J.D. Rogers, Mycotaxon 28(1): 54 (1987)

Type species: ***Apiocamarops alba*** Samuels & J.D. Rogers, Mycotaxon 28(1): 54 (1987)

Apiorhynchostoma Petr., Annls mycol. 21(3/4): 185 (1923)

Type species: ***Apiorhynchostoma apiculata*** (Sacc.) Petr., Annls mycol. 21(3/4): 185 (1923)

Camaropella Lar.N. Vassiljeva, Mikol. Fitopatol. 31(1): 6 (1997)

Type species: ***Camaropella pugillus*** (Schwein.) Lar.N. Vassiljeva, Mikol. Fitopatol. 31(1): 6 (1997)

Camarops P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 6, 53 (1873)

Type species: ***Camarops hypoxyloides*** P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 53 (1873)

Cornipulvina Huhndorf et al., Fungal Diversity 20: 61 (2005)

Type species: ***Cornipulvina ellipsoides*** Huhndorf et al., Fungal Diversity 20: 63 (2005)

Endoxyla Fuckel, Jb. nassau. Ver. Naturk. 25–26: 321 (1871)

Type species: ***Endoxyla operculata*** (Alb. & Schwein.) Sacc., Syll. fung. (Abellini) 1: 181 (1882)

Mollicamarops Lar.N. Vassiljeva, Mycotaxon 99: 160 (2007)

Type species: ***Mollicamarops stellata*** Lar.N. Vassiljeva, Mycotaxon 99: 160 (2007)

Neohypodiscus J.D. Rogers, Y.M. Ju & Læssøe, Mycologia 86(5): 684 (1994)

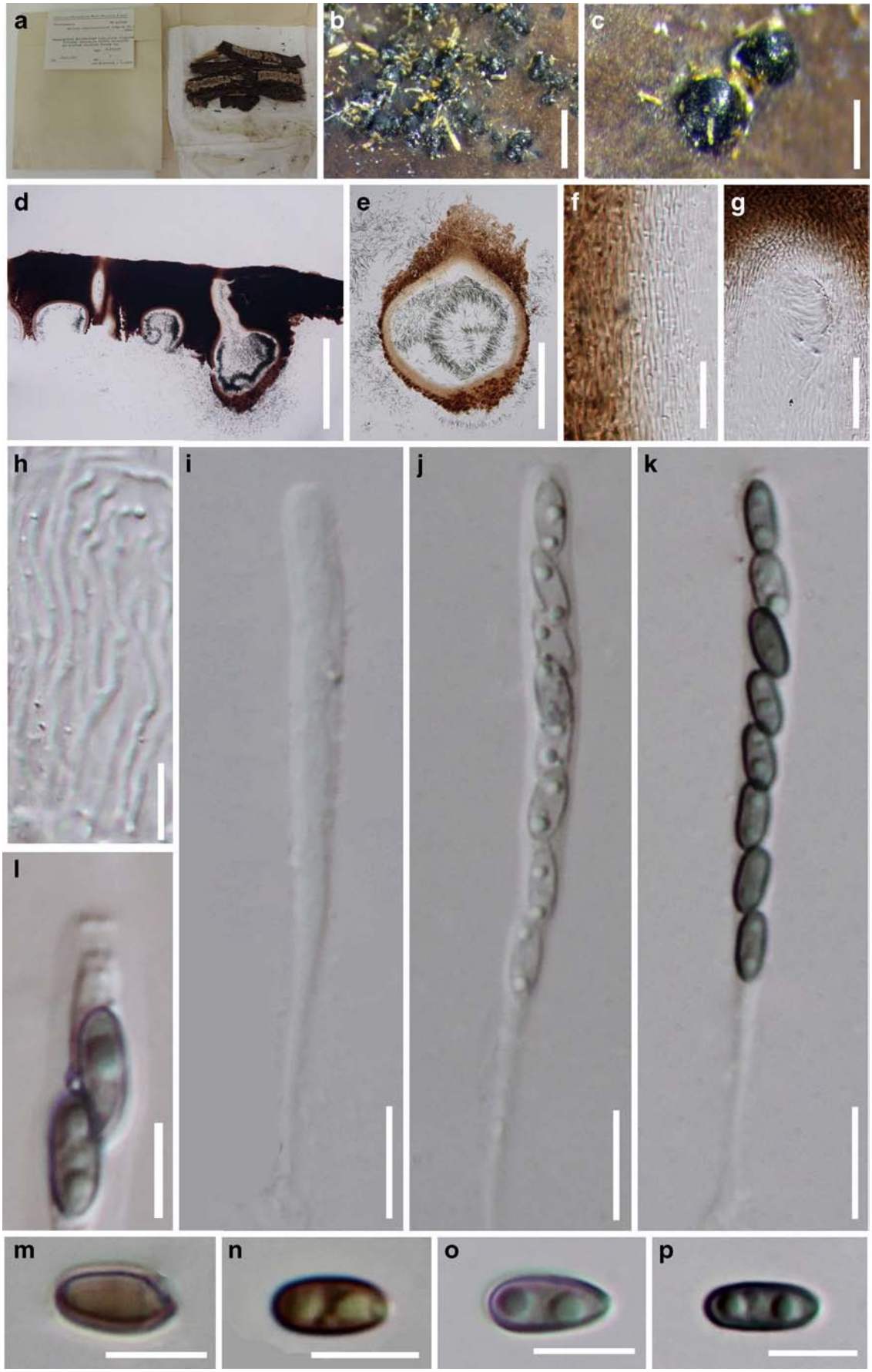
Type species: ***Neohypodiscus rickii*** (Lloyd) J.D. Rogers, Y.M. Ju & Læssøe, Mycologia 86(5): 685 (1994)

Pseudovalsaria Spooner, Trans. Br. mycol. Soc. 86(3): 405 (1986)

Type species: ***Pseudovalsaria foedans*** (P. Karst.) Spooner, Trans. Br. mycol. Soc. 86(3): 405 (1986)

Key to genera of *Boliniaceae*

1. Ascostroma immersed 2
1. Ascostroma erumpent or superficial 5
2. Ascostroma poorly-developed 3
2. Ascostroma well-developed 4
3. Ascospores 2-septate, with a hyaline basal cell and two dark brown cells at the center, the shorter brown cell with an apical germ pore at the end ***Apiorhynchostoma***
3. Ascospores 1-septate, with a hyaline cell and a brown cell with an apical germ pore at the end . . . . ***Endoxyla***
4. Ascospores aseptate, brownish . . . . . ***Camaropella***
4. Ascospores 1-septate, dark brown . . . . ***Pseudovalsaria***
5. Ascospores hyaline . . . . . ***Cornipulvina***
5. Ascospores brown or composed of a brown cell and hyaline cell 6
6. Ascospores one colour 7
6. Ascospores 1-septate, composed of a large, porate brown cell and a small, hyaline cell. . . . . ***Apiocamarops***


a
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◀ **Fig. 20** ***Bolinia tubulina*** (Material examined: SWEDEN, Bökeberg Forest in Femsjö, on the trunks, 18 October 1967, PRM PR647008) **a** Material and herbarium packet **b**, **c** Stroma with immersed ascomata **d** Stroma in cross section **e** Ascoma in cross section **f** Peridium **g** Periphyses **h** Paraphyses **i–k** Asci **l** Apical ring of ascus **m–p** Ascospores. Notes: Figs e-p are stained in KOH. Scale bars: **d** = 1 mm, b. e = 500 μm, c = 200 μm, **g** = 30 μm, **f** = 20 μm, **h–k** = 10 μm, **l–p** = 5 μm

7. Ascomata with stellate ostioles. . . . . ***Mollicamarops***
7. Ascomata lacking stellate ostioles 8
8. Perithecia monostichous. . . . . ***Camarops***
8. Perithecia polystichous. . . . . ***Bolinia***

Cainiaceae J.C. Krug, Sydowia 30 (1–6):123 (1978) [1977]

Facesoffungi number: FoF 00687

Saprobic on dead grasses, bamboo and other monocotyledons, appearing as shiny black dots, slightly effuse from the substrate. **Sexual morph**: *Pseudostromata* poorly developed or lacking, or sometimes clypeate, scattered, superficial, dome-shaped or slightly effuse, dark brown to black. *Ascomata* immersed, solitary or aggregated, globose to subglobose, coriaceous, brown, ostiolate. *Ostiolar* papilla short, internally lined with hyaline periphyses. *Peridium* one or two-layered, outer layer comprising of thick-walled, brown cells of *textura angularis* and inner layer comprising of hyaline thin-walled cells of *textura angularis*. *Hamathecium* comprising abundant, filamentous paraphyses, slightly constricted at the septa. *Asci* 8-spored, unitunicate, cylindrical to broadly cylindrical, short pedicellate, with a complex J+, cylindrical apical ring or series of rings. *Ascospores* uniseriate, overlapping uniseriate to biseriate, hyaline when young and dark brown at maturity, sphaerical to ellipsoidal, unicellular to 1-septate, slightly constricted at the septum, wall ornamented with longitudinal germ slits or germ pores, surrounded by a gelatinous sheath. **Asexual morph**: Coelomycetous. *Conidiomata* pycnidial, scattered, immersed, globose to subglobose, black. *Conidiophores* hyaline, denticulate, sympodially proliferating. *Conidiogenous cells* with 1–3 phialides, filiform, branched or simple, septate, hyaline. *Conidia* elongate fusiform, falcate to lunate, unicellular or septate, hyaline, with pointed ends.

Type: ***Cainia*** Arx & E. Müll.

Notes: The family *Cainiaceae* was introduced by Krug (1977) to accommodate the species with unique apical ring of the asci, which consisted of a series of rings, and ascospores with longitudinal germ slits. The genera *Arecophila*, *Atrotorquata*, *Cainia*, *Ceriophora*, *Reticulosphaeria* and *Ommatomyces* have been placed in this family at various times (Kohlmeyer and Kohlmeyer 1993; Hyde et al. 1996). *Seynesia* was included based on phylogenetic analysis by Maharachchikumbura et al. (2015). The placement of *Arecophila*, *Cainia* and *Seynesia* in *Cainiaceae* was confirmed based on molecular analysis (Smith et al. 2003; Maharachchikumbura et al. 2015). The combined LSU and ITS gene analysis also confirmed the phylogenetic placement of *Atrotorquata* in *Cainiaceae* (Senanayake et al. 2015). Another genus, *Amphibambusa* was introduced from bamboo in Liu et al. (2015) and LSU gene analysis and morphology indicated that the genus belongs to *Cainiaceae*. Based on both morphological and phylogenetic data, Senanayake et al. (2015) accepted the genera *Amphibambusa*, *Arecophila*, *Atrotorquata*, *Cainia* and *Seynesia* in *Cainiaceae*. The asexual morph of *Cainiaceae* from a pure culture of *Cainia desmazieri* C. Moreau & E. Müll. ex Krug has been observed and was reported by Muller and Corbaz (1956) as Rhabdospora-like. However, later attempts at obtaining the asexual morph from *Cainia desmazieri* in culture have not been successful (Kang et al. 1999a, b; Senanayake et al. 2015). The genera included in this family are confused and may be wrongly placed. Their placement is pending molecular data.

Cainia Arx & E. Müll., Acta bot. neerl. 4 (1): 111 (1955)

Facesoffungi number: FoF 00688; Fig. 21

Saprobic or pathogenic on *Poaceae* and *Cyperaceae*, forming leaf or stem spots, appearing as shiny, black, scattered dots on host surface. **Sexual morph**: *Pseudoclypeus* indistinct, scattered, dome-shaped, effuse, dark brown to black, smooth, each containing one, or rarely several ascomata. *Ascomata* immersed, scattered, solitary or aggregated, ampulliform, coriaceous, with ostiolate. *Ostioles* short, internally lined with hyaline, filamentous periphyses. *Peridium* comprising an outer layer of thick-walled, brown, *textura angularis* cells and inner layer comprising of thick-walled, hyaline, *textura angularis* cells. *Hamathecium* comprising numerous, septate paraphyses, slightly constricted at the septa, *Asci* 8-spored, unitunicate, cylindrical to clavate, short pedicellate, apex rounded, with a complex, J+, dome-shaped to cylindrical series of rings. *Ascospores* overlapping uniseriate to biseriate, dark brown, ellipsoidal, 1- septate, constricted at the septum, wall with longitudinal striations, surrounded by a gelatinous sheath. **Asexual morph**: Coelomycetous. *Conidiomata* pycnidia, scattered, immersed, globose to subglobose, black. *Conidiophores* hyaline, denticulate. *Conidiogenous cells* with 1–3 phialides, filiform, simple or branched, septate, hyaline. *Conidia* elongate-fusiform to filiform, falcate to lunate, with holoblastic conidiogenesis, unicellular or septate, hyaline, sometimes with pointed ends (description of asexual morph is based on Krug 1977 and Kang et al. 1999a, b).

Type species: ***Cainia graminis*** (Niessl) Arx & E. Müll., Acta bot. neerl. 4(1):112 (1955)

Notes: The genus was introduced by von Arx and Müller (1955). It was distinguished from *Amphisphaeriaceae* based on the complex structure of the apical ring and presence of germ slits in the ascospores and thus, accommodated in *Cainiaceae*. Senanayake et al. (2015) designated a reference

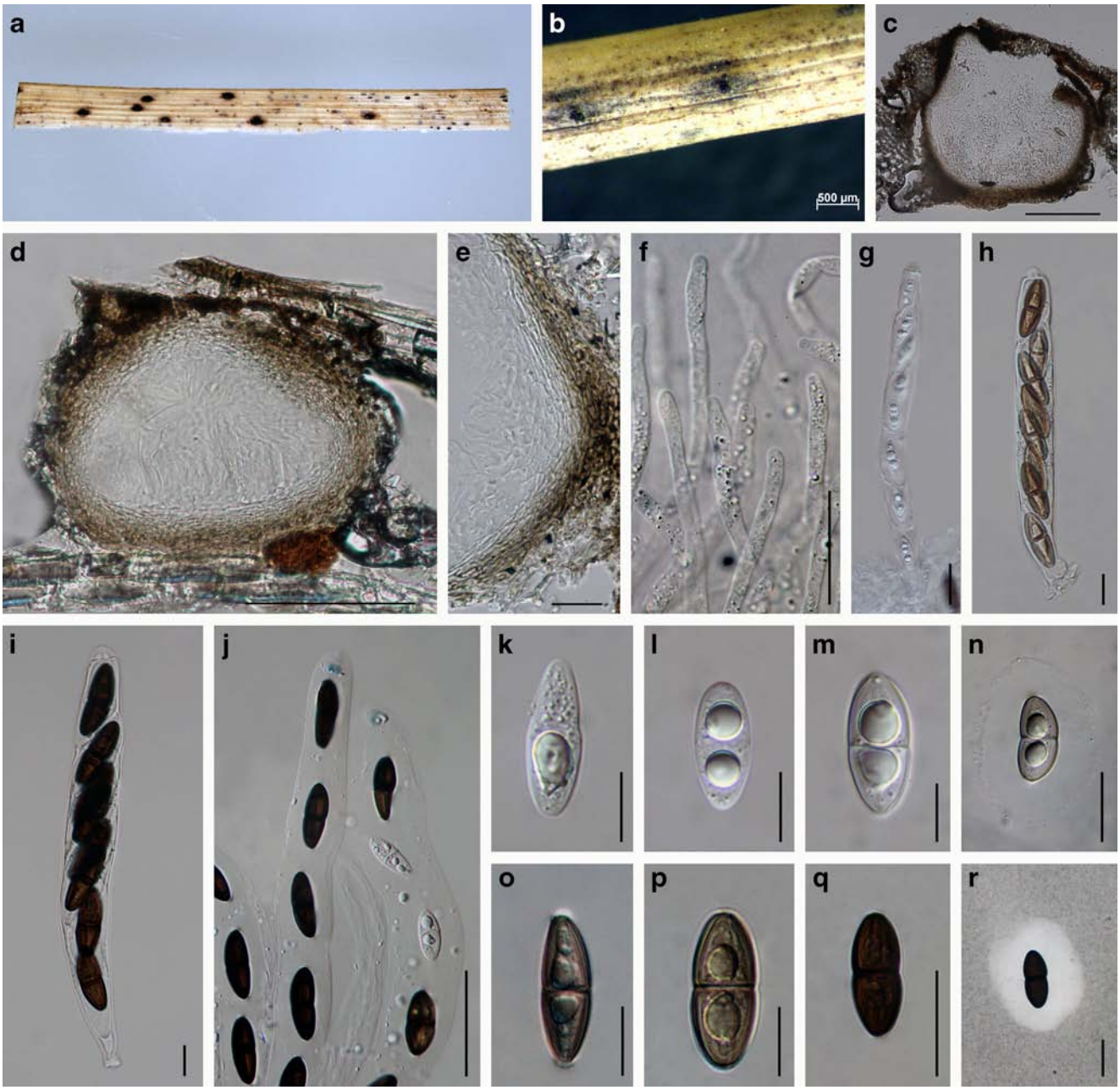


Fig. 21 ***Cainia graminis*** (Material examined: ITALY, Province of Forlì-Cesena [FC], Santa Sofia, Corniolo, stem of *Lolium temulentum* L (*Poaceae*), 25 September 2013, Erio Camporesi, IT 1462, MFLU 15-0724)) **a** Ascomata on host **b** Close up of ascomata **c**, **d** Vertical section of ascomata **e** Peridium **f** Paraphyses **g-i** Asci **j** J+ apical ring in Melzer's reagent **k-q** Ascospores **r** Sheath surrounding ascospore after treating with Indian ink. Scale bars: **a** = not to scale, **c**, **g**–**j** = 100 µm, **d** = 250 µm, **e**, **f**, **o**–**r** = 25 µm, **k**–**n** = 10 µm

specimen for the type *Cainia graminis*. Currently, five epithets have been listed for *Cainia* in Index Fungorum (2016).

Other genera included

Amphibambusa D.Q. Dai & K.D. Hyde, in Liu et al., Fungal Divers. 72: 7 (2015)

Type species: *Amphibambusa bambusicola* D.Q. Dai & K.D. Hyde, Liu et al., Fungal Divers. 72: 7 (2015)

Arecophila K.D. Hyde, Nova Hedwigia 63(1–2):82 (1996)

Type species: ***Arecophila gulubiicola*** K.D. Hyde, Nova Hedwigia 63(1–2):91 (1996)

Atrotorquata Kohlm. & Volkm.-Kohlm., Syst. Ascom. 12(1–2):8 (1993)

Type species: ***Atrotorquata lineata*** Kohlm. & Volkm.-Kohlm., Syst. Ascom. 12(1–2):8 (1993)

Seynesia Sacc., Syll. fung. (Abellini) 2:668 (1883)

Type species: ***Seynesia nobilis*** (Welw. & Curr.) Sacc., Syll. fung. (Abellini) 2:668 (1883)

Key to the genera of *Cainiaceae*

1. Apical apparatus consisting of a wedge-shaped or conical, subapical ring 2
   1. Apical apparatus consisting of several rings 4
   2. Ascospores bearing a single conical appendage emerging from the outer sheath . . . . . ***Seynesia***
   2. Ascospores not bearing an appendage as above 3
   3. Ascospores fusiform to broad fusiform . . . . . ***Amphibambusa***
   3. Ascospores ellipsoidal . . . . . ***Arecophila***
   4. Apical apparatus wedge-shaped, ascospores having 5–7 longitudinal striations at each apex . . . . . ***Atrotorquata***
   4. Apical apparatus dome-shaped to cylindrical or appearing as plates, ascospores bearing a germ slit at each end . . . . . ***Cainia***

Calosphaeriaceae Munk, Dansk bot. Ark. 17(no. 1): 278 (1957)

Facesoffungi number: FoF 01133

Saprobic on wood or decorticated wood or leaves in freshwater and terrestrial habitats, sometimes *fungicolous*. **Sexual morph**: *Ascostromata* scattered, erumpent through leaf epidermis, ellipsoid, long axis parallel to the leaf surface. *Ascomata* perithecial, scattered or gregarious, dark brown to black, superficial, erumpent or immersed, globose to subglobose, coriaceous or membranous, tuberculate or smooth or with brown, septate, hyphal coating, ostiolate. *Neck* long or short neck, periphysate. *Peridium* thick (10–250 μm), outer layer coriaceous or membranous, composed of dark brown, reddish brown to brown cells of *textura angularis* or *prismatica*, or *porrecta*; inner layer membranous, composed of hyaline cells of *textura prismatica*. *Hamathecium* composed of numerous, broad, septate, unbranched, tapering, paraphyses. *Ascogenous hyphae* discrete, hyaline, smooth, branched, producing a sympodial sequence of hyaline, ovoid to ellipsoidal cells, often with mucronate apex, in dense clusters, each giving rise to an ascus. *Asci* 8-spored, unitunicate, clavate, long or short pedicellate, mostly in fascicles, apical ring distinct or absent. *Ascospores* 2-seriate or overlapping, hyaline to light brown, allantoid to ellipsoid, straight to slightly curved, aseptate to multi-septate, smooth-walled, sometimes with guttules. **Asexual morph**: Hyphomycetous. *Conidiophores* micronematous, mononematous or semimacronematous, brown or hyaline, straight or flexuous, septate, branched or unbranched, with a terminal. *Phialides* terminal or lateral, aggregated, monophialidic, smooth, hyaline, elongate ampulliform to subcylindrical, pigmented in the apical. *Conidiogenous cells* enteroblastic or holoblastic, phialidic, hyaline, with brown apex, smooth-walled. *Conidia* aggregated, hyaline, aseptate to multi-septate, cylindrical to allantoid, sometimes 4–5-radiate and consisting of a main axis and three or four arcuate branches inserted near its base, with or without guttules (from Réblová et al. 2004).

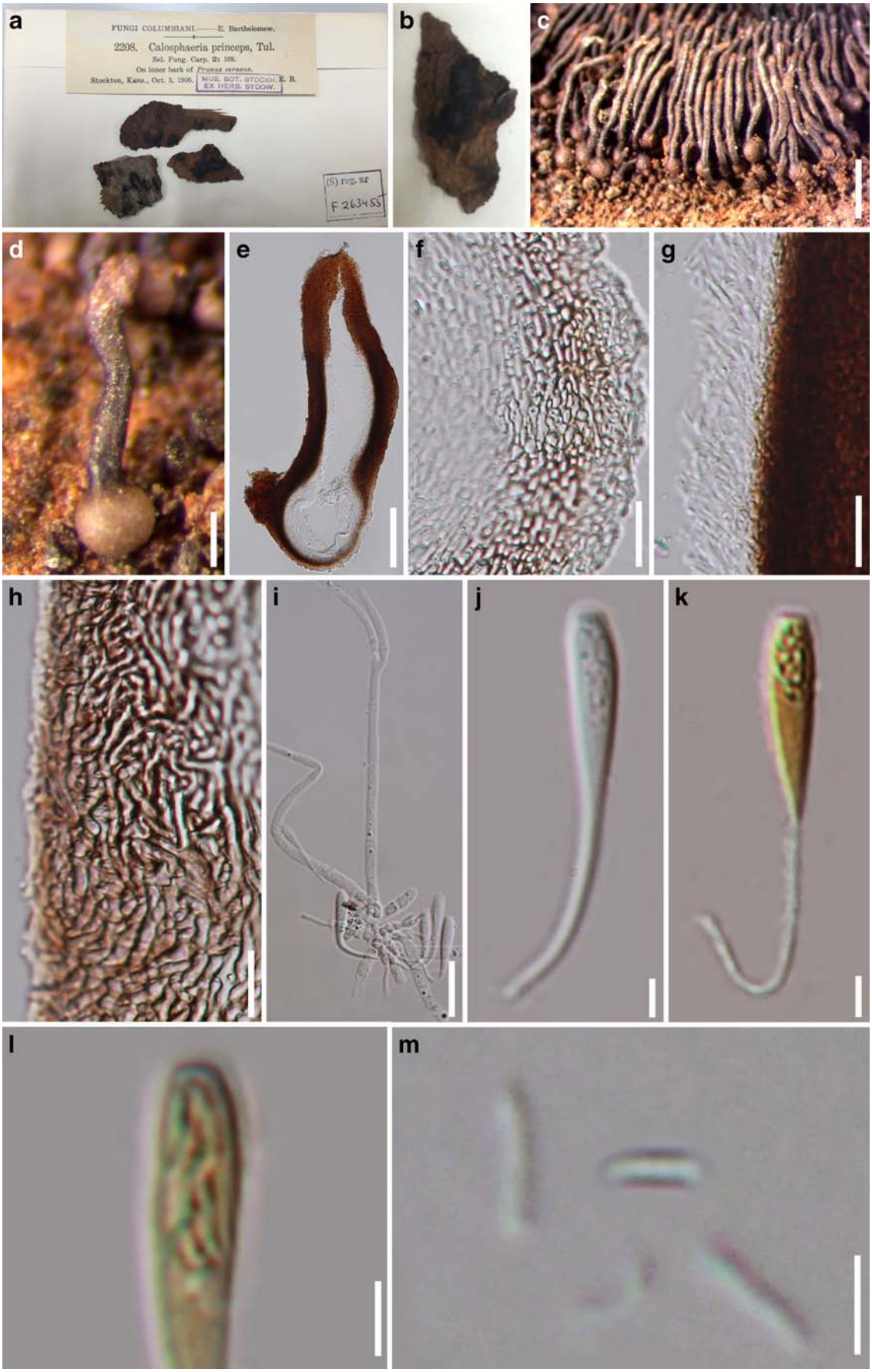
Type: ***Calosphaeria*** Tul. & C. Tul.

Notes: The family *Calosphaeriaceae* was introduced by Munk (1957) based on immersed, globose ascomata, clavate, pedicellate asci with hyaline allantoid ascospores, enteroblastic, phialidic conidiogenesis, micronematous conidiophores and hyaline, aseptate conidia, and is typified by *Calosphaeria*. Many asexual morphs have been reported for this family (Hyde et al. 2011; Wijayawardene et al. 2012), but information is incomplete. *Calosphaeria* has been referred to various families based on the allantoid ascospores. The genera *Calosphaeria* and *Pleurostoma* were placed in the *Diatrypaceae* (Fuckel 1870; Saccardo 1882; Winter 1885; Schroeter 1897); *Allantosporae* (Berlese 1900); *Valsaceae* (Traverso 1906); and *Allantosphaeriaceae* (von Höhnel 1918). Petrak (1923, 1941) included *Phragmocalosphaeria* and *Calosphaeriopsis* in this family because of similar morphological characters. Wehmeyer (1975) accepted *Calosphaeriaceae* in *Allantosphaeriales*, while Barr (1983) recognized this family in *Calosphaeriales*. Lumbsch and Huhndorf (2010) included eight genera (*Calosphaeria*, *Conidiotheca*, *Jattaea*, *Kacosphaeria*, *Phragmocalosphaeria*, *Sulcatistroma*, *Togniniella*, *Wegelina*) in this family, while Maharachchikumbura et al. (2015) accepted *Calosphaeria* (= *Calosphaeriophora*), *Jattaea* (= *Phragmocalosphaeria*, = *Wegelina*), *Kacosphaeria*, *Sulcatistroma*, *Togniniella* (= *Phaeocrella*), and *Tulipispora*.

Calosphaeria Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 108 (1863)

Facesoffungi number: FoF 01134, Figs 22, 23

Saprobic on wood or decorticated wood or leaves in freshwater and terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, scattered or solitary, dark brown to black, immersed, globose to subglobose, coriaceous or membranous, tuberculate or smooth or with hyphal coating, ostiolate. *Neck* long or short neck, periphysate. *Peridium* thick, outer layer coriaceous or membranous, composed of dark brown, reddish brown to brown cells of *textura angularis*; inner layer membranous, composed of hyaline cells of *textura prismatica*. *Hamathecium* composed of numerous, broad, septate, unbranched, tapering, paraphyses. *Ascogenous hyphae* discrete, hyaline, smooth, branched, producing a sympodial sequence of hyaline, ovoid to ellipsoidal cells, often with mucronate apex, in dense clusters, each giving rise to an


a
FUNGI COLUMBIANI—E. Bartholomew.
2208. Calosphaeria princeps, Tul.
Sel. Fung. Carp. 2: 109.
On inner bark of Prunus serotina.
Stockton, Kans., Oct. 5, 1906.
MUS. BOT. STOCKH. E. B.
EX HERB. SYDOW.
(S) rog. nr
F 263455
b
c
d
e
f
g
h
i
j
k
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◀ **Fig. 22** ***Calosphaeria princeps*** (Material examined: USA, Kansas, Stockton, on inner bark of *Prunus cerasus* L. (*Rosaceae*), 5 October 1906, S-F263455)**. a** Herbarium packet and material **b** Material **c** Ascomata in mass **d** Ascoma **e** Ascoma in cross section **f** Peridium at bottom of ascoma substructure **g** Peridium of neck with periphyses **h** Peridium in cross section **i** Paraphyses with asci **j–k** Asci **l** Ascospores in ascus **m** Ascospores. Notes: Figs i-m soaked in 3 % KOH; Figs k–l stained in Melzer's reagent. Scale bars: **c** = 1 mm, **d** = 200 μm, **e** = 100 μm, **f–i** = 10 μm, **j–m** = 2 μm

ascus. *Asci* 8-spored, unitunicate, clavate, long or short pedicellate, mostly in fascicles, apical ring distinct or absent. *Ascospores* 2-seriate or overlapping, hyaline, allantoid to ellipsoid, straight to slightly curved, aseptate, smooth-walled, sometimes with guttules. **Asexual morph**: Hyphomycetous. *Conidiophores* micronematous, hyaline, straight or flexuous, septate, branched, with a terminal. *Phialides* terminal or lateral, aggregated, monophialidic, smooth, hyaline, elongate ampulliform to subcylindrical, pigmented in the apical. *Conidiogenous cells* enteroblastic or holoblastic, phialidic, hyaline, with brown apex, smooth-walled. *Conidia* aggregated, hyaline, aseptate, cylindrical to allantoid, with or without guttules (From Réblová et al. 2004 and Révay et al. 2009).

Type species: ***Calosphaeria princeps*** Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 109 (1863)

Notes: The genus *Calosphaeria* was introduced by Tulasne and Tulasne (1863a). In the type species *C. princeps*, the sexual morph is characterized by immersed ascomata, tuberculate perithecia, clavate asci and hyaline ascospores. The asexual morph of *Calosphaeria pulchella* (Pers.) J. Schröt is *Calosphaeriophora pulchella* Réblová et al. The monotypic genus, *Calosphaeriophora*, is characterized by micronematous conidiophores, and smooth aseptate conidia (Barr 1985; Réblová et al. 2004; Damm et al. 2008). In our opinion, *Calosphaeriophora* should be included in *Calosphaeriaceae*.

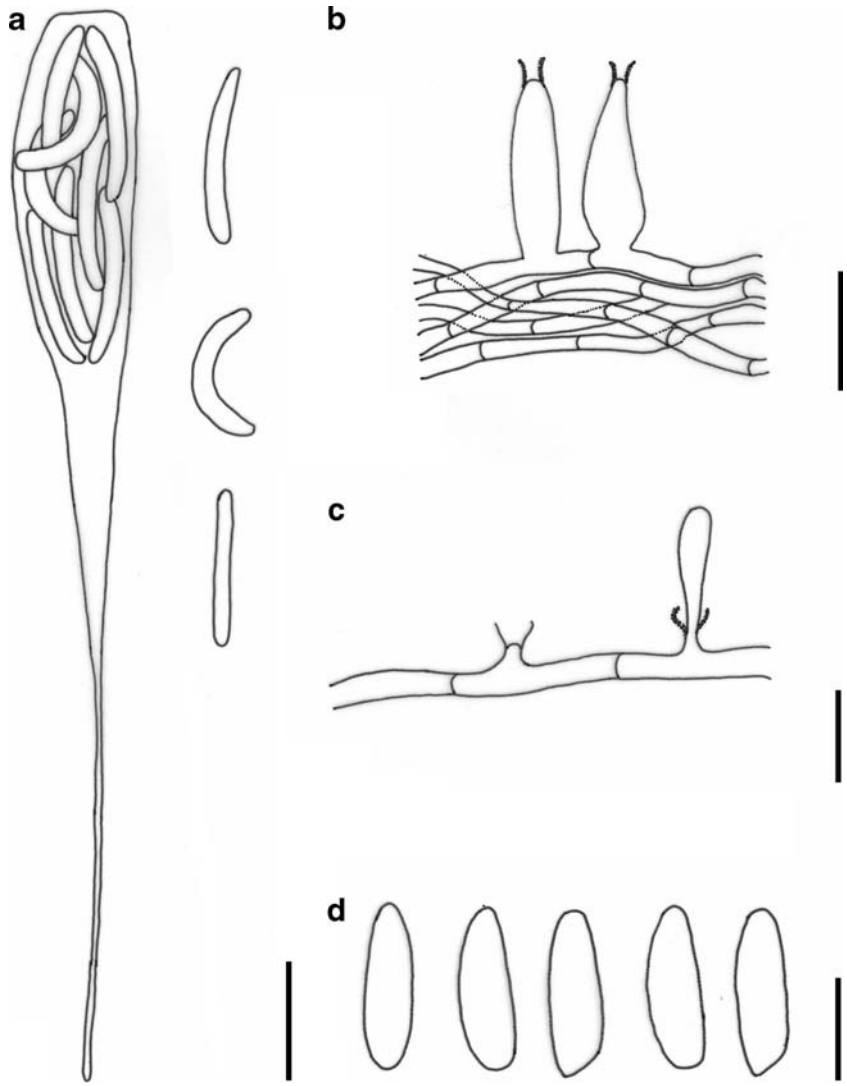


Fig. 23 ***Calosphaeria princeps*** **a** Asci and ascospores. **b-d** ***Calosphaeriophora pulchella*** (redrawn from Réblová et al. 2004) **b**, **c** Conidiophores **d** Conidia. Scale bars: **a** = 2 μm, **b–d** = 5 μm

Other genera included

Calosphaeriophora Réblová et al., Stud. Mycol. 50(2): 542 (2004)

Type species: ***Calosphaeriophora pulchella*** Réblová et al., Stud. Mycol. 50(2): 542 (2004)

Jattaea Berl., Icon. fung. (Abellini) 3(1–2): 6 (1900)

Type species: ***Jattaea algeriensis*** Berl., Icon. fung. (Abellini) 3(1–2): 6 (1900)

Kacosphaeria Speg., Boln Acad. nac. Cienc. Córdoba 11(2): 214 (1888)

Type species: ***Kacosphaeria antarctica*** Speg., Boln Acad. nac. Cienc. Córdoba 11(2): 214 (1888)

Sulcatistroma A.W. Ramaley, Mycotaxon 93: 140 (2005)

Type species: ***Sulcatistroma nolinae*** A.W. Ramaley, Mycotaxon 93: 140 (2005)

Togniniella Réblová et al., Stud. Mycol. 50(2): 543 (2004)

Type species: ***Togniniella acerosa*** Réblová et al., Stud. Mycol. 50(2): 545 (2004)

Tulipispora Révay & J. Gönczöl, in Révay et al., Nova Hedwigia 88(1–2): 42 (2009)

Type species: ***Tulipispora ingoldii*** Révay & J. Gönczöl, Nova Hedwigia 88(1–2): 42 (2009)

Key to genera of *Calosphaeriaceae*

1. Hyphomycete 2
   1. Ascomycete 3
   2. Conidia multi-septate, branched . . . . . ***Tulipispora***
   2. Conidia aseptate, unbranched . . . . . ***Calosphaeriophora***
   3. Ascomata immersed in ascostromata . . . ***Sulcatistroma***
   3. Ascomata without ascostromata 4
   4. Ascospores light greyish brown . . . . . ***Jattaea***
   4. Ascospores hyaline 5
   5. Peridium composed of brown to hyaline cells of *textura prismatica* . . . . . ***Togniniella***
   5. Peridium outer layer composed of brown cells of *textura angularis*; inner layer composed of hyaline cells of *textura prismatica* 6
   6. Ascomata globose to subglobose, with hyphal coating, asexual morphs *Calosphaeriophora* . . . . ***Calosphaeria***
   6. Ascomata pyriform, asexual morph Undetermined . . . . . ***Kacosphaeria***

Catabotrydaceae Petr. ex M.E. Barr, Mycotaxon 39: 83 (1990)

Facesoffungi number: FoF 01372; Fig. 24

Saprobic on dead leaves and stems of tropical monocotyledons. **Sexual morph**: *Stromata* irregularly scattered, occasionally coalescing, conspicuous, multi-loculate, superficial, with base slightly penetrating the epidermis at regular intervals, discoid to pulvinate, reddish brown to black, surface scurfy, flat or slightly convex, composed of rather thin-walled, reddish yellow cells of *textura angularis*, *textura globosa* and *textura epidermoidea*. *Ascomata* perithecial, deeply imbedded in stromatic columns, globose, with a long, periphysate, ostiolar neck. *Peridium* thick, composed of several layers of compressed, reddish brown cells of *textura angularis*. *Paraphyses* hypha-like, numerous, tapering towards the apex, not embedded in a gelatinous matrix. *Asci* 8-spored, unitunicate, broad cylindrical, short pedicellate, apically rounded or truncate, with a J-, discoid, refractive, apical ring. *Ascospores* bi-seriate, hyaline, 1-celled, ellipsoidal to cylindrical, smooth-walled, lacking a mucilaginous sheath. **Asexual morph**: Undetermined.

Type: ***Catabotrys*** Theiss. & Syd.

Notes: The monotypic family *Catabotrydaceae* was proposed by Petrak (1954) to accommodate the genus *Catabotrys*. Later this family was validated by Barr (1990). According to the characteristics of hamathecium and asci, *Catabotrydaceae* has been placed in *Sordariales* (Barr 1990). Hyde et al. (2000) placed *Catabotrydaceae* in *Xylariales*, while Kirk et al. (2001) suggested that it is morphologically similar to some *Boliniaceae* and thus the order *Boliniales* was introduced to include both families. Huhndorf et al. (2004a) showed that the relationship between *Catabotrydaceae* and *Boliniaceae* is not supported by molecular data, hence *Catabotrydaceae* was excluded from *Boliniales* and placed in *Sordariomycetidae* family *incertae sedis*. Although analysis of combined β-tubulin, LSU and RPB2 sequence data by Miller and Huhndorf (2005) indicated that *C. decidua* is a member of *Diaporthales*, however, recent molecular studies by Maharachchikumbura et al. (2015) confirmed that *Catabotrydaceae* clusters with *Amplistromataceae*, hence it has been placed in *Amplistromatales*.

Type species: ***Catabotrys deciduum*** (Berk. & Broome) Seaver & Waterston, Mycologia 38(2): 184 (1946)

Cephalothecaceae Höhn., Annls mycol. 15(5): 362 (1917)

Facesoffungi number: FoF 01330

Saprobic or *epiphytic* on rotting or dead plants or fungi, or causing systemic mycotic infection in humans with burns. **Sexual morph**: *Ascomata* perithecial, solitary to gregarious, superficial, subglobose to globose, dark brown to black, glabrous, carbonaceous, covered by sulphureous hyphae, ostiole central, without periphyses. *Peridium* cephalothecoid, comprising 2–3 layers, outer layer composed of dark brown cells of *textura angularis* to *prismatica*, inner layer composed of elongated, hyaline cells of *textura prismatica*. *Ascogenous hyphae* septate, hyaline. *Asci* 8-spored, unitunicate, pyriform to subglobose to globose, evanescent, apedicellate, without an apical ring. *Ascospores* irregularly arranged, brown, variously-shaped, unicellular, without germ pores, smooth-walled.

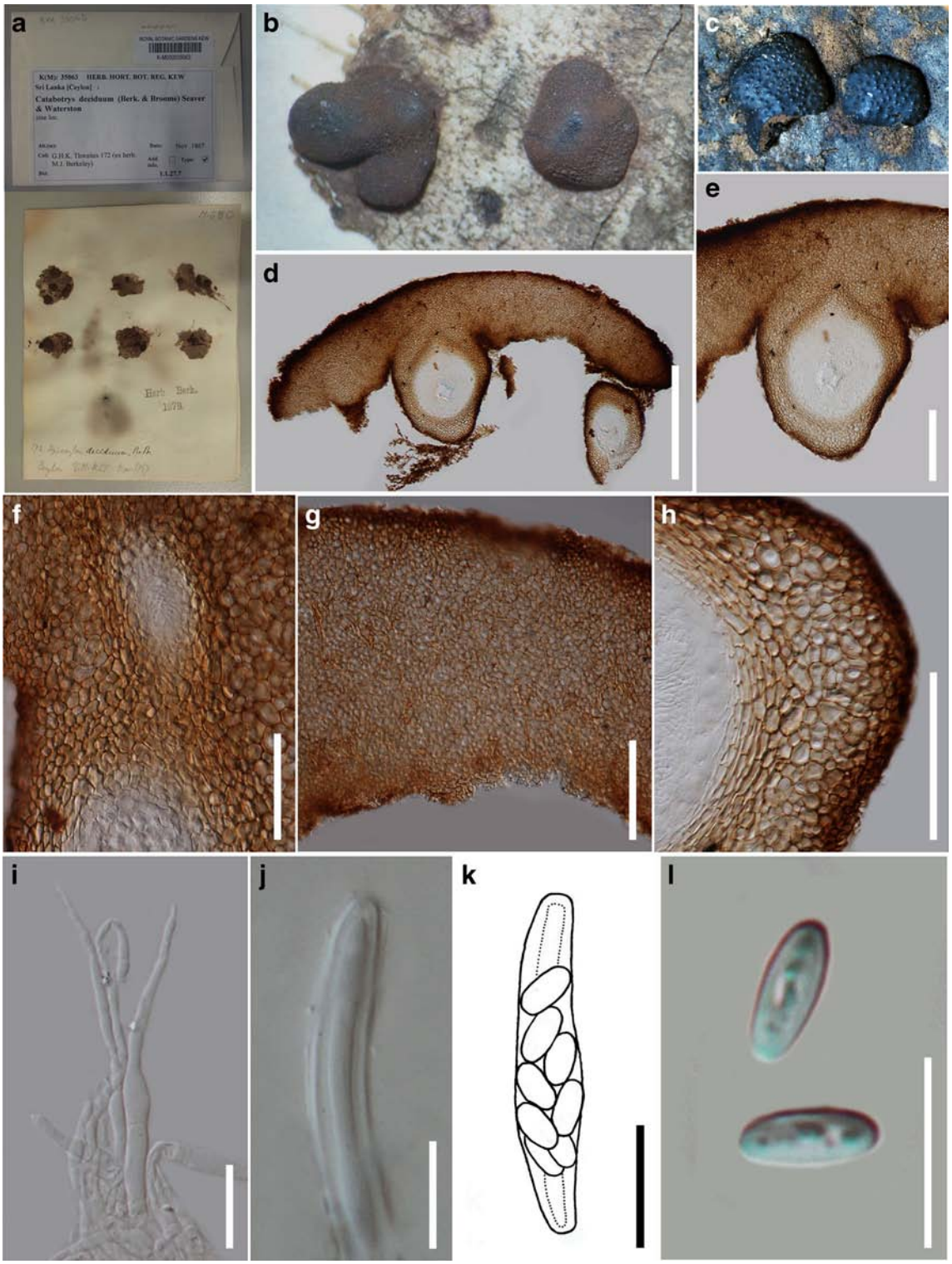


Fig. 24 ***Catabotrys deciduum*** (Material examined: a-b, d-j. Sri Lanka, on unidentified dead palm, G.H.K. Thwaites 172 (ex herb. M.J. Berkeley), November 1867, K (M) 35063, **holotype;** Hyde and Cannon (1999); c, i. Australia, Queensland, Cape Tribulation, J.E. Taylor, 15 April 1995, HKU(M) 4306) **a** Herbarium material with label **b–c** Stromata on host surface **d–e** Transverse section of stromata with ascomata **f** Ostiole with periphyses **g** Stromatic tissue **h** Peridium **i** Paraphyses **j–k** Immature and mature asci **l** ascospores. Scale bars: **d** = 500 μm, **e** = 200 μm, **f–h** = 100 μm, **i** = 20 μm, **j–l** = 10 μm

Asexual morph: Hyphomycetous. *Mycelium* pale-yellowish to brownish-yellow, branched septate. *Conidiophores* long, cylindrical, stiffly upright, septate, verticillate and whorled or not. *Conidiogenous cells*

phialidic, cylindrical, hyaline to brown, smooth-walled. *Conidia* in chains, hyaline to brown, cylindrical, ovate or obovate, with or without an apiculate or truncate base, 1-celled, smooth-walled.

Type: ***Cephalotheca*** Fuckel

Notes: The family *Cephalothecaceae* was introduced by von Höhnel (1917) and is typified by *Cephalotheca* with *C. sulfurea* Fuckel as the type species (von Höhnel 1917). This family is characterized by ascomata with a cephalothecoid peridium. The peridial cells form plate-like complexes made up of radiating groups of cells, where each plate is separated by well-defined lines of dehiscence (Malloch and Cain 1970). They can be small and simple, or very large and complex (Malloch and Cain 1970; Suh and Blackwell 1999). Four genera, *Albertiniella*, *Cephalotheca*, *Cryptendoxyla* and *Phialemonium* are presently placed in the family (Maharachchikumbura et al. 2015). The sexual morph of these genera have carbonaceous, dark brown to black ascomata, with a central ostiole and a cephalothecoid peridium (Suh and Blackwell 1999). Ascospores are small, brown, 1-celled, without germ pores, and smooth-walled (Chesters 1935; Kirschstein 1936; Malloch and Cain 1970; Yaguchi et al. 2006). The genus *Phialemonium* was included in *Cephalothecaceae* as an asexual morph based on phylogenetic analysis (Perdomo et al. 2013b).

Cephalotheca Fuckel, Jb. nassau. Ver. Naturk. 25–26: 297 (1871)

Facesoffungi number: FoF 01331, Figs 25, 26

Saprobic in soil or on wood or mushrooms. *Mycelium* brown, branched. **Sexual morph**: *Ascomata* perithecial, solitary to gregarious, superficial, *immature ascomata*, disc-like,

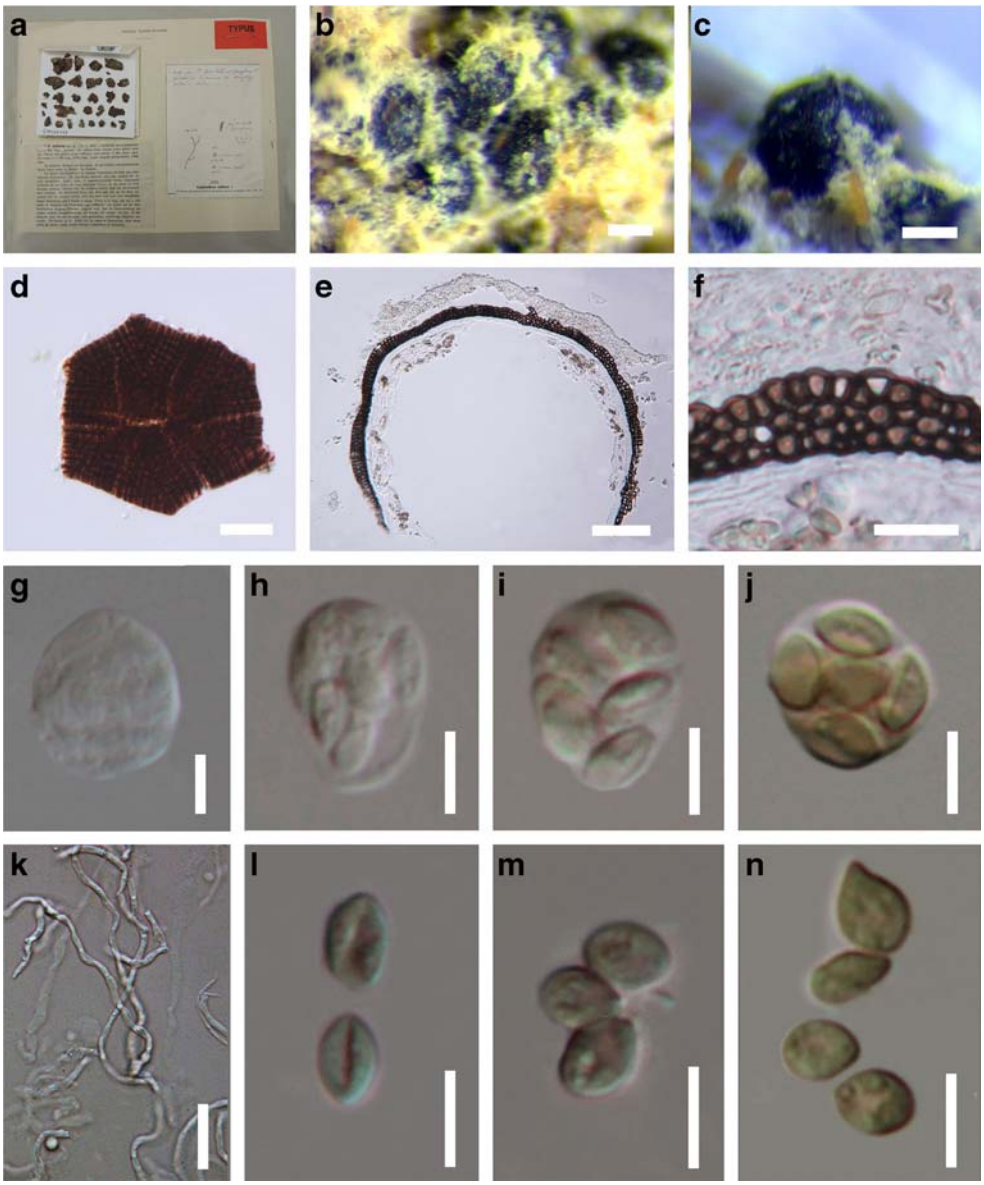


Fig. 25 ***Cephalotheca sulfurea*** **(**Material examined: GERMANY, Oestrich, on rotting planks of Oak, lying on damp, ammoniacal ground, G00266459, **holotype) a** Herbarium material **b** Ascomata covered by sulphureous hyphae **c** Close up of ascoma **d** Squash mount of ascoma **e** Cross section of ascoma **f** Peridium **g–j** Asci **k** Ascogenous hyphae **l–n** Ascospores. Scale bars: **b–c** = 100 μm, **d**, **k** = 20 μm, **e** = 50 μm, **f** = 10 μm, **g-j**, **l–n** = 5 μm

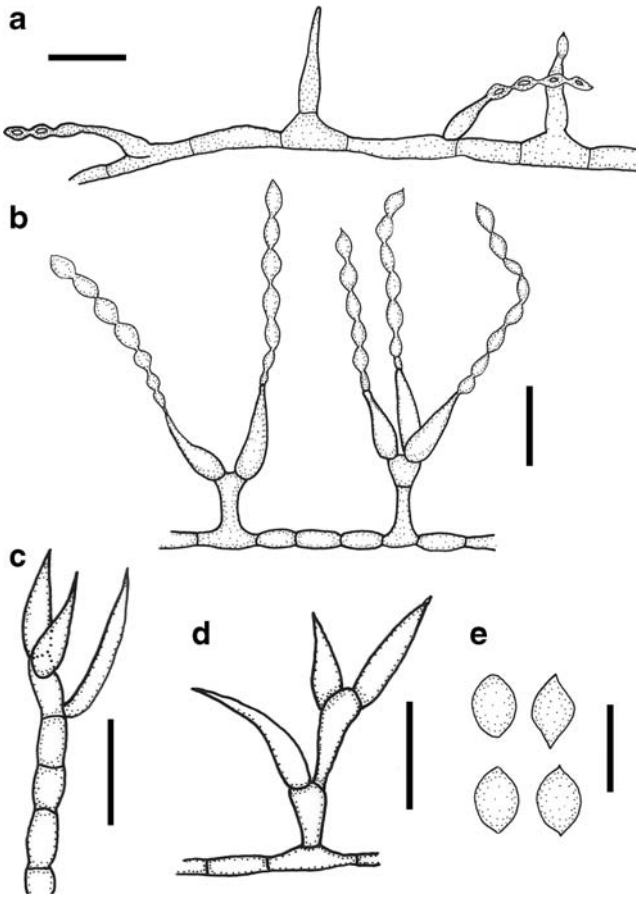


Fig. 26 ***Cephalotheca sulfurea*** **(**redrawn from Chesters 1935**) a**, **b** Conidiophores with conidiogenous cells and conidia **c**, **d** Conidiogenesis **e** Conidia. Scale bars: **a–d** = 10 μm, **e** = 5 μm

rather flat, with a central ostiole, with a thin and dark brown wall composed of the cells of *textura prismatica* to *textura angularis*; *mature ascomata* subglobose to globose, dark brown to black, glabrous, carbonaceous, covered by sulphureous hyphae. *Peridium* of mature ascomata cephalothecoid, comprising two layers, outer layer composed of dark brown, rows of cells *textura angularis*, inner layer composed of elongated, hyaline cells of *textura prismatica. Ascogenous hyphae* of septate, hyaline, woven ascogenous hyphae and asci irregularly disposed on ascogenous hyphae. *Asci* 8-spored, unitunicate, subglobose to globose, lacking a pedicel, lacking an apical ring. *Ascospores* irregularly arranged, ovate to fusiform, reniform, brown to dark brown, 1-celled, without germ pores, smooth-walled. **Asexual morph**: Hyphomycetous. *Mycelium* pale-yellowish to brown, branched septate. *Conidiophores* long, cylindrical, septate, with apex expanded and branched. *Conidiogenous cells* phialidic, hyaline to brown, smooth-walled. *Conidia* in chains, hyaline to brown, broad fusiform to obovate, 1-celled, smooth-walled.

Type species: ***Cephalotheca sulfurea*** Fuckel, Jb. nassau. Ver. Naturk. 25–26: 297 (1871) Bot. 15(5): 742 (2002)

Notes: *Cephalotheca* was established by Fuckel (1872) and includes about 20 epithets (Index Fungorum 2016). Species are saprobes inhabiting soil, wood, and mushrooms (Suh et al. 2006). *Cephalotheca* is a poorly known genus, which has both sexual and asexual morphs. Fungal isolate SB5-1 was identified as a new strain of *Cephalotheca sulfurea* through molecular and phylogenetic approaches. Culture filtrates (CFs) of isolate SB5-1 were analyzed for the presence of gibberellins, and it was found that all physiologically active gibberellins were present. Gibberellins are well known for plant growth promotion (Hamayun et al. 2012).

Other genera included

Albertiniella Kirschst., Annls mycol. 34(3): 183 (1936)

Type species: ***Albertiniella reticulata*** Kirschst., Annls mycol. 34(3): 183 (1936)

Cryptendoxyla Malloch & Cain, Can. J. Bot. 48(10): 1816 (1970)

Type species: ***Cryptendoxyla hypophloia*** Malloch & Cain, Can. J. Bot. 48(10): 1816 (1970)

Phialemonium W. Gams & McGinnis, Mycologia 75(6): 978 (1983)

Type species: ***Phialemonium obovatum*** W. Gams & McGinnis, Mycologia 75(6): 978 (1983)

Key to genera of *Cephalothecaceae*

1. Asexual morph comprising of simple or branched, hyaline conidiophores, phialidic pegs conidiogenous, hyaline or pigmented, cylindrical to globose, 1-celled, arranged in slimy heads or in long chains conidia . . . . ***Phialemonium***
   1. Mostly known in sexual morph 2
   2. Asci pyriform to subglobose . . . . . ***Cryptendoxyla***
   2. Asci globose 3
   3. Ascospore globose . . . . . ***Albertiniella***
   3. Ascospore ovate to fusiform. . . . . ***Cephalotheca***

Ceratocystidaceae Locq. ex Réblová et al., Stud. Mycol. 68(1): 188 (2011)

Facesoffungi number: FoF 01248

Saprobic or *pathogenic* on plant material. **Sexual morph**: *Ascomata* globose to pyriform or ovoid, light brown or dark brown to black, with spines or septa, unornamented or with undifferentiated ornamental hyphae, ostiolate. *Ostioles* comprising long, tapering, dark brown or dark grey to black necks. *Peridium* thin-walled, composed of polyhedral pseudoparenchymatous cells of *textura angularis*, pale yellow to reddish brown, appearing dark brown or black. *Hamathecium* comprising light brown to hyaline, aseptate, convergent or slightly divergent, paraphyses, tapered at the apex. *Asci* dehiscent. *Ascospores* 0–1-septate, hyaline, varied in shape, hat-shaped, ellipsoidal, or elongate to slightly curved, with round ends, or

oblong cylindrical, or narrow fusiform to spindle-shaped, hyaline, often with eccentric wall thickening or surrounded by a sheath, accumulating as masses at apices of ascomatal necks. **Asexual morph**: *Conidiophores* phialidic, arising laterally from vegetative hyphae, lageniform, tubular, rectangular, cylindrical to flask-shaped, sometimes with slightly flared collarette, single to aggregated in sporodochia or synnemata, septate, tapering to the apex, hyaline, unbranched or sparingly branched, conidiophores consisting of two types; primary conidiophores (*Ceratocystis*) and secondary conidiophores (*Huntiella*). *Conidiogenous cells* phialidic, oblong or cylindrical, hyaline, subhyaline or pale brown, tapering towards the apex. *Conidia* unicellular, varied in shape, cylindrical to oblong, barrel-shaped to subglobose, rectangular, single or formed in chains or as terminal aleurioconidia, with rounded or truncate ends, hyaline to light brown or pale brown, or hyaline becoming grey; some of genera with two types of conidia; primary and secondary conidia for genera such as *Ceratocystis*, *Huntiella*, and *Thielaviopsis*. *Aleurioconidia* globose to subglobose, ovoid to pyriform, singly or in chains, pale brown to brown.

Type: ***Ceratocystis*** Ellis & Halst.

Notes: The family level classification of *Ceratocystis* has been discussed since the genus was removed from the *Ophiostomatales* (Barr 1990; Samuels 1993). Recently, some authors placed *Ceratocystis* in *Chadefaudiellaceae*, while other authors placed it in its own family, *Ceratocystidaceae* (as "*Ceratocystaceae*"), which was formerly proposed by Locquin (1972) but was not validly published. The family *Ceratocystidaceae* was subsequently validated by Réblová et al. (2011) and placed in *Microascales* in the subclass Hypocreomycetidae (Réblová et al. 2011; De Beer et al. 2013). *Ceratocystidaceae* forms a monophyletic group, including *Ambrosiella*, *Ceratocystis* and *Thielaviopsis*, which is distinct from *Gondwanamycetaceae* based on strong bootstrap support (Réblová et al. 2011). *Davidsoniella* and *Huntiella* were introduced as new genera in *Ceratocystidaceae* by De Beer et al. (2014). Seven genera were emended based on morphological characters, ecological differences, as well as DNA-sequence data for three gene regions (60S, LSU, MCM7), these include *Ambrosiella*, *Ceratocystis sensu stricto*, *Chalaropsis*, *Davidsoniella*, *Endoconidiophora*, *Huntiella* and *Thielaviopsis* (De Beer et al. 2014). *Cornuvesica* was referred to *Microascales*, genera *incertae sedis* (Maharachchikumbura et al. 2015).

Ceratocystis Ellis & Halst., New Jersey Agric. Coll. Exp. Sta. Bull. 76: 14 (1890)

Facesoffungi number: FoF 01249; Figs 27, 28

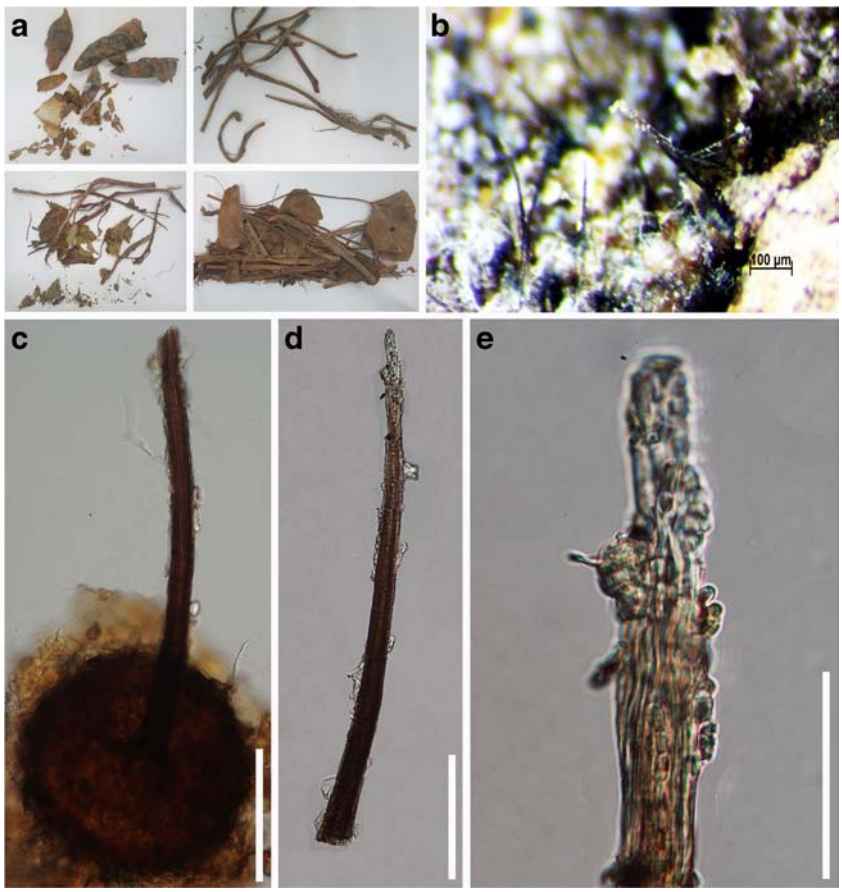


Fig. 27 ***Ceratocystis fimbriata*** (Material examined: USA, New Jersey, Swedesboro, on leaves of *Ipomoea batatas*, 12 April 1891, B. D. Halsted, BPI 595863–595866 **neotype**) **a** Herbarium material **b** Ascomata on *Ipomoea batatas* L. (*Convolvulaceae*) **c** Enlarged view of ascomatal base and ascomatal neck d **e** Neck region Scale bars: **b–d** = 100 µm, **d** = 50 µm

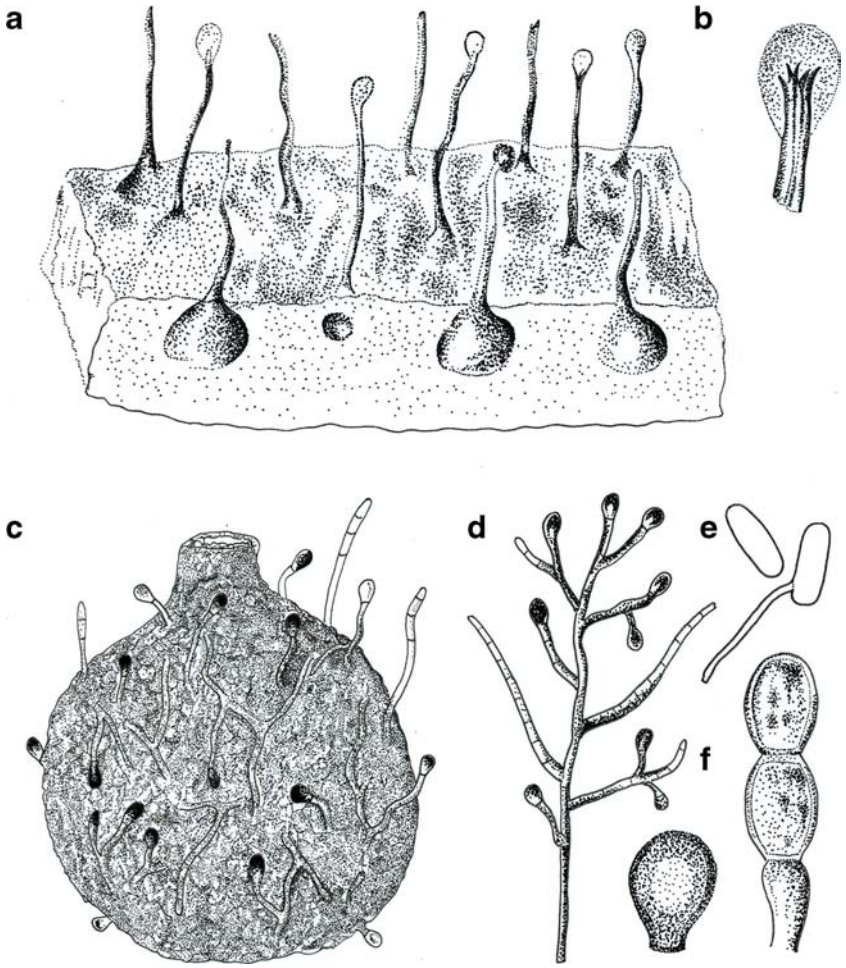


Fig. 28 ***Ceratocystis fimbriata*****. a** Habitat on wood **b** Ascospores being released from ostiolar hyphae **c** Ascoma with spines or septa, unornamented or with undifferentiated ornamental hyphae **d** Conidiophore **e** Germinated spores **f** Aleurioconidia (redrawn from Halsted and Fairchild 1891)

Saprobic or *pathogenic* on stems or roots of vascular plants, some species associated with bark beetles. **Sexual morph**: *Ascomata* single to aggregated, superficial or immersed in substrate, globose to subglobose, dark brown to black, with ornamented or unornamented hyphae, with or without spines, spines if present dark brown to black. *Ostiole* with long necks, cylindrical, tapering to the apex, straight, dark-brown to black, hyaline at apex, ostiolar hyphae divergent, aseptate, tapering to apex, hyaline to light brown. *Peridium* thin–walled, comprising pseudoparenchymatous cells of *textura angularis* in surface view. *Hamathecium* containing centrum interascal tissue absent. *Asci* dehiscent. *Ascospores* hyaline, 1-celled, variable in shape, fusoid, oblong, obovoid, cylindrical, or hat–shaped, curved, lunate, with or without a gelatinous sheath, accumulating in cream-coloured masses at apices of the ascomatal necks. **Asexual morph**: *Conidiophores* simple tubular, flask-shaped, tapering at the apex, with phialidic conidiogenesis. *Primary conidiophores* phialidic, flask-shaped. *Secondary conidiophores* flaring or wide-mouthed. *Primary conidia* cylindrical, hyaline. *Secondary conidia* barrel-shaped to subglobose, hyaline to light brown. *Aleurioconidia* globose ovoid to pyriform, single or in chains, pale-brown to brown (De Beer et al. 2014).

Type species: ***Ceratocystis fimbriata*** Ellis & Halst., Bull. New York Agricultural Experimental Station 76: 14 (1890)

Notes: The genus *Ceratocystis* with *C. fimbriata* as the type was introduced by Ellis and Halsted (1890) for the pathogen that causes black rot of sweet potatoes in the USA. *Ceratocystis* species are associated with bark beetles, which are symbiotically associated with insects as well as important causal agents of sap-stain in timber and many important pathogens of plants, including pineapples and palms (Hedgcock 1906; Mitchell 1937; Seifert 1993; Alvarez et al. 2012; Mbenoun et al. 2014).

Ceratocystis was removed from the order *Ophiostomatales* (Barr 1990; Samuels 1993) and the taxonomic confusion between *Ceratocystis* and *Ophiostoma* was subsequently resolved using DNA sequence data, showing that these genera are unrelated (Hausner et al. 1993a, b; Spatafora and Blackwell 1994). *Ophiostoma* belongs to the order *Ophiostomatales* (*Sordariomycetidae*) and *Ceratocystis* was

accommodated in the *Ceratocystidaceae* (*Microascales*, *Hypocreomycetidae*) (Réblová et al. 2011; De Beer et al. 2013). Recently, these differences have been substantially amplified by the discovery of many new and often cryptic species, revealed through DNA-sequence comparisons (Wingfield et al. 1996; Harrington and Wingfield et al. 1998; De Beer et al. 2014).

Huntiella Z.W. de Beer et al., in de Beer et al., Stud. Mycol. 79: 211 (2014) Fig. 29

Other genera included

Ambrosiella Brader ex von Arx & Hennebert, Mycopath. Mycol. appl. 25: 314 (1965)

Type species: ***Ambrosiella xylebori*** Brader ex von Arx & Hennebert, Mycopath. Mycol. appl. 25(7): 314 (1965)

Chalaropsis Peyronel, Staz. Sper. Argar. Ital. 49: 595 (1916)

Type species: ***Chalaropsis thielavioides*** Peyronel, Staz. Sper. Argar. Ital. 49: 585 (1916)

Davidsoniella Z.W. de Beer et al., in de Beer et al., *Stud. Mycol*. 79: 210 (2014)

Type species: ***Davidsoniella virescens*** (R.W. Davidson) Z.W. de Beer et al., in de Beer et al., Stud. Mycol. 79: 210 (2014)

Endoconidiophora Münch, Naturwiss. Z. Forst–Landw. 5: 564 (1907)

Type species: ***Endoconidiophora coerulescens*** Münch, Naturwiss. Z. Forst–Landw. 5: 564 (1907)

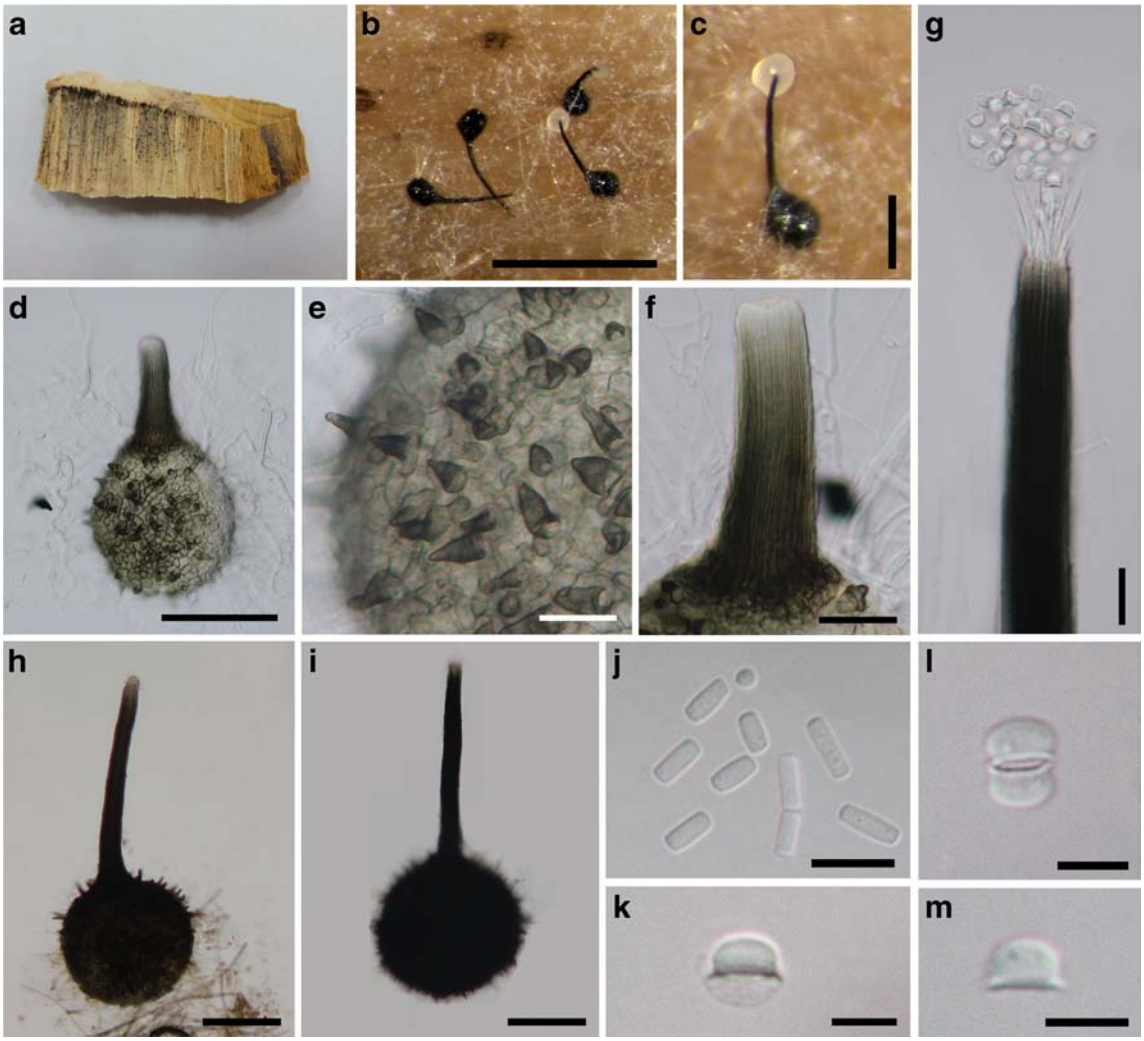


Fig. 29 ***Huntiella chinaeucensis*** (Material examined: THAILAND, Chiang Rai Province, Mae Suai District, Mae Lao garden, on stumps of *Tectona grandis* L. (*Lamiaceae*), 24 December 2012, M. Doilom, MFLU 15-3204). **a** Ascomata on *Tectona grandis* wood **b**, **c** Globose ascomata with long necks with subhyaline to cream masses at tips of ascomata necks on teak wood **d** Immature globose ascoma **e** Ascomata base with conical spines **f** Ascoma neck **g** Hat-shaped ascospores being released from ostiolar hyphae **h** Globose ascoma with ascoma neck **i** Hat-shaped ascospores **j** Cylindrical conidia **k** Conidiophores with conidiogenous cells Scale bar **b–c** = 500 μm, **d**, **h** = 100 μm. **e–g** = 20 μm, **i**, **j** = 5 μm, **k** = 10 μm

Type species: ***Huntiella moniliformis*** (Hedgc.) Z.W. de Beer et al., Stud. Mycol. 79: 212 (2014)

Saprobic on wood. **Sexual morph**: *Ascomata* superficial, globose to subglobose, ornamented with dark brown to black, conical spines; dark brown to black. *Ostiolar neck* long, black, tapering to apex, with a disk-like base. *Ostiole* comprising hyaline hyphae. *Asci* not observed. *Ascospores* hyaline, hat-shaped in side view, aseptate, being released from ostiolar hyphae, by accumulating in cream-coloured masses at apices of the ostiolar neck. **Asexual morph**: *Conidiophores* long, macronematous, straight or flexuous, tapering to apex, arising from hyphae, septate, slightly constricted at septa, hyaline, smooth. *Conidiogenous cells* phialidic, cylindrical, tapering toward apex, hyaline. *Conidia* cylindrical to barrel-shaped, truncate at the ends, hyaline, single to catenate, aseptate.

Notes: The genus *Huntiella* was introduced by De Beer et al. (2014), and placed in the family *Ceratocystidaceae*. They introduced 17 *Huntiella* species with another new combination of 17 species in *Ceratocystis* based on morphological and phylogenetic analyses of 60S ribosomal RNA, LSU and MCM7 dataset (De Beer et al. 2014). The species included in this study show 100 % similarity to *Huntiella moniliformis* (Hedgc.) De Beer et al. (2014), based on nucleotide blast results of ITS gene, as well as the distinctive features of morphology. Based on morphological features as well as DNA sequence data, we recognized our collection as *H. moniliformis. Thielaviopsis* has been reported as asexual morph of *Huntiella moniliformis* (Chen et al. 2013).

Thielaviopsis Went, Meded. Proefstn Suik Riet W. Java 5: 4 (1893)

Type species: ***Thielaviopsis ethacetica*** Went [as 'ethaceticus'], Annuario Soc. Alpinisti Trident.: 4 (1893)

Key to the sexual genera of *Ceratocystidaceae*

1. Ascospores one-celled, hat-shaped 2
   1. Ascospores one-celled, not hat-shaped (elongate or oblong cylindrical, or narrow fusiform to spindle-shaped)3
   2. Ascomatal bases globose to pyriform, with ornamented hyphae, conical spines, disk-like bases of the ascomatal necks . . . . . ***Huntiella***
   2. Ascomatal bases globose, with unornamented hyphae . . . . . ***Ceratocystis***
   3. Ascomatal necks long, brown to dark brown or black, with non-digitate or non-stellate appendages on the ascomatal. 4
   3. Ascomatal necks long, dark grey, with digitate or stellate appendages on the asco . . . . . ***Thielaviopsis***
   4. Ascomatal globose, surrounded by ornamental hyphae, ascospores elongate, narrow fusiform to spindle shaped, slightly curved, with hyaline sheath . . . . ***Davidsoniella***
   4. Ascomatal globose to ovoid, surrounded by distinct basal spines, ascospores elongate to slightly curved with round ends or some species oblong cylindrical, and surrounded by distinct translucent sheath. . . . . ***Endoconidiophora***

Key to the asexual genera of *Ceratocystidaceae*

Notes: The morphological characters of the asexual morph in several genera are indistinguishable. Generic delineations are better achieved by using DNA sequence data.

1. Sexual morph not known or not observed 2
1. Sexual morph known 3
2. Conidiophores single to aggregated in sporodochia; conidia globose, associated with ambrosia beetles . . . . . ***Ambrosiella***
2. Conidiophores sympodially or irregularly branched; conidia cylindrical . . . . . ***Chalaropsis***
3. Aleurioconidia not present 4
3. Aleurioconidia present 6
4. Conidiogenous cells cylindrical 5
4. Conidiogenous cells flask-shaped. . . . . ***Huntiella***
5. Conidia cylindrical with flattened ends, barrel-shaped . . . . . ***Davidsoniella***
5. Conidia rectangular with two attachment points. . . . . ***Endoconidiophora***
6. Secondary conidia cylindrical to oblong; conidiophores lageniform . . . . . ***Thielaviopsis***
6. Secondary conidia barrel to subglobose; conidiophores flared or wide-mouthed . . . . . ***Ceratocystis***

Ceratostomataceae G. Winter [as 'Ceratostomeae'], Rabenh. Krypt.–Fl., Edn 2 (Leipzig) 1.2: 247 (1885)

Facesoffungi number: FoF 01803

Saprobic or *weakly parasitic*, often found growing on other fungi, commonly isolated from soil. **Sexual morph**: *Ascomata* perithecial or cleistothecial, usually translucent, yellow to pale brown, ostiolate or not, often with long-necks, with smooth ostiolar setae. Interascal tissue absent. *Peridium* membranaceous, comprising pale yellow to pale yellowish-brown, cell of a *textura angularis* or *textura globulosa. Asci* 8-spored, unitunicate, thin-walled, clavate, without an apical ring, deliquescing. *Ascospores* biseriate, brown to dark brown, ellipsoidal to citriform, occasionally discoid or fusiform, usually 2-germ pored at each end, aseptate, smooth to strongly ornamented, sheath absent. **Asexual morph**: Hyphomycetous. *Conidiophores* simple, semi-macronematous, mononematous, some genera (*Acrospeira*) branched towards the apex, some genera (*Gonatobotrys*, *Erythrocarpon*) conidiophore with several roughened swellings along its length, reddish-brown to dark. *Conidiogenous cells* integrated, terminal, monoblastic, some genera (*Pteridiosperma*) with phialides,

singly on aerial hyphae or rarely on conidiophores, lageniform, hyaline. *Conidia* globose, spindle-shaped, ovate to pyriform, some genera (*Pteridiosperma*) are aggregated in small globose heads at the apices of phialides, one-celled, some genera (*Erythrocarpon*, *Acrospeira*) containing with 2–3-transverse septa, hyaline, brown and verrucose.

Type: ***Melanospora*** Corda

Notes: The family *Ceratostomataceae* was established by Winter (1885). Barr (1990), Hawksworth et al. (1995), and Samuels and Blackwell (2001) placed *Melanospora* and its allies in *Ceratostomataceae* (synonymy: *Melanosporaceae*), based on the ascospore colour and ornamentation and ribosomal DNA sequences. The family was placed in *Sordariales* based on the characters of the ascospores, with dark with germ pores, which are the most conspicuous similarities (Huang 1976; Uecker 1976). Zhang and Blackwell (2002) placed *Ceratostomataceae* in the order *Melanosporales* based on phylogenetic analyses, while emphasizing the morphological characters, *Sordaria*-type centrum composed of paraphyses in addition to pseudoparenchyma, which differs from the centrum of *Melanospora*. Most of the species of *Ceratostomataceae* are saprobic on plant material. Certain species have a widespread host range, and are closely associated with other fungi, on soil, or rotting vegetation and some species are considered as potential biocontrol agents as they can grow on other plant pathogens. Recently, Maharachchikumbura et al. (2015) provided an updated outline of the family *Ceratostomataceae* and included ten genera.

Melanospora Corda, Icon. fung. (Prague) 1: 24 (1837)

Facesoffungi number: FoF 01804; Fig. 30

Saprobic or *weakly parasitic* on plant materials, commonly isolated from soil and closely associated with other fungi. **Sexual morph**: *Ascomata* superficial to immersed, globose to ovoid, gregarious, inconspicuously ostiolate, setose, pale yellow, translucent, appearing dark brown to black, due to the massed ascospores, with short neck or sometimes absent, with a ring of rigid, hyaline, smooth and thick-walled setae around the ostiole, setae right to slightly curved or sinuous, pale yellow, aseptate, thick-walled. *Peridium* membranaceous, thick-walled, pale yellow to pale yellowish-brown, cell of a *textura globulosa* or *textura angularis*. *Paraphyses* absent. *Asci* 8-spored, unitunicate, broadly clavate to obovate, fasciculate, apex rounded, without apical ring, short stipitate, broadly rounded apex, evanescent walled. *Ascospores* irregularly biseriate, at first hyaline and guttulate, brown to dark brown, large ellipsoidal, one-celled, smooth and thick-walled, with two terminal germ pores, surrounded by a dark ring-like structure. **Asexual morph**: Hyphomycetous. *Conidiophore* simple, erect, brown or dark brown. *Conidiogenous* cell phialides, single on aerial hyphae or rarely on conidiophores, lageniform, hyaline, some genera (*Acrospeira*) integrated, terminal, monoblastic. *Conidia* globose, spindle-shaped, 1–(−4) cell, some genera (*Gonatobotrys*) produced in grape-like clusters around each swelling, some genera (*Pteridiosperma*) produced from single phialides on aerial hyphae or rarely on conidiophores.

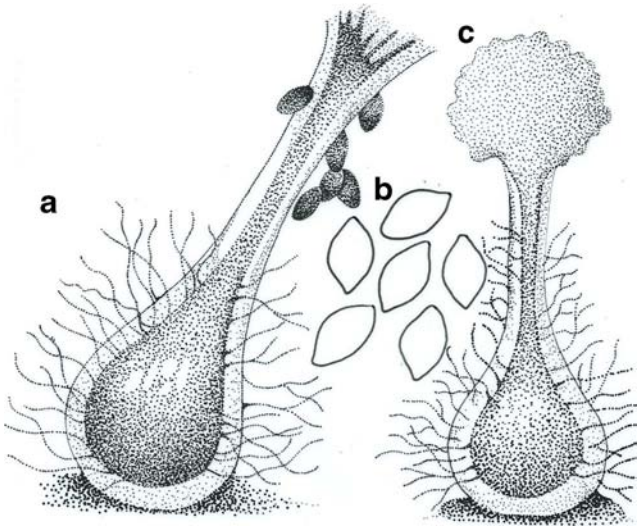


Fig. 30 ***Melanospora zamiae*** **(holotype). a** Ascomata **b** Ascospores **c** Ascomata and ascospores mass (redrawn from Corda 1837)

Type species: ***Melanospora zamiae*** Corda, Icon. fung. (Prague) 1: 24 (1837)

Notes: The genus *Melanospora* was introduced by Corda (1837) with the type species, *M. zamiae*, and subsequently referred to the family *Ceratostomataceae* (Winter 1885) and *Sordariales* (Hawksworth and Eriksson 1986). *Melanospora* was traditionally placed within the *Ceratostomataceae*, *Sordariales* based on morphological similarities with the *Chaetomiaceae* (Hawksworth et al. 1995). Later molecular phylogenetic studies indicated that *Melanospora* belonged in *Hypocreales* (Rehner and Samuels 1995; Jones and Blackwell 1998). Zhang and Blackwell (2002) and Chaudhary et al. (2006) considered the *Melanospora* clade to be a sister group of *Hypocreales* and found that sequences derived from other genera of *Ceratostomataceae* (synonymy: *Melanosporaceae*) clustered within the main *Hypocreales* clade. Zhang et al. (2006) concluded that the family belongs to *Hypocreomycetidae* but that it was a sister group of the *Coronophorales* and introduced a new order *Melanosporales*. The order was published formally by Hibbett et al. (2007). A similar placement was proposed by Schoch et al. (2007) in a study of marine fungal lineages within the *Hypocreomycetidae*. However, the phylogenetic inconsistencies of the order *Melanosporales* have not been addressed.

Most species in *Melanospora* are parasitic and associated on wide host range such as basidiomycetes, sexual and asexual ascomycetes as well as with other fungi and some species obtain nutrients by fusing with the host protoplasts, an interaction called fusion biotrophism (Jeffries and Young 1994). Harveson (1999) reported *Melanospora* species as potential biocontrol agents as they can grow on other plant pathogenic fungi.

Asexual morphs of the genus belong in a wide range of genera, including *Gonatobotrys*, *Harzia*, *Papulaspora* and *Proteophiala* (Hyde et al. 2011).

Melanospora collipora Stchigel & Guarro, in Stchigel et al., Mycol. Res. 101(4): 446 (1997); Fig. 31.

Notes: *Melanospora collipora* was described by Stchigel et al. (1996), isolated from a soil sample from India. This species was introduced to *Melanospora* based on its large ellipsoidal, 1-celled ascospores, with two terminal germ pores, surrounded by ring-like structure (Fog. 31). *Melanospora collipora* differs from other species in conidial size and character of germ pores, and hyaline rim around the germ pores (Stchigel et al. 1996).

Other genera included

Acrospeira Berk. & Broome, in Berk., Intr. crypt bot (London): 305 (1857)

Type species: ***Acrospeira mirabilis*** Berk. & Broome, in Berkeley, Intr crypt. Bot. (London): 305, fig. 69a (1857)

Arxiomyces P.F. Cannon & D. Hawksw., Trans Br Mycol Soc 81(3): 644 (1983)

Type species: ***Arxiomyces vitis*** (Fuckel) P.F. Cannon & D. Hawksw, Trans. Br. Mycol. Soc. 81(3): 644 (1983)

Erythrocarpon Zukal, Verh zool-bot Ges Wien 35: 337 (1886)

Type species: ***Erythrocarpon microstomum*** Zukal, Verh zool-bot Ges Wien 35: 337 (1886)

Gonatobotrys Corda, Pracht-Fl. Eur. Schimmelbild.: 9 (1839)

Type species: ***Gonatobotrys simplex*** Corda, Pracht - Flora. Europaeischer Schimmel-Bildungen: 9 (1839)

Pteridiosperma J.C. Krug & Jeng, Mycotaxon 10(1): 44 (1979)

Type species: ***Pteridiosperma foveolatum*** (Udagawa & Y. Horie) J.C. Krug & Jeng, Mycotaxon 10(1): 45 (1979)

Pustulipora P.F. Cannon, Mycotaxon 15: 526 (1982)

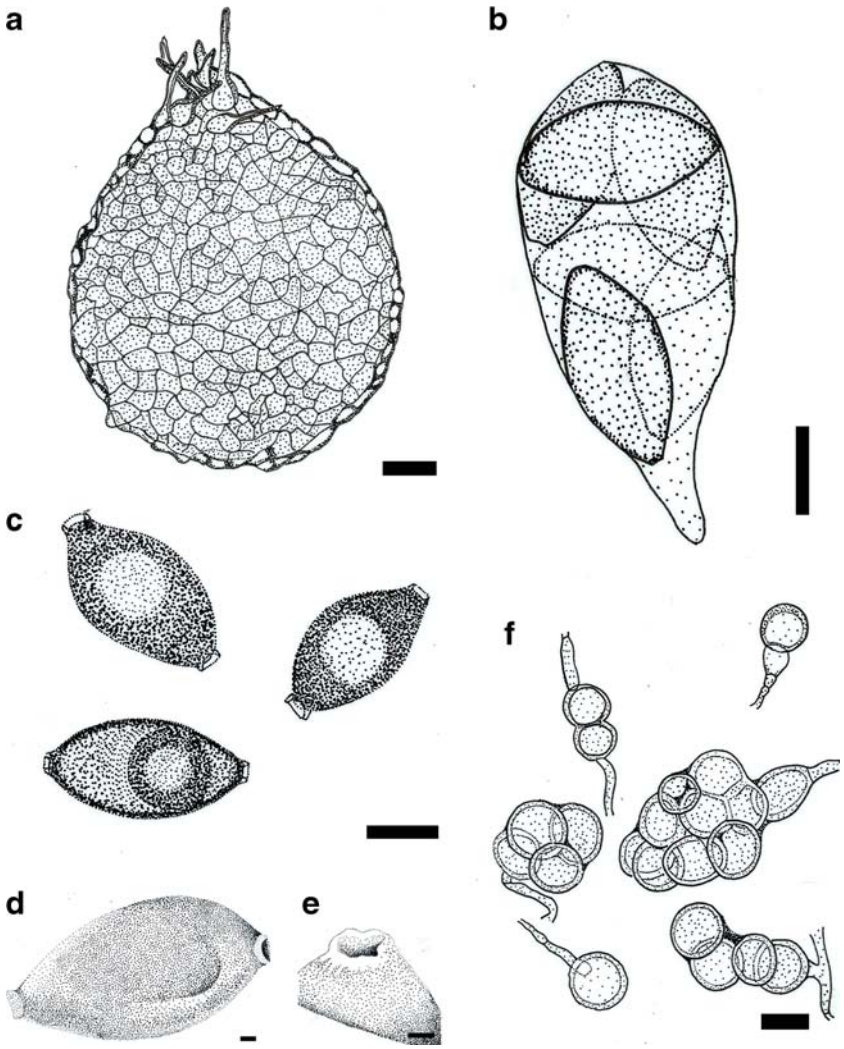


Fig. 31 ***Melanospora collipora*** **(holotype). a** Ascoma **b** Ascus **c**, **d** Ascospores **e** Detail of germ pores **f** Chlamydospores. Scale bars: **a** = 25 μm, **b**, **c**, **f** = 10 μm, **d**, **e** = 1 μm. (redrawn from Stchigel et al. 1996)

Type species: ***Pustulipora corticola*** P.F. Cannon, Mycotaxon 15: 526 (1982); Fig. 32

Notes: *Pustulipora* was established by Cannon and Hawksworth (1982), based on *P. corticola*, as the type species isolated from bark (unidentified) in UK. *Pustulipora* was placed in *Ceratostomataceae* based on its ascospores, which are muriform-ellipsoidal with two simple terminal germ pores (Fig. 32) and other characters which confirmed the close relationship of this genus to *Ceratostomataceae* (Cannon and Hawksworth 1982).

Rhytidospora Jeng & Cain, Mycotaxon 5(1): 278 (1977)

Type species: ***Rhytidospora tetraspora*** Jeng & Cain, Mycotaxon 5(1): 279 (1977)

Setiferotheca Matsush., Matsush. Mycol Mem 8: 34 (1995)

Type species: ***Setiferotheca nipponica*** Matsush., Matsush. Mycol. Mem. 8: 35 (1995)

Vittatispora P. Chaudhary et al., Mycologia 98(3): 461 (2006)

Type species: ***Vittatispora coorgii*** P. Chaudhary et al., Mycologia 98(3): 461 (2006)

Key to the sexual genera of *Ceratostomataceae*

1. Ascomata with necks 2
1. Ascomata lacking necks 3
2. Peridium coriaceous to carbonaceous, dark brown to black; ascospores with a large sunken germ pore and small basal appendage . . . . . ***Arxiomyces***
2. Peridium membranous brownish or pale yellow to reddish brown, and translucent; ascospores with two apical germ pores 4
3. Ascomata with ostiole 5
3. Ascomata without ostiole 6
4. Ascospores with a thick hyaline ridge running full length of the ascospore between the germ pores . . . . . ***Vittatispora***
4. Ascospores without a thick hyaline ridge running full length of the ascospore between the germ pores . . . . . ***Melanospora***
5. Ascospores with two apical germ pores 7

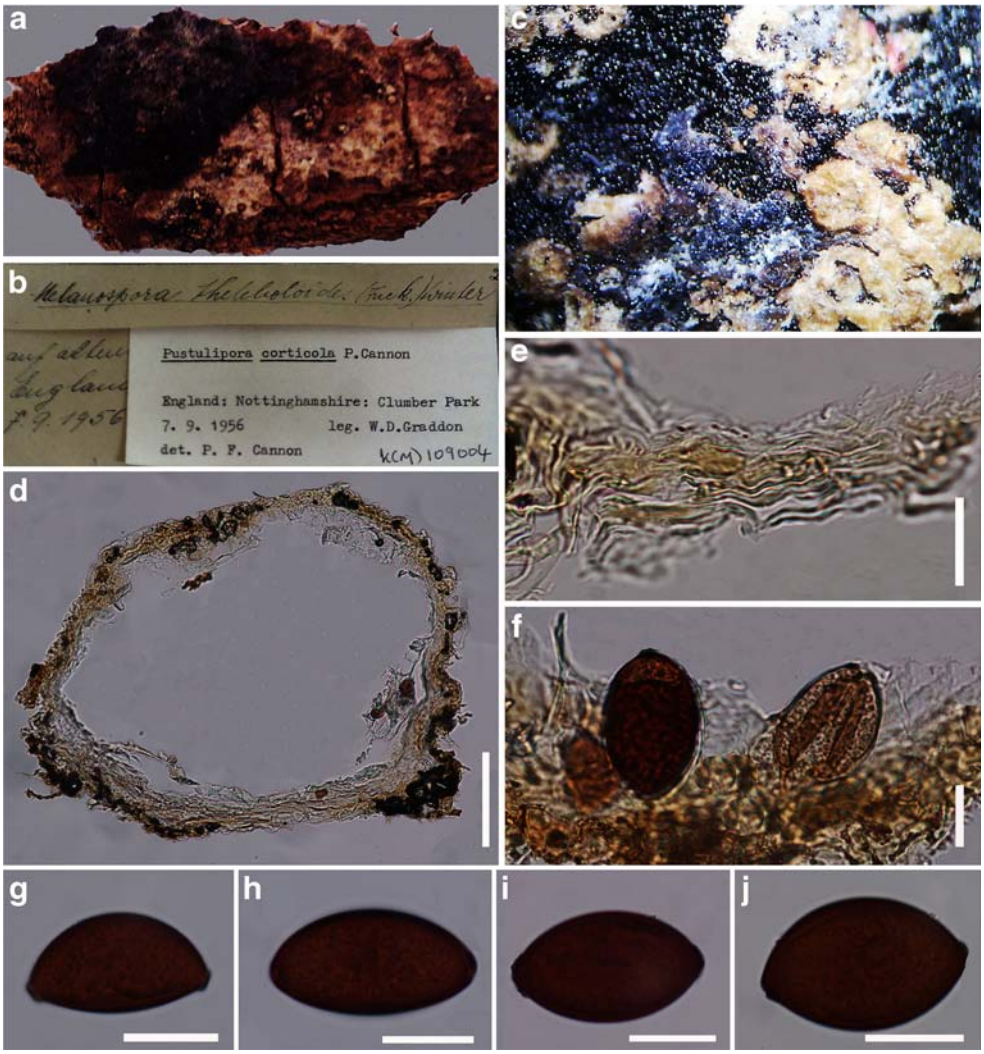


Fig. 32 ***Pustulipora corticola*** (UK, Nottinghamshire, Nottingham, Clumber park, on unidentified bark, 7 September 1956, W.D. Graddon., IMI 284968, **holotype**). **a**, **b** Herbarium specimen **c** Ascomata superficial on host tissue **d** Section through ascoma **e** Peridium **f** Ascospores attached to the inner wall of ascoma **g–j** Ascospores. Scale bars: **d** = 100 μm, **e–j** = 20 μm

5. Ascospores with a single germ pore at one end……..……..***Setiferotheca***
6. Ascospores black, with wing-like ridges at convex surfaces……..……***Pteridiosperma***
6. Ascospores brown to dark brown, without wing-like ridges at convex surfaces. . . . . ***Rhytidospora***
7. Asci cylindrical, ephemeral, 8-spored. . ***Erythrocarpon***
7. Asci clavate to obovoid, 4-spored . . . . . ***Pustulipora***

Key to the asexual genera of *Ceratostomataceae*

1. Conidia 1-celled 2
   1. Conidia 3- or 4-cell 3
   2. Conidia produced in grape-like clusters around each swelling on hyphae . . . . . ***Gonatobotrys***
   2. Conidia produced from single phialides on hyphae . . . . . ***Pteridiosperma***
   3. Conidia globose, with 2 transverse septa . . ***Acrospeira***
   3. Conidia spindle-shaped, with 3 transverse septa. . . . . ***Erythrocarpon***

Chadefaudiellaceae Faurel & Schotter ex Benny & Kimbr., Mycotaxon 12(1): 46 (1980)

Facesoffungi number: FoF 01666

Saprobic on mammalian dung. **Sexual morph**: *Ascomata* perithecial, elongate or hemisphaerical, immersed at the base, pale yellow to brown, basal perithecial envelope black, globular, carbonaceous, foot cylindrical, light yellow to brown, translucent, striated, upper part with brown, anastomosing setae or setae lacking, lacking ostioles. *Peridium* composed of pseudoparenchymatous cells forming a *textura angularis* embedded in the substrate and an aerial "capillitium". *Asci* overlapping, 8-spored, globose or clavate, catenulate, evanescent. *Ascospores* 1-celled, hyaline to pale brown, ellipsoidal or fusiform, without germ pores, striate or striations lacking, turning reddish brown in Melzer's reagent (dextrinoid) or non-dextrinoid formed in a mazaedial mass. **Asexual morph**: Hyphomycetous, forming arthrospores.

Type: ***Chadefaudiella*** Faurel & Schotter

Notes: *Chadefaudiellaceae* was introduced by Benny and Kimbrough (1980) to accommodate the genus *Chadefaudiella*. Cannon and Kirk (2007) added a second genus to the family, *Faurelina* (Locquin-Linard 1975). Parguey-Leduc (1977) placed *Chadefaudiella* in the order *Microascales* because of its perithecial ascomata, catenate asci, and characteristic centrum structures, i.e. "asci arising from a fertile layer lining the bottom of the cavity, ascogenous hyphae ramifying upwards, asci extricated without croziers and liberated by basal dissolution to float free in the centrum" (Benny and Kimbrough 1980). *Faurelina* was included in this family because it has characters reminiscent of *Chadefaudiella*, such as a cephalothecoid ascomatal wall and asci which are catenate and irregularly disposed in the centrum at maturity (Udagawa and Furuya 1973). However, the classification of *Faurelina* has been problematic. Despite the similarities with *Chadefaudiella* noted by Locquin-Linard (1975), Parguey-Leduc and Locquin-Linard (1976) concluded that *Faurelina* should be placed in the *Loculoascomycetes* (now in Dothideomycetes; Hyde et al. 2013). *Faurelina* was later transferred by von Arx (1978) to the family *Microascaceae*. Recently both genera were placed in *Chadefaudiellaceae*, *Microascales* (Cannon and Kirk 2007; Maharachchikumbura et al. 2015). However, phylogenetic re-evaluation of *Microascales* by Réblová et al. (2011) concluded that *Chadefaudiella* is morphologically slightly different from *Faurelina* and further molecular analysis may lead to a re-establishment of the family *Chadefaudiellaceae* in the order *Microascales*, but with the exclusion of *Faurelina*. The family is poorly understood and needs recollecting.

Chadefaudiella Faurel & Schotter, Revue Mycol., Paris 30: 339 (1959)

Facesoffungi number: FoF 02103; Fig. 33

Saprobic on mammalian dung**. Sexual morph**: *Ascomata* relatively large (500–1500 μm high, 150–250 μm wide), light yellow, elongate or hemisphaerical, immersed at the base, pale yellow to brown, basal perithecial envelope black, globular, carbonaceous, foot cylindrical, light yellow to brown, translucent, striated, upper part with brown, anastomosing setae or setae lacking, carbonaceous, lacking ostioles. *Peridium* composed of pseudoparenchymatous cells forming a *textura angularis* embedded in the substrate and an aerial "capillitium". *Asci* 8-spored, globose, evanescent. *Ascospores* 1-celled, fusiform, thick, striate, not turn into reddish-brown upon application of Melzer's reagent (non-dextrinoid). **Asexual morph**: Undetermined.

Type species: ***Chadefaudiella quezelii*** Faurel & Schotter, Comptes rendus hebdomadaires des séances de l'Académie des sciences, Paris 249(1): 152 (1959)

Notes: The genus *Chadefaudiella* was described for a single species, *Chadefaudiella quezelii*. A later study by Faurel and Locquin (1972) introduced another species, *Chadefaudiella thomasii* Faurel & Locq. isolated from dung. Benny and Kimbrough (1980) proposed a new family *Chadefaudiellaceae* in the order *Microascales* to include the genus *Chadefaudiella* and this has been followed by Cannon and Kirk (2007), Réblová et al. (2011) and Maharachchikumbura et al. (2015). The genus is poorly understood and needs recollecting.

Other genus included

Faurelina Locq.-Lin., Revue Mycologique, Paris 39(2): 127 (1975)

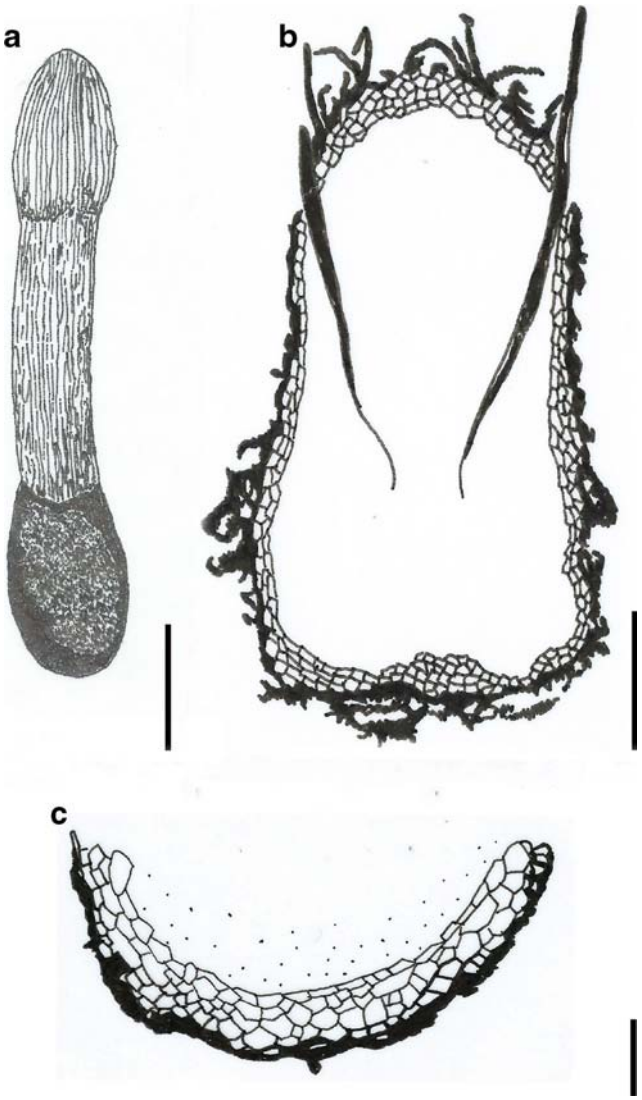


Fig. 33 ***Chadefaudiella quezelii*** **a** Ascoma **b** Longitudinal section of ascoma **c** Peridium. Scale bars: a–b = 200 μm, c = 100 μm (redrawn from Faurel and Schotter 1959)

Type species: ***Faurelina fimigena*** Locq.-Lin. [as 'fimigenes'], Revue Mycol., Paris 39(2): 127 (1975)

Key to genera of *Chadefaudiellaceae*

1. Ascomata with apical anastomosing setae; ascospores non dextrinoid . . . . . ***Chadefaudiella***

1. Ascomata without apical anastomosing setae; ascospores dextrinoid . . . . . ***Faurelina***

Chaetomiaceae G. Winter [as 'Chaetomieae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 153 (1885)

Facesoffungi number: FoF 01900

Saprobic or *parasitic* on plant debris, straw, seeds, dung, feathers of birds, soil, paper, textiles, air, mushrooms, rabbit and humans. **Sexual morph**: *Ascomata* perithecial or cleistothecial, colourless to light brown, egg yellow, grey-olivaceous to (greenish) grey, to grey, golden brown, brown to black, solitary to scattered to gregarious, superficial or immersed to semi-immersed, subglobose to obpyriform, globose; ellipsoidal; ovoid to pyriform, cylindrical; covered with hair/setae or glabrous, hairs maybe simple or branched and of one to two types, ostiole or non-ostiole. *Peridium* with thick wall, comprising several layers of hyaline or brown cells of *textura epidermoidea* to *textura intricata*. *Hamathecium* septate with hyaline paraphyses. *Asci* 4- or 8-spored, unitunicate, clavate, or clavate to cylindrical, obovate or ellipsoidal, pedicellate, without apical structures or with an indistinct thickened ring, evanescent, with wall dissolving at maturity. *Paraphyses* absent or greatly reduced. *Ascospores* irregularly arranged, at first colourless and dextrinoid, (translucent, greenish, dark), brown to black, and opaque when mature, ellipsoidal, globose, subglobose, oval, fusiform or triangular, with single or sometimes two germ pores, aseptate, with thick, smooth walls. **Asexual morph**: Hyphomycetous. *Colonies* brown or orange or white to (black, green) grey brown or grey, woolly, border even, reverse uncolored or buff-coloured to brown, aerial mycelium cottony or felty, with funiculose setae and hyphae. *Mycelium* abundant, intramatrical and aerial, composed of septate, hyaline or dark brown hyphae. *Conidiophores* absent or simple, vegetative hyphae, hyaline, branched, septate, smooth-walled or slightly rough. *Conidiogenous cells* phialidic, verticillate or solitary, hyaline, consisting of a lageniform or ellipsoid swollen basal portion, or reduced or cylindrical. *Conidia* dimorphic, first kind holoblastic, hyaline to brown, smooth, globose to obclavate, 1-celled, formed on hyphae or cylindrical conidiogenous cells, single or in racemose clusters; second kind produced form phialides, hyaline to brown, lutescens, or dark brown, subglobose to globose or ellipsoidal, occasionally cylindrical to pyriform or fusiform, formed single or in chains, 1-celled, with thick, smooth-walled.

Type: ***Chaetomium*** Kunze

Notes: The family *Chaetomiaceae* was introduced by Winter (as *Chaetomiea*) in 1885, and is typified by *Chaetomium* (Grunow et al. 1887). Earlier, the family was placed in the order *Chaetomiales* by Ames (1961), Alexopoulos (1962) and Mukerji (1968). Barr (1976b), Müller and von Arx (1973) transferred the family *Chaetomiaceae* to the order *Sphaeriales*, while Hawksworth and Wells (1973) and Mehrotra and Aneja (1990) placed it in *Sordariales*. Later molecular data showed *Chaetomiaceae* belonged to the order *Sordariales* (Huhndorf et al. 2004a; Kirk et al. 2008; Lumbsch and Huhndorf 2010; Liu 2011; Maharachchikumbura et al. 2015). Twenty genera are presently placed in the family (Maharachchikumbura et al. 2015). However, *Diplogelasinospora* and *Zopfiella* need to be transferred to *Lasiosphaeriaceae*, which was shown by Cai et al. (2006b, c) and Morgenstern et al. (2012) based on gene sequence data. Members of this family are ubiquitous fungi,

commonly residing in soil, on lignin and cellulosic or similar materials such as paper, cotton, fabrics, straw, manure. Species have also been found as human opportunistic pathogens (von Arx et al. 1986; Mukerji and Manoharachary 2010; Ahmed et al. 2015).

Chaetomium Kunze, in Kunze and Schmidt, Mykologische Hefte (Leipzig) 1: 15 (1817)

Facesoffungi number: FoF 01901; Fig. 34

Saprobic or *parasitic* on plant debris, straw, seeds, dung, feathers of birds, soil, paper, textiles and humans. **Sexual**

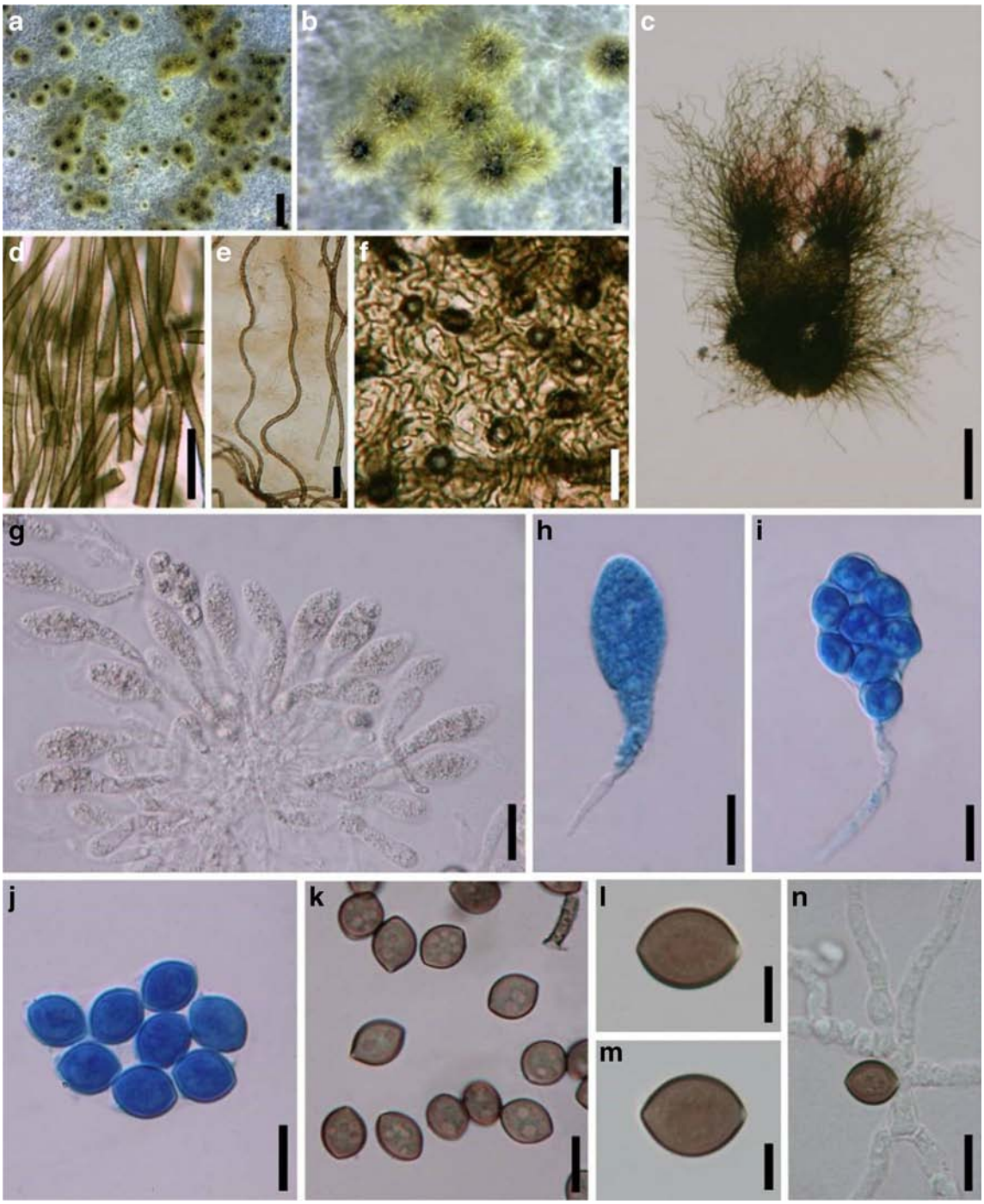


Fig. 34 ***Chaetomium globosum*** **(**Material examined: THAILAND, Phayao Province, Muang District, on dead moist twig of *Tectona grandis* L. (*Lamiaceae*), M. Doilom, 12 March 2012, MFLU 15-3206, living culture, MFLUCC 12-0290) **a** Ascomata on PDA after 7 days **b** Close-up ascomata on PDA **c** Ascomata with yellowish ascomatal hairs **d**, **e** Ascomatal hairs **f** Squash mount showing surface of peridium **g**, **h** Immature asci **i** Mature asci **j** Immature ascospores **k-m** Mature ascospores **n** Germinating ascospore. Scale bars: **a** = 1000 μm, **b** = 500 μm, **c** = 200 μm, **d**, **e**, **g**, = 20 μm, **f**, **h–k**, **n** = 10 μm, **l**, **m** = 5 μm

morph: *Ascomata* dark, olive brown to greyish yellow, grey or green, superficial, globose, subglobose to ovoid, pyriform or ampulliform, numerous, with broadly rounded base and narrow ostiole. *Peridium* with thick wall, composed of several layers of pale brown cells of *textura intricata* or *textura epidermoidea. Ascomatal hairs* numerous, usually unbranched, brown, flexuous, undulate or coiled, often tapering, septate, broad at the base. *Asci* 8-spored, rarely 4-spored, unitunicate, clavate, obovate, fusiform, or nearly cylindrical, pedicellate, apically rounded, evanescent. *Ascospores* overlapping biseriate to crowded, hyaline when young, later brown, variable in shape, most are ellipsoidal, broadly fusiform or limoniform, aseptate, thick and smooth-walled, containing several small guttules, with an apical germ pore. **Asexual morph**: Hyphomycetous. *Colonies* brown or orange or white, woolly, border even, reverse buff-colored to brown, aerial mycelium cottony or felty, with funiculose setae and hyphae. *Mycelium* abundant, intramatrical and aerial, composed of hyaline or dark brown, septate, hyphae. *Conidiophores* reduced to conidiogenous cells or simple, vegetative hyphae, branched, hyaline, septate, with smooth or slightly rough wall. *Conidiogenous cells* phialidic, hyaline, lateral or intercalary on aerial mycelium, or immersed in agar or on conidiophore. *Conidia* hyaline to brown, subglobose to globose, or oblong, occasionally cylindrical to pyriform, formed single or in chains, aseptate, smooth-walled, wall thick with age.

Type species: ***Chaetomium globosum*** Kunze, in Kunze and Schmidt, Mykologische Hefte (Leipzig) 1: 16 (1817)

Notes: *Chaetomium* is a cosmopolitan genus with more than 150 species (Asgari and Zare 2011a; Zhang et al. 2012a, b). The genus belongs to *Sordariomycetes*, family *Chaetomiaceae* with *C. globosum* as the type species (Zhang et al. 2012a, b). Special characteristics of *Chaetomium* are ascomata covered with hairs or setae (Hawksworth and Wells 1973), clavate or fusiform or sometimes cylindrical thin-walled asci, lacking paraphyses before ascomata mature (von Arx et al. 1986) and 1-celled, brown or gray-brown ascospores with germ pores. A comprehensive classification of *Chaetomium* was provide by Dreyfuss (1976) based on morphological characters and some physiological traits (temperature and nutritional requirements, growth and fruiting rate, and compatibility). *Chaetomium* species can be potential biological control agents (Soytong et al. 2001), can produce bioactive metabolites (Wang et al. 2012; Li et al. 2014), others produce mycotoxins and infect skin and nails in humans (Pieckova 2003).

Other genera included

Achaetomium J.N. Rai et al., Can. J. Bot. 42(6): 693 (1964)

Type species: ***Achaetomium globosum*** J.N. Rai & J.P. Tewari, in Rai et al., Can. J. Bot. 42(6): 693 (1964)

Bommerella Marchal, Bull. Soc. R. Bot. Belg. 24(2): 164 (1885)

Type species: ***Bommerella trigonospora*** Marchal, Bull. Soc. R. Bot. Belg. 24(2): 164 (1885)

Boothiella Lodhi & Mirza, Mycologia 54(2): 217 (1962)

Type species: ***Boothiella tetraspora*** Lodhi & J.H. Mirza, Mycologia 54(2): 217 (1962)

Botryotrichum Sacc. & Marchal, in Marchal, Bull. Soc. R. Bot. Belg. 24(1): 66 (1885)

Type species: ***Botryotrichum piluliferum*** Sacc. & Marchal, in Marchal, Bull. Soc. R. Bot. Belg. 24(1): 66 (1885)

Chaetomidium (Zopf) Sacc., Syll. fung. (Abellini) 1: 39 (1882)

Type species: ***Chaetomidium fimeti*** (Fuckel) Zopf, Syll. fung. (Abellini) 1: 39 (1882)

Corynascella Arx & Hodges, in von Arx, Stud. Mycol. 8: 23 (1975)

Type species: ***Corynascella humicola*** Arx & Hodges, Stud. Mycol. 8: 23 (1975)

Chaetomiopsis Moustafa & Abdul-Wahid, Mycologia 82(1): 129 (1990)

Type species: ***Chaetomiopsis dinae*** Moustafa & Abdul-Wahid, Mycologia 82(1): 129 (1990)

Crassicarpon Y. Marín et al., Mycologia 130(3): 629 (2015)

Type species: ***Crassicarpon thermophilum*** (Fergus & Sinden) Y. Marín et al., Mycologia 130(3): 629 (2015)

Emilmuelleria Arx, Sydowia 38: 6 (1986) [1985]

Type species: ***Emilmuelleria spirotricha*** (R.K. Benj.) Arx, Sydowia 38: 6 (1986) [1985]

Farrowia D. Hawksw., Persoonia 8(2): 173 (1975)

Type species: ***Farrowia longicollea*** (Krzemien. & Badura) D. Hawksw. [as 'Farrowia longicollis'], (1975) Persoonia 8(2): 173 (1975)

Guanomyces M.C. González, Hanlin & Ulloa, Mycologia 92(6): 1139 (2000)

Type species: ***Guanomyces polythrix*** M.C. González et al., Mycologia 92(6): 1141 (2000)

Humicola Traaen, Nytt Mag. Natur. 52: 31 (1914)

Type species: ***Humicola fuscoatra*** Traaen, Nytt Mag. Natur. 52: 33 (1914)

Madurella Brumpt, Compt.-Rend. Séances Mém. Soc. Biol. 58: 999 (1905)

Type species: ***Madurella mycetomi*** (Laveran) Brumpt [as 'Madurella mycetomatis'], (1905)

Myceliophthora Costantin, C. r. hebd. Séanc. Acad. Sci., Paris 114: 849 (1892)

Type species: ***Myceliophthora lutea*** Costantin, C. r. hebd. Séanc. Acad. Sci., Paris 114: 2 (1892)

Staphylotrichum J. Mey. & Nicot, Bull. trimest. Soc. mycol. Fr. 72: 322 (1957) [1956]

Type species: ***Staphylotrichum coccosporum*** J.A. Mey. & Nicot, Bull. trimest. Soc. mycol. Fr. 72(4): 323 (1957) [1956]

Subramaniula Arx, Proc. Indian Acad. Sci., Pl. Sci. 94(2–3): 344 (1985)

Type species: ***Subramaniula thielavioides*** (Arx et al.) Arx, Proc. Indian Acad. Sci., Pl. Sci. 94(2–3): 344 (1985)

Taifanglania Z.Q. Liang et al., Fungal Diversity 34: 72 (2009)

Type species: ***Taifanglania hechuanensis*** Z.Q. Liang et al., Fungal Diversity 34: 72 (2009)

Thielavia Zopf, Verh. bot. Ver. Prov. Brandenb. 18: 101 (1876)

Type species: ***Thielavia basicola*** Zopf, Sber. bot. Ver. Prov. Brandenb. 18: 105 (1871)

Key to genera of *Chaetomiaceae*

1. Sexual morph present 2
1. Asexual morph present. 15
2. Ascospores with one germ pore 3
2. Ascospores with two germ pores 12
3. Ascomata perithecioid 4
3. Ascomata cleistothecioid 8
4. Ascospores triangular; ascomata bearing ampulliform setae . . . . . ***Bommerella***
4. Ascospores limoniform, ovoid, globose or fusoid; ascoma ornamentation different from ampulliform setae 5
5. Ascomata glabrous, urn-shaped . . . . . ***Subranmaniula***
5. Ascomata bearing hyphae and/or appendages, not urn-shaped 6
6. Ascomata attached to substrate by basal tuft of hyphae; appendages not ornamented . . . . . ***Farrowia***
6. Ascomata not attached to substrate by basal tuft of hyphae; appendages ornamented 7
7. Peridium dark and wide beneath vestiture . . . . . ***Achaetomium***
7. Peridium brown or pallid and narrow beneath vestiture . . . . . ***Chaetomium***
8. Ascomata with pallid or light brown, translucent peridium 9
8. Ascomata with dark peridium 10
9. Germ pore not protuberant . . . . . ***Thielavia***
9. Germ pore protuberant . . . . . ***Boothiella***
10. Ascomata bearing appendages 11
10. Ascomata glabrous. . . . . ***Thermothelomyces***
11. Ascomata bearing smooth, coiled appendages. . . . . ***Emilmuelleria***
11. Ascomata bearing verrucoses and/or smooth, straight or undulate appendages, sometimes with circinate tips . . . . . ***Chaetomidium***
12. Ascomata perithecioid, bearing setae or branched hyphae or circinate appendages . . . . . ***Chaetomium***
12. Ascomata cleistothecioid 13
13. Asci 4-6-spored . . . . . ***Crassicarpon***
13. Asci 8-scospored 14
14. Asci cylindrical, clavate or obovate . . . . ***Corynascella***
14. Asci globose to broadly ellipsoidal. . . . . ***Corynascus***
15. Conidiogenous blastic 16
15. Conidiogenous phialidic, conidia amerospores, basipetal chains with or without connectives . . ***Taifanglania***
16. Conidiophore absent 17
16. Conidiophore present 18
17. Conidia brown . . . . . ***Humicola***
17. Conidia hyaline . . . . . ***Madurella***
18. Conidiophore branched 19
18. Conidiophore reduced, unbranched, conidiogenus monoblastic or polyblastic, conidia hyaline, ovoid. . . . . ***Myceliophthora***
19. Conidiophore apically branched, brown, conidia pale brown . . . . . ***Staphylotrichum***
19. Conidiophore branched from base, hyaline, conidia hyaline . . . . . ***Botryotrichum***

Chaetosphaerellaceae Huhndorf et al., in Huhndorf et al., Mycol. Res. 108(12): 1387 (2004)

Facesoffungi number: FoF 01114

Saprobic on woody substrates in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, dark brown to black, scattered or densely gregarious, superficial, sitting on or in a subiculum or absent, pyriform, obpyriform or ovoid, coriaceous, turbinate or tuberculate or smooth, with or without, brown, branched or unbranched setae, papilla at the apex present or lacking, collabent or not collapsing, ostiolate. *Subiculum* thin or thick, brown to dark brown, septate, branched or unbranched with spiny hyphae. *Peridium* thick (10–80 μm), munk pores present, outer layer composed of dark brown to brown cells of *textura angularis*; inner layer composed of hyaline cells of *textura prismatica. Hamathecium* composed of paraphyses, often present only in young ascomata. *Asci* 8-spored, unitunicate, clavate, long or short pedicellate, apical ring distinct, indistinct or absent, evanescent. *Ascospores* 1–3-seriate or overlapping, with brown or brown median cells and hyaline end cells, oblong cylindrical, ellipsoid or fusiform, 1–3-septate. **Asexual morph**: Hyphomycetous. *Conidiophores* mononematous, brown, septate, branched, percurrent, with a terminal ampulla. *Conidiogenous cells* enteroblastic, phialidic, holoblastic or polyblastic, integrated, terminal, brown. *Conidia* brown, oval or elliptical, solitary or catenate, 1–3-septate.

Type: ***Chaetosphaerella*** E. Müll. & C. Booth

Notes: The family *Chaetosphaerellaceae* was introduced by Huhndorf et al. (2004a) based on its superficial, ostiolate ascomata on a subiculum, clavate or cylindrical asci, with pigmented ellipsoid ascospores, and enteroblastic, phialidic or holoblastic conidiogenesis, and is typified by *Chaetosphaerella* (Müller and Booth 1972). Sivanesan (1976) synonymized

Chaetosphaeria fusispora P. Larsen as *Chaetosphaerella fusispora* Sivan. In a re-evaluation of *Chaetosphaeria* species, Réblová (1999a, b, c, d) accepted only *Chaetosphaerella phaeostroma* (Durieu & Mont.) E. Müll. & C. Boot and *C. fusca* (Fuckel) E. Müll. & C. Booth in *Chaetosphaerella* and placed this genus in the family *Helminthosphaeriaceae* based on the characteristic ostiolate ascomata without a quellkörper. The new genera *Tengiomyces* and *Crassochaeta* with versicolorous ascospores were placed in *Helminthosphaeriaceae* (*Tengiomyces indicus* (Varghese & V.G. Rao) Réblová) and *Trichosphaeriaceae* (*Crassochaeta nigrita* (Sacc.) Réblová and *C. fusispora* (Sivan.) Réblová) (Réblová 1999a, d). Réblová (1999d) transferred *Chaetosphaerella fusispora* to *Crassochaeta fusispora* (Sivan.) Réblová based on different asexual morphs; *Chaetosphaerella* is associated with *Oedemium* and *Veramycina* asexual morphs, while *Crassochaeta* has Undetermined asexual morphs with *Arthrinium*-like conidia. Réblová (1999a) reported that *Chaetosphaerella* was similar to the family *Nitschkiaceae* based on their characteristic peridium.

LSU rDNA sequence data analysis (Huhndorf et al. 2004b), showed that *Chaetosphaerella* and *Crassochaeta* clustered in the same clade i.e. *Chaetosphaerellaceae*. Mugambi and Huhndorf (2010) introduced *Spinulosphaeria* in Sordariomycetes genera *incertae sedis*, based on morphology and analysis of LSU sequence data of *S. nuda* Mugambi and Huhndorf. In Maharachchikumbura et al. (2015), *Oedemium* was included in *Chaetosphaerellaceae* based on the type species *Chaetosphaerella phaeostroma* linked with *Oedemium minus* (Link) S. Hughes. The type species of *Oedemium* (*O. atrum* Link) is linked with *Chaetosphaerella fusca* (Müller and Booth 1972; Réblová 1999a, b, c, d). In a combined gene dataset including LSU, SSU, TEF and RPB2 sequences, *Spinulosphaeria nuda* formed a sister group to *Chaetosphaerella* species with high support in the family *Chaetosphaerellaceae* (Mugambi and Huhndorf 2010; Maharachchikumbura et al. 2015).

Chaetosphaerella E. Müll. & C. Booth, Trans. Br. mycol. Soc. 58(1): 76 (1972)

Facesoffungi number: FoF 01115; Fig. 35

Saprobic on woody substrates in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, dark brown or black, densely gregarious, superficial, sitting on a subiculum, obpyriform, coriaceous, tuberculate or slightly roughened, with brown setae, with a small papilla at the apex, collabent when dry, ostiolate. *Subiculum* thin, brown to dark brown, septate, branched with spiny hyphae. *Peridium* thick (20–70 μm), munk pores present, outer layer composed of dark brown to brown cells of *textura angularis*; inner layer composed of none pigmented cells of *textura prismatica. Hamathecium* composed of numerous, filiform, paraphyses, often present only in young ascomata. *Asci* 8-spored, unitunicate, clavate, long or short pedicellate, apical ring distinct or indistinct, evanescent. *Ascospores* 1–3-seriate or overlapping, with brown median cells and hyaline end cells, cylindrical to oblong, slightly curved, 3-septate, slightly constricted or not constricted in the center, middle cells may become slightly inflated, smooth-walled. **Asexual morph**: Hyphomycetous. *Conidiophores* mononematous, brown, septate, branched, percurrent, with a terminal, ampulla. *Conidiogenous cells* holoblastic or enteroblastic, polyblastic, integrated, terminal, smooth-walled. *Conidia* brown, elliptical, solitary, 3-septate, slightly constricted in the middle, the central cells longer and darker than the end cells, sometimes with guttules.

Type species: ***Chaetosphaerella phaeostroma*** (Durieu & Mont.) E. Müll. & C. Booth, Trans. Br. mycol. Soc. 58(1): 77 (1972)

Notes: The genus *Chaetosphaerella* was introduced by Müller and Booth (1972) and included two species (*C. phaeostroma* and *C. fusca* (Fuckel) E. Müll. & C. Booth). The type species *C. phaeostroma*, is characterized by black ascomata surrounded by a subiculum, with tuberculate or roughened perithecia, clavate asci and pigmented ascospores. Varghese and Rao (1979) and Sivanesan (1976) included *C. fusispora* and *C. indica* Varghese & V.G. Rao in *Chaetosphaerella* based on the morphological characters, however, Réblová (1999a, d) excluded these two from the genus as they had different asexual morphs.

Other genera included

Crassochaeta Réblová, Mycotaxon 71: 46 (1999)

Type species: ***Crassochaeta nigrita*** (Sacc.) Réblová, Mycotaxon 71: 48 (1999)

Oedemium Link, in Willdenow, Sp. pl., Edn 4 6(1): 42 (1824); Fig. 36

Type species: ***Oedemium atrum*** Link, in Willdenow, Sp. pl., Edn 4 6(1): 42 (1824)

Spinulosphaeria Sivan., Trans. Br. mycol. Soc. 62(1): 5 (1974)

Type species: ***Spinulosphaeria thaxteri*** (Pat.) Sivan., Trans. Br. mycol. Soc. 62(1): 36 (1974)

Key to genera of *Chaetosphaerellaceae*

1. Asexual morph with brown, septate conidia, produced in short acropetal chains, conidiogenesis monoblastic or sympodial simple, brown conidiophores ***Oedemium***
   1. Asexual morph differs and/or sexual morph present . . 2
   2. Ascomata scattered, ascospores 1-septate when mature . . . . . ***Spinulosphaeria***

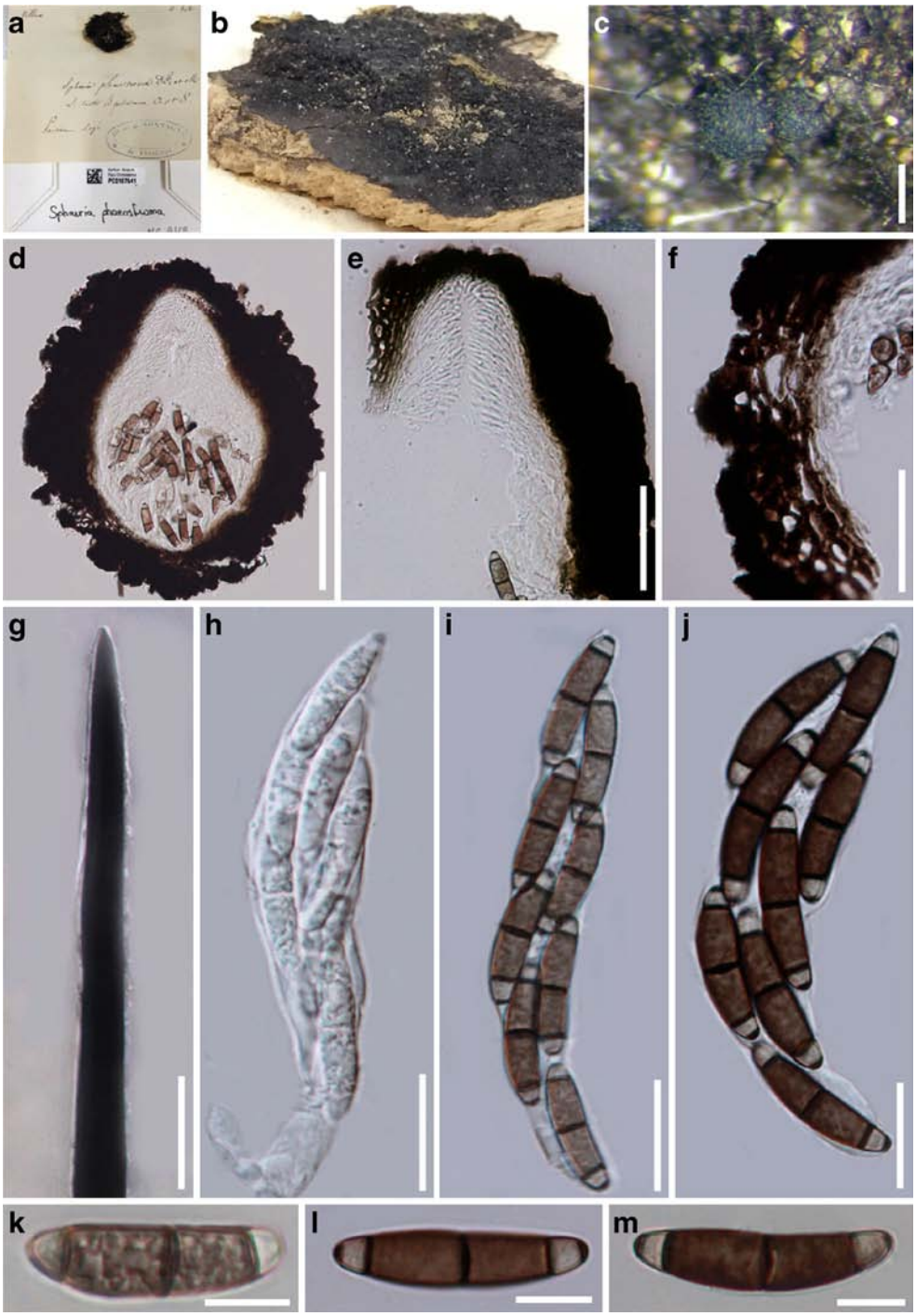


Fig. 35 ***Chaetosphaerella phaeostroma*** (Material examined: FRANCE, Paris, on dead wood, Montagne C, PC PC0167641) **a** Herbarium packet **b** Herbarium material **c** Ascomata on host **d** Ascoma cross section **e**, **f** Peridium **g** Septate and spiny hypha **h–j** Immature and mature asci **k–m** Ascospores. Notes: d-m soaked in 3 % KOH. Scale bars: **c** = 200 μm, **d** = 100 μm, **e** = 50 μm, **f** = 30 μm, **g–j** = 20 μm, **k–m** = 10 μm

2. Ascomata densely gregarious, ascospores 3-septate when mature,. 3
3. Ascomata collapsing or not, tuberculose, asexual morphs *Oedemium* . . . . . ***Chaetosphaerella***
3. Ascomata not collapsing, with spiny setae on the surface, asexual morphs *Arthrinium*-like . . . . . ***Crassochaeta***

Chaetosphaeriaceae Réblová et al., Sydowia 51(1): 56 (1999)

Facesoffungi number: FoF 01139

Saprobic on wood in terrestrial habitats, some fungicolous. **Sexual morph**: *Ascomata* perithecial, dark brown to black, gregarious or scattered, solitary, superficial or basally immersed on a thin stroma or on a thin subiculum or the subiculum absent, ovoid, globose to subglobose, carbonaceous, coriaceous or membranaceous, rough, smooth or with short setae, papillate, the apex collapsing when dry. *Ostiole* lined with hyaline periphyses or absent. *Subiculum* thin,

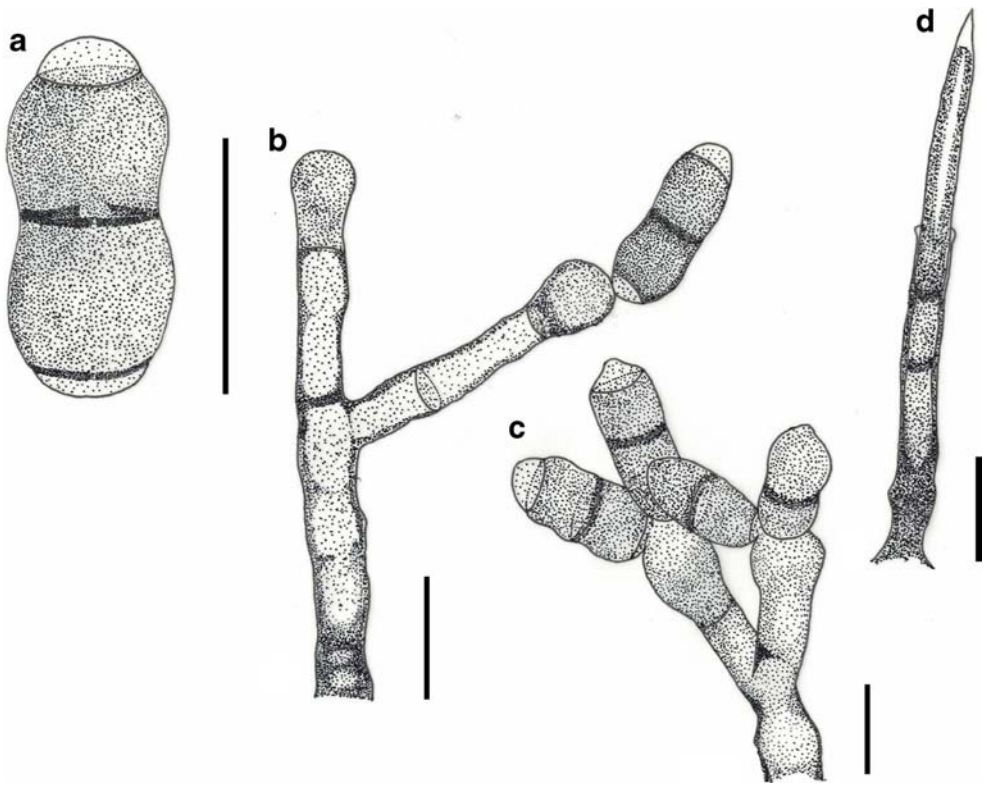


Fig. 36 ***Oedemium minus*** (Link) S. Hughes (Asexual morph of ***Chaetosphaerella phaeostroma***, Silva 2015) **a** Conidia **b**, **c** Conidiogenous cells and conidia **d** Setae. Scale bars = 20 μm

scanty, brown to dark brown, septate, of unbranched hyphae. *Peridium* thin-walled (10–40 μm), composed of two layers, outer layer comprising brown cells of *textura epidermoidea* or *angularis*, carbonaceous; inner layer comprising hyaline cells of *textura prismatica*, thin, membranaceous. *Hamathecium* with numerous, septate, unbranched, tapering, filiform or cylindrical paraphyses. *Asci* 8-spored, unitunicate, thin-walled, clavate to cylindrical, long or short pedicellate, with J-, refractive apical ring. *Ascospores* 2–3-seriate, hyaline or brown or becoming dark colored in part, fusiform, cylindrical to ellipsoid, sometimes curved, 0–3-septate, with or without fragmenting, smooth or striate, with guttules, sheath or appendages **Asexual morph**: Hyphomycetous. *Conidiophores* macronematous, mononematous, scattered or gregarious, dark brown or hyaline, straight or flexuous, septate, branched or unbranched, with short encircling collar hyphae. *Conidiogenous cells* monophialidic or polyphialidic, holoblastic or enteroblastic, proliferating percurrently or sympodial, hyaline, with a distinct funnel-shaped collarette, smooth-walled. *Conidia* aggregated, continuous or mucilaginous, hyaline to brown, aseptate to multi-septate, flexuous, fusiform, cylindrical to allantoid, curved or straight, with obtuse to subobtusely rounded apex, truncate at base, eguttulate or guttulate. Coelomycetous. *Conidiomata* stromatic, scattered or aggregated, superficial, cupulate or globose, unilocular, setose, comprising black to dark brown cells of *textura angularis* or *intricata*. *Setae* numerous, black to brown, septate, ovoid to cylindrical or arising from the outer elements of excipulum, smooth, thick-walled, multi-septate. *Conidiophores* lining the basal stroma in a dense layer or arising from conidiomatal cavity, brown, 4–6-septate, unbranched, cylindrical, thin-walled, smooth. *Conidiogenous cells* integrated, determinate, holoblastic or enteroblastic, phialidic with conspicuous periclinal thickening at an attenuated apex, brown, smooth, subcylindrical to lageniform. *Conidia* hyaline to brown, aseptate, thin-walled, smooth, fusiform to allantoid, curved or straight, obtuse to subobtusely rounded at apex, truncate at base, eguttulate or guttulate, with a single, cellular, unbranched, flexuous, with tubular appendage at each end, separated by a septum, with basal asymmetrically located appendage.

Type: ***Chaetosphaeria*** Tul. & C. Tul.

Notes: The family *Chaetosphaeriaceae* was introduced by Réblová et al. (1999) based on *Chaetosphaeria* (Tulasne and Tulasne 1863a). Müller and von Arx (1962) included *Chaetosphaeria* in the *Sphaeriaceae*. Réblová et al. (1999) suggested *Chaetosphaeriaceae* belonged in the order *Sordariales* based on morphological characters. Huhndorf (2004b), placed this family in *Chaetosphaeriales*, based on LSU nrDNA sequence data. *Zignoëlla* was distinguished from *Chaetosphaeria* based on the color of the ascospores (Saccardo 1883; Munk 1953), but Booth (1957) regarded *Zignoëlla* as a synonym of *Chaetosphaeria*. Based on morphological characters, *Chaetosphaeria* did not appear to belong to *Helminthosphaeriaceae* or *Trichosphaeriaceae* (Samuels et al. 1997a; Réblová et al. 1999). This family is

morphologically diverse with the genera *Catenularia*, *Cylindrotrichum*, *Chalara*, *Chloridium*, *Custingophora*, *Dictyochaeta*, *Menispora*, *Phialophora* and *Zanclospora* reported as the asexual morphs (Réblová et al. 1999). *Infundibulomyces* was included in *Chaetosphaeriaceae* based on SSU and LSU gene data by Somrithipol et al. (2008). Lumbsch and Huhndorf (2010) listed ten sexual genera in the family, while Maharachchikumbura et al. (2015) listed 35 sexual and asexual genera. Hashimoto et al. (2015) introduced *Neopseudolachnella* and *Pseudodinemasporium* to the family and key to 37 genera are showing here. The genera of the family are confused and a monograph is needed with molecular support for accepted genera.

Chaetosphaeria Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 252 (1863)

Facesoffungi number: FoF 01140, Fig. 37

Saprobic on wood in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, black, gregarious, superficial or basally immersed in a thin basal stroma, ovoid, globose to subglobose, carbonaceous or membranaceous, the apex collapsing when dry, smooth or covered by setae, papillate, ostiole lined with hyaline periphyses,. *Peridium* thick (10–20 μm), composed of two layers, outer layer comprising brown cells of *textura epidermoidea*, thin, carbonaceous; inner layer comprising of hyaline cells of *textura prismatica*, thin, membranaceous. *Hamathecium* with abundant, cylindrical, septate branched paraphyses. *Asci* 8-spored, unitunicate, clavate to cylindrical, short pedicellate, with small, distinct, refractive, J- apical ring. *Ascospores* 2–3-seriate, hyaline, allantoid or ellipsoid, curved, septate, smooth-walled, with guttules. **Asexual morph**: Hyphomycetous. *Conidiophores* macronematous, mononematous, scattered or gregarious, dark brown or hyaline, straight or flexuous, septate, branched or unbranched, with short encircling collar hyphae. *Conidiogenous cells* monophialidic or polyphialidic, holoblastic to enteroblastic, proliferating percurrently or sympodially, hyaline, with a distinct funnel-shaped collarette, smooth-walled. *Conidia* aggregated, continuous or mucilaginous, hyaline to brown, aseptate to multi-septate, flexuous, fusiform, cylindrical to allantoid, curved or straight, obtuse to subobtusely rounded at apex, truncate at base, with or without appendage, eguttulate or guttulate.

Type species: ***Chaetosphaeria innumera*** Berk. & Broome ex Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 252 (1863)

Notes: The genus *Chaetosphaeria* was introduced by Tulanse and Tulanse (1863a) and is typified by *C. innumera*. Saccardo (1883) included the genus in the "*Sphaeriaceae*, *Phaeophragmiae*" which included several species with dark

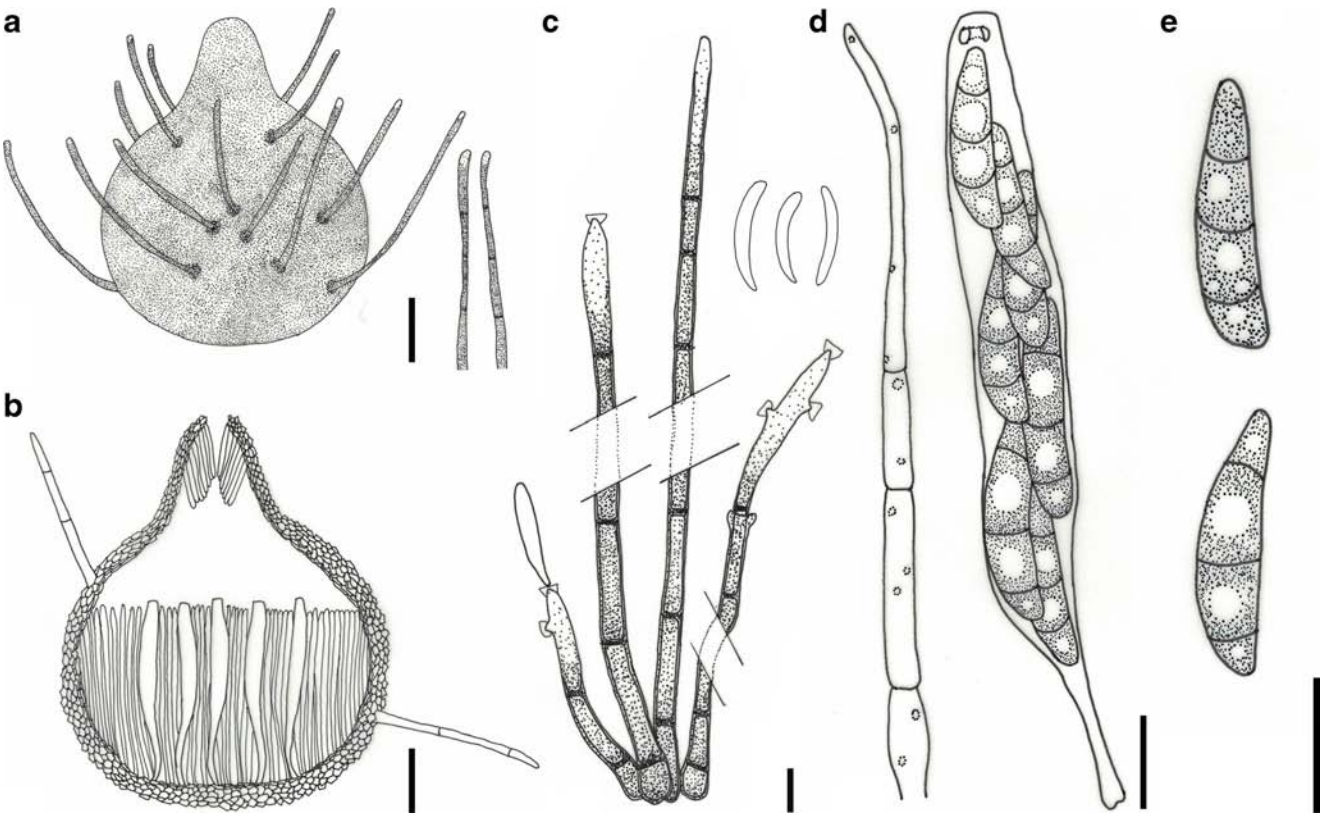


Fig. 37 ***Chaetosphaeria innumera*** (redrawn from Discover Life, http://www.discoverlife.org/) **a** Ascoma with setae. **b** Vertical section of ascoma **c** Conidiophores and conidia (asexual morph: *Dictyochaeta fuegiana*) **d.** Asci and paraphyses. **e.** Ascospores. Scale bars: **a**–**b** = 100 μm, **c**–**e** = 10 μm

ascospores, along with the type species. Huhndorf et al. (2004b) referred it to the *Chaetosphaeriaceae* based on the LSU nrDNA analyses. The sexual morph is characterized by superficial perithecia, cylindrical asci and brown ascospores, while the asexual morph is characterized by enteroblastic conidiogenous cells, and aggregated conidia (Réblová 1999a, b, c, d).

Fernández et al. (2006) concluded that two kinds of patterns are observed in the asexual morph of *Chaetosphaeria*. 1. Broadly integrated conidiogenous cells and endogenous conidiogenous loci with aseptate to multi-septate conidia (*Exserticlava* S. Hughes 1978); 2. Narrow conidiogenous locus in a discrete or integrated conidiogenous cells with aseptate to uni-septate conidia (*Chloridium* Link 1809).

Other genera included

Ascochalara Réblová, Sydowia 51(2): 212 (1999)

Type species: ***Ascochalara gabretae*** Réblová, Sydowia 51(2): 212 (1999)

Brunneodinemasporium Crous & R.F. Castañeda, in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 28: 128 (2012)

Type species: ***Brunneodinemasporium brasiliense*** Crous & R.F. Castañeda, in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 28: 129 (2012)

Catenularia Grove, in Saccardo, Syll. fung. (Abellini) 4: 303 (1886)

Type species: ***Catenularia simplex*** Grove, in Saccardo, Syll. fung. (Abellini) 4: 303 (1886)

Chloridium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 13 (1809)

Type species: ***Chloridium viride*** Link, Mag. Gesell. naturf. Freunde, Berlin 1: 13 (1805)

Codinaea Maire, Publ. Inst. Bot. 3(4): 15 (1937)

Type species: ***Codinaea aristata*** Maire, Publ. Inst. Bot. 3(4): 15 (1937)

Codinaeopsis Morgan-Jones, Mycotaxon 4(1): 166 (1976)

Type species: ***Codinaeopsis gonytrichoides*** (Shearer & J.L. Crane) Morgan-Jones, Mycotaxon 4(1): 167 (1976)

Craspedodidymum Hol.-Jech., Česká Mykol. 26(2): 70 (1972)

Type species: ***Craspedodidymum elatum*** Hol.-Jech., Česká Mykol. 26(2): 70 (1972)

Cryptophiale Piroz., Can. J. Bot. 46: 1123 (1968)

Type species: ***Cryptophiale kakombensis*** Piroz., Can. J. Bot. 46: 1124 (1968)

Dendrophoma Sacc., Michelia 2(no. 6): 4 (1880)

Type species: ***Dendrophoma cytisporoides*** Sacc., Michelia 2(no. 6): 4 (1880)

Dinemasporium Lév., Annls Sci. Nat., Bot., sér. 3 5: 274 (1846)

Type species: ***Dinemasporium graminum*** (Lib.) Lév., Annls Sci. Nat., Bot., sér. 3 5: 274 (1846)

Dictyochaeta Speg., Physis, Rev. Soc. Arg. Cienc. Nat. 7: 18 (1923); Fig. 38

Type species: ***Dictyochaeta fuegiana*** Speg., Physis, Rev. Soc. Arg. Cienc. Nat. 7: 18 (1923)

Dictyochaetopsis Aramb. & Cabello, Mycotaxon 38: 12 (1990)

Type species: ***Dictyochaetopsis apicalis*** (Berk. & M.A. Curtis) Aramb. & Cabello, Mycotaxon 38: 12 (1990)

Exserticlava S. Hughes, N.Z. J Bot. 16(3): 332 (1978)

Type species: ***Exserticlava vasiformis*** (Matsush.) S. Hughes, N.Z. J Bot. 16(3): 332 (1978)

Gonytrichum Nees & T. Nees, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 9: 244 (1818)

Type species: ***Gonytrichum caesium*** Nees, Nova Acta Acad. Leop. Carol. Ac. Naturf. Fo. 9: 244 (1818)

Hemicorynespora M.B. Ellis, Mycol. Pap. 131: 19 (1972)

Type species: ***Hemicorynespora deightonii*** M.B. Ellis, Mycol. Pap. 131: 20 (1972)

Infundibulomyces Plaingam, Somrith. & E.B.G. Jones 2003

Type species: ***Infundibulomyces cupulata*** Plaingam et al., Can. J. Bot. 81(7): 733 (2003)

Kionochaeta P.M. Kirk & B. Sutton, Trans. Br. mycol. Soc. 85(4): 712 (1986) [1985]

Type species: ***Kionochaeta ramifera*** (Matsush.) P.M. Kirk & B. Sutton, Trans. Br. mycol. Soc. 85(4): 715 (1986) [1985]

Lecythothecium Réblová & Winka, Mycologia 93(3): 481 (2001)

Type species: ***Lecythothecium duriligni*** Réblová & Winka, Mycologia 93(3): 482 (2001)

Melanopsammella Höhn., Annls mycol. 17(2/6): 121 (1920) [1919]

Type species: ***Melanopsammella inaequalis*** (Grove) Höhn., Annls mycol. 17(2/6): 121 (1920) [1919]

Menispora Pers., Mycol. eur. (Erlanga) 1: 32 (1822)

Type species: ***Menispora glauca*** (Link) Pers., Mycol. eur. (Erlanga) 1: 32 (1822)

Miyoshiella Kawam., Jap. J. Bot. 4: 295 (1929)

Type species: ***Miyoshiella fusispora*** (Kawam.) Kawam., Jap. J. Bot. 4: 295 (1929)

Neopseudolachnella A. Hashim et al., Mycologia 107(2): 385 (2015)

Type species: ***Neopseudolachnella acutispora*** A. Hashim. et al., in Hashimoto et al., Mycologia 107(2): 385 (2015)

Phaeostalagmus W. Gams, in Gams & Holubová-Jechová, Stud. Mycol. 13: 90 (1976)

Type species: ***Phaeostalagmus cyclosporus*** (Grove) W. Gams, in Gams & Holubová-Jechova, Stud. Mycol. 13: 91 (1976)

Phialogeniculata Matsush., in Kobayasi, Bull. natn. Sci. Mus., Tokyo, N.S. 14: 471 (1971)

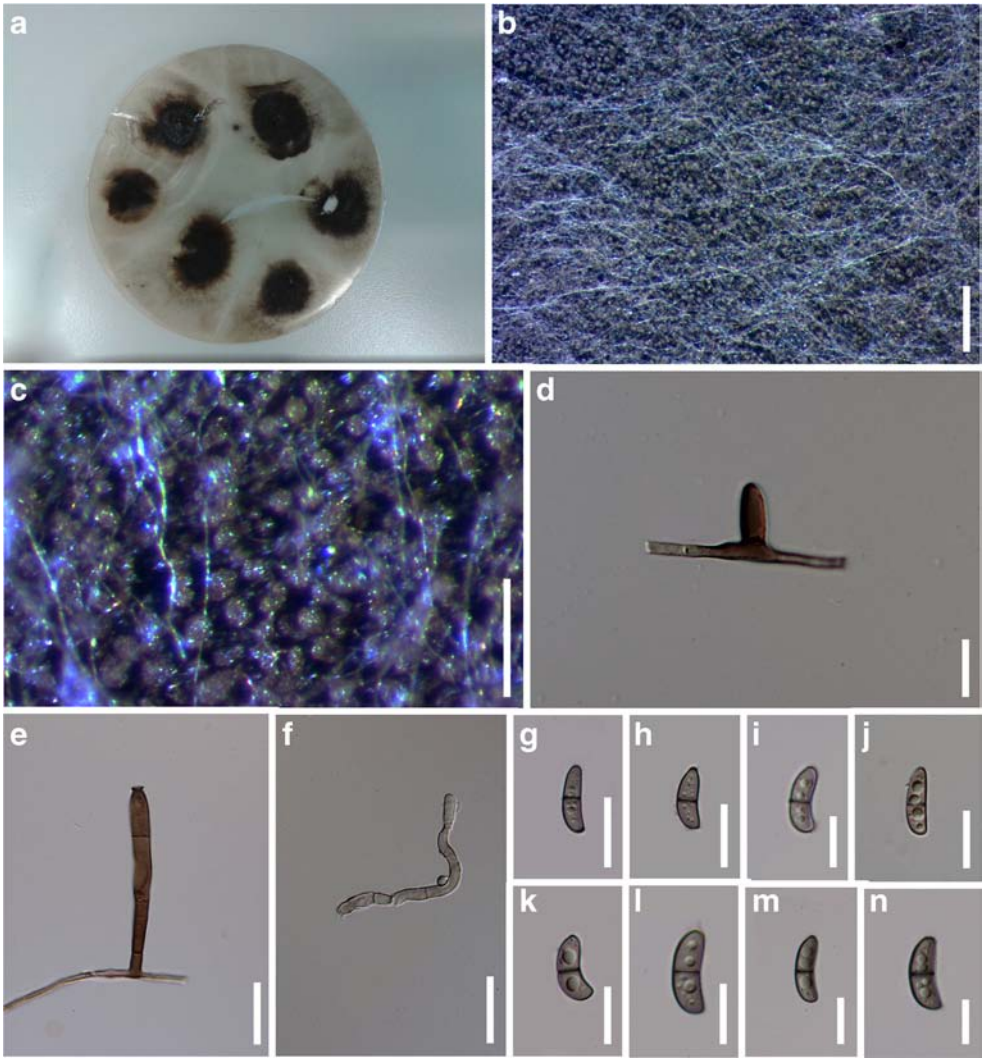


Fig. 38 *Dictyochaeta* **sp.** (Asexual morph) **a–c** Colonies on drying veneer in surface view **d–f** Conidiophores with conidia **g–n** Conidia. Scale bars: **b** = 500 μm, **c** = 200 μm, **e–f** = 20 μm, **d**, **g–n** = 10 μm

Type species: ***Phialogeniculata guadalcanalensis*** Matsush., in Kabayasi et al., Bull. natn. Sci. Mus., Tokyo 14(3): 472 (1971)

Pseudobotrytis Krzemien. & Badura, Acta Soc. Bot. Pol. 23: 761 (1954)

Type species: ***Pseudobotrytis fusca*** Krzemien. & Badura, Acta Soc. Bot. Pol. 23: 762 (1954)

Pseudodinemasporium A. Hashim et al., in Hashimoto et al., Mycologia 107(2): 390 (2015)

Type species: ***Pseudodinemasporium fabiforme*** A. Hashim. et al., in Hashimoto et al., Mycologia 107(2): 390 (2015)

Pseudolachnea Ranoj., Annls mycol. 8(3): 393 (1910)

Type species: ***Pseudolachnea insignis*** Velen., Monogr. Discom. Bohem. (Prague): 314 (1934)

Pyrigemmula D. Magyar & Shoemaker, in Magyar et al., Mycol. Progr. 10(3): 310 (2011)

Type species: ***Pyrigemmula aurantiaca*** D. Magyar & Shoemaker, in Magyar et al., Mycol. Progr. 10(3): 309 (2011)

Rattania Prabhug. & Bhat, Mycotaxon 108: 218 (2009)

Type species: ***Rattania setulifera*** Prabhug. & Bhat, Mycotaxon 108: 220 (2009)

Sporoschisma Berk. & Broome, in Berkeley, Gard. Chron., London: 540 (1847)

Type species: ***Sporoschisma mirabile*** Berk. & Broome, in Berkeley, Gard. Chron., London: 540 (footnote) (1847)

Striatosphaeria Samuels & E. Müll., Sydowia 31(1–6): 131 (1979) [1978]; Fig. 39

Type species: ***Striatosphaeria codinaeaphora*** Samuels & E. Müll., Sydowia 31(1–6): 132 (1979) [1978]

Tainosphaeria F.A. Fernández & Huhndorf, Fungal Diversity 18: 44 (2005)

Type species: ***Tainosphaeria crassiparies*** F.A. Fernández & Huhndorf, in van der Walt & Scott, Fungal Diversity 18: 44 (2005)

Thozetella Kuntze, Revis. gen. pl. (Leipzig) 2: 873 (1891)

Type species: ***Thozetella nivea*** (Berk.) Kuntze, Revis. gen. pl. (Leipzig) 2: 873 (1891)

Umbrinosphaeria Réblová, Mycotaxon 71: 17 (1999)

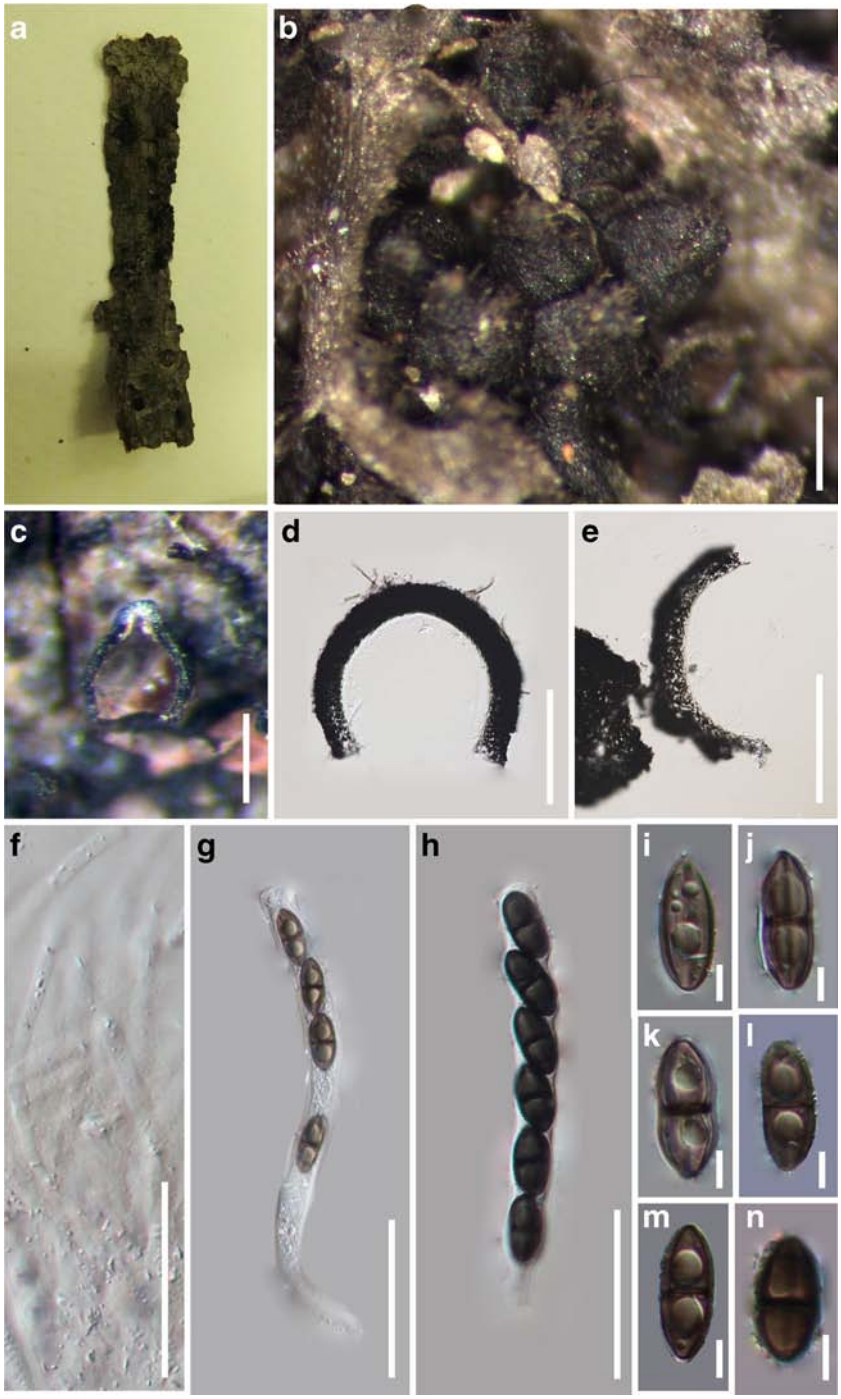


Fig. 39 ***Striatosphaeria codinaeaphora*** **(**Material examined: BRAZIL, Roraima. ca 219 km North of Boa Vista, on the Boa Vista Sta. Elena Venezuela Rd. (BR 174), on dead log, Dumont KP, Hosford DR, Samuels GJ, Buck WR, Araujo I, Souza MA, Bernardi JC; 1 December 1977, NY 01050494, **isotype) a** Herbarium material **b** Ascomata **c**, **d** Ascomata cross section **e** Peridium **f** Paraphyses **g**, **h** Asci **i-n** Ascospores Scale bars: **b–c** = 200 μm, **d–e** = 100 μm, **g–h** = 50 μm, **f** = 20 μm, **i–n** = 5 μm

Type species: ***Umbrinosphaeria caesariata*** (Clinton & Peck) Réblová, Mycotaxon 71: 18 (1999)

Zanclospora S. Hughes & W.B. Kendr., N.Z. J Bot. 3: 151 (1965)

Type species: ***Zanclospora novae-zelandiae*** S. Hughes & W.B. Kendr., N.Z. Jl Bot. 3: 152 (1965)

Zignoëlla Sacc., Michelia 1(no. 3): 346 (1878)

Type species: ***Zignoëlla pulviscula*** (Curr.) Sacc., Michelia 1(no. 3): 346 (1878)

Key to sexual genera of *Chaetosphaeriaceae*

1. Ascomata immersed or semi-immersed. 2
   1. Ascomata superficial 3
   2. Ascomata globose to subglobose; ascospores 1–3-septate, hyaline, not fragmenting, allantoid or ellipsoid. . . . . ***Chaetosphaeria***
   2. Ascomata ovoid; ascospores multi-septate, versicolored, fusiform, straight or inequilateral . . . . ***Lecythothecium***

3. Ascomata carbonaceous 4
3. Ascomata membranous 7
4. Ascospores fragmenting at maturity . . . . . ***Ascochalara***
4. Ascospores not fragmenting 5
5. Ascospores fusiform, straight or inequilateral 6
5. Ascospores ellipsoid, striate, germ pore in the median septum . . . . . ***Striatosphaeria***
6. Ascospores hyaline, concolourous, 3-septate . . . . . ***Miyoshiella***
6. Ascospores with middle cells brown and the end cells hyaline, versicolored, multi-septate . ***Umbrinosphaeria***
7. Ascomata smooth or setose 8
7. Ascomata rough . . . . . ***Tainosphaeria***
8. Ascospores 1-septate, fragmenting at maturity, hyaline . . . . . ***Melanopsammella***
8. Ascospores 0–3-septate, not fragmenting, greenish . . . . . ***Zignoëlla***

Key to asexual genera of *Chaetosphaeriaceae*

1. Coelomycetous taxon 2
1. Hyphomycetous taxon 6
2. Conidiomata comprising black to brown cells of *textura intricata* . . . . . ***Dendrophoma***
2. Conidiomata comprising black to brown cells of *textura angularis* 3
3. Conidia fusiform with obtuse ends, 1-septate, hyaline, smooth macroconidia with appendages, intermixed with aseptate microconidia. . . . . ***Pseudolachnea***
3. Conidia oblong to fusiform, curved or straight, hyaline to brown, aseptate 4
4. Conidiomata setae absent . . . . . ***Infundibulomyces***
4. Conidiomata setae present 5
5. Conidiophores brown, unbranched ..... ***Brunneodinemasporium***
5. Conidiophores apex hyaline, base brown 6
6. Conidia cylindrical to subcylindrical ..... ***Neopseudolachnella***
6. Conidia ovoid to ellipsoidal . . . ***Pseudodinemasporium***
6. Conidia allantoid to lunate . . . . . ***Dinemasporium***
7. Conidia collarette present 8
7. Conidia collarette absent 13
8. Conidia multi-septate 9
8. Conidia 0–3-septate 10
9. Conidia short, cylindrical . . . . . ***Sporoschisma***
9. Conidia lunate, with or without a long appendages at the ends . . . . . ***Dictyochaetopsis***
10. Conidia with appendages 11
10. Conidia with papillate at the ends. 12
11. Conidia aseptate, hyaline, cylindrical . . ***Codinaeopsis***
11. Conidia 0–3-septate, fusiform to ellipsoid ..... ***Dictyochaeta***
12. Conidia aseptate, brown, ellipsoid to obovoid. . . . . ***Craspedodidymum***
12. Conidia 1-septate, obclavate, guttulate . . . . . ***Phialogeniculata***
13. Conidia thick-walled, capitate hyphae present 14
13. Conidia thin-walled, capitate hyphae absent 15
14. Conidia obovoid, aseptate . . . . . ***Catenularia***
14. Conidia ellipsoid, 1–3-septate. . . . . ***Exserticlava***
15. Conidia inverted T-shaped or L-shaped, straight or obpyriform . . . . . ***Thozetella***
15. Conidia slightly curved or not curved. 16
16. Conidia curved. 17
16. Conidia not curved. 21
17. Conidia lunate 18
17. Conidia clavate, fusiform or cylindrical 19
18. Conidia with appendages at the ends . . . . . ***Codinaea***
18. Conidia lacking appendages. . . . . ***Zanclospora***
19. Conidia cylindrical, hyaline to yellow-green, strongly recurved. . . . . ***Menispora***
19. Conidia clavate or fusiform 20
20. Conidia aseptate, rounded at the apex. . . ***Kionochaeta***
20. Conidia 0–multi-septate, with appendages at the ends . . . . . ***Rattania***
21. Conidia aseptate. 22
21. Conidia septate. 23
22. Conidia subglobose to oval, hyaline to light brown. . . . . ***Gonytrichum***
22. Conidia cylindrical, ovoid, reniform. . . . . ***Chloridium***
23. Conidia hyaline 24
23. Conidia grey, brown to reddish brown 25
24. Conidia globose to subglobose. . . . . ***Cryptophiale***
24. Conidia ellipsoid or cylindrical with rounded ends . . . . . ***Phaeostalagmus***
25. Conidia 1-septate, ellipsoid to clavate with apiculate apex. . . . . ***Pseudobotrytis***
25. Conidia multi-septate, oblong, obovoid to obclavate 26
26. Conidia acrogenous, obovoid to obclavate, constricted at the basal septum. . . . . ***Hemicorynespora***
26. Conidia not acrogenous, not constricted, long oblong . . . . . ***Pyrigemmula***

Clavicipitaceae Earle, in Mohr, Contr. U.S. natnl. Herb. 6: 170 (1901)

Facesoffungi number: FoF 01313

Obligate saprotrophic, *parasites* and *symbiotic* with insects, fungi, grasses, rushes or sedges. **Sexual morph**: *Stromata* or subiculum darkly or brightly coloured, fleshy or tough. *Perithecia* superficial to completely immersed, ordinal or oblique in arrangement. *Asci* cylindrical with thickened ascus apex. *Ascospores* usually cylindrical and multi-septate, disarticulating into part-spores or non-disarticulating. **Asexual morph**: *Clavicipitaceae* can be isolated from these genera: *Aschersonia*, *Metarrhizium*, *Nomuraea*, *Pochonia*,

Paecilomyces, *Rotiferophthora*, *Tolypocladium* and *Verticillium*.

Type: ***Claviceps*** Tul.

Notes: The name *Clavicipitaceae* was introduced by Earle (1901). Nannfeldt (1932) accepted the name, which was used as variously classified by Diehl (1950), Luttrell (1951), Rogerson (1970), Eriksson (1982) Eriksson and Hawksworth (1985), Spatafora and Blackwell (1993) and Rehner and Samuels (1994). Sung et al. (2007) divided the family *Clavicipitaceae* into three monophyletic groups (*Clavicipitaceae*, *Ophiocordycipitaceae* and *Cordycipitaceae*) based on phylogenetic analyses.

Rogerson (1970) list 13 genera under *Clavicipitaceae*. White et al. (2000) characterized six genera in *Clavicipitaceae* based on morphological and phylogenetic analyses. *Nigrocornus* was introduced to accommodate a species of *Balansia*, which were significantly different from that of the type and all other *Balansia* species (Ryley 2003). Sung et al. (2007) list 22 genera under *Clavicipitaceae*. They also listed *Berkelella*, *Cavimalum*, *Dussiella*, *Epicrea*, *Helminthascus*, *Konradia*, *Moelleriella*, *Mycomalus*, *Neobarya*, *Neocordyceps*, *Podocrella*, *Romanoa*, *Sphaerocordyceps*, and *Stereocrea* as uncertain genera in the family. Kirk et al. (2008) recorded 43 genera in this family within the order *Hypocreales*. Chaverri et al. (2008) introduced *Samuelsia* under *Clavicipitaceae* based on morphology and phylogenetic analyses. *Ustilaginoidea* was introduced by Brefeld (1895) and revised by Tanaka et al. (2008) as a genus of *Clavicipitaceae. Conoideocrella* and *Orbiocrella* have been introduced by Johnson (2009). *Chamaeleomyces* was introduced as a new monotypic genus isolated from the liver of *Chamaeleo calyptratus* based on morphological and phylogenetic analyses (Sigler et al. 2010). *Periglandula* was introduced with *P. ipomoeae* U. Steiner as the type species, which was isolated from *Ipomoea asarifolia* in Ecuador (Steiner et al. 2011). Lumbsch and Huhndorf (2010) list 32 genera under *Clavicipitaceae*. According to phylogenetic analyses, Kepler et al. (2012) placed *Tyrannicordyceps* under *Clavicipitaceae*, which live on sclerotia of *Claviceps* and *Collarina* was introduced by Crous et al. (2014b). Maharachchikumbura et al. (2015) list 48 genera under this family including *Aciculosporium*, *Amphichorda*, *Atkinsonella*, *Balansia*, *Cavimalum*, *Chamaeleomyces*, *Claviceps*, *Conoideocrella*, *Corallocytostroma*, *Diploöspora*, *Dussiella*, *Ephelis*, *Epichloë*, *Epicrea*, *Helminthascus*, *Heteroepichloë*, *Hypocrella*, *Konradia*, *Loculistroma*, *Metacordyceps*, *Metarhiziopsis*, *Metarhizium*, *Metapochonia*, *Moelleriella*, *Mycomalus*, *Myriogenospora*, *Neobarya*, *Neoclaviceps*, *Neocordyceps*, *Neotyphodium*, *Nigrocornus*, *Nomuraea*, *Orbiocrella*, *Parepichloë*, *Periglandula*, *Pochonia*, *Pseudogibellula*, *Pseudomeria*, *Regiocrella*, *Romanoa*, *Rotiferophthora*, *Samuelsia*, *Shimizuomyces*, *Sphacelia*, *Sphaerocordyceps*, *Stereocrea*, *Tyrannicordyceps* and *Ustilaginoidea*.

Claviceps Tul., Annls Sci. Nat., Bot., sér. 3 20: 43 (1853)

Facesoffungi number: FoF 01316; Fig. 40

Parasitic of the ovaries of grasses and a few species of rushes and sedges. *Unfertilized ovaries* are especially susceptible to infection. **Sexual morph**: *Stromata* stipitate, spherical, pale brown to orange-brown when fresh. *Stroma* surface dotted with mid to dark brown, weakly to strongly papillate ostioles. *Ascomata* numerous, 150–250 per stroma, ovoid with a somewhat elongate neck region. *Perithecia* are at least partially embedded within the stromata and are distributed over the surface, resulting in a punctate appearance. *Asci*, narrowly cylindrical, thin-walled and not fissitunicate, with a conspicuously thickened capitate apex that is penetrated by a narrow channel, 8-spored. *Ascospores* arranged in a fascicle, not helically coiled, thin, filiform-shaped. *Ascospores* that land on stigmas of a susceptible host germinate and produce infection hyphae that grow down the element to infect the base of the ovary. Within several days of infection, a sphacelium producing large numbers of conidia develops. A sugary syrup commonly referred to as the honeydew stage is replaced by a sclerotium, generally 1–4 times larger than the host seed. **Asexual morph**: Undetermined.

Type species: ***Claviceps purpurea*** (Fr.) Tul., Annls Sci. Nat., Bot., sér. 3 **20**: 45 (1853)

Notes: This genus was described by Tulasne (1853). There were some doubts as to the taxonomic status of the genus in the 1950s, which has been corrected in recent years based on molecular sequence data and acceptance of *Clavicipitaceae* (Pazoutova and Parbery 1999; Yokoyama et al. 2006; Sung et al. 2007; Tanaka et al. 2008). This genus occur on a wide range of host plants and is pathogenic on some economic plants (Hulvova et al. 2013). The genus produces secondary metabolites with toxicity and pharmaceutical properties (Hulvova et al. 2013). There are 36 species of *Claviceps*, which can infect about 600 species of monocotyledonous plants (Hulvova et al. 2013).

Other genera included

Aciculosporium I. Miyake, Bot. Mag., Tokyo 22: (307) (1908)

Type species: ***Aciculosporium take*** I. Miyake, Bot. Mag., Tokyo 22: (307) (1908)

Amphichorda Fr., Syst. orb. veg. (Lundae) 1: 170 (1825)

Type species: ***Amphichorda felina*** (DC.) Fr., Syst. orb. veg. (Lundae) 1: 170 (1825)

Atkinsonella Diehl, Agriculture Monogr., US Dept Agric. 4: 48 (1950)

Type species: ***Atkinsonella hypoxylon*** (Peck) Diehl, Agric. Monogr. U.S.D.A. 4: 49 (1950)

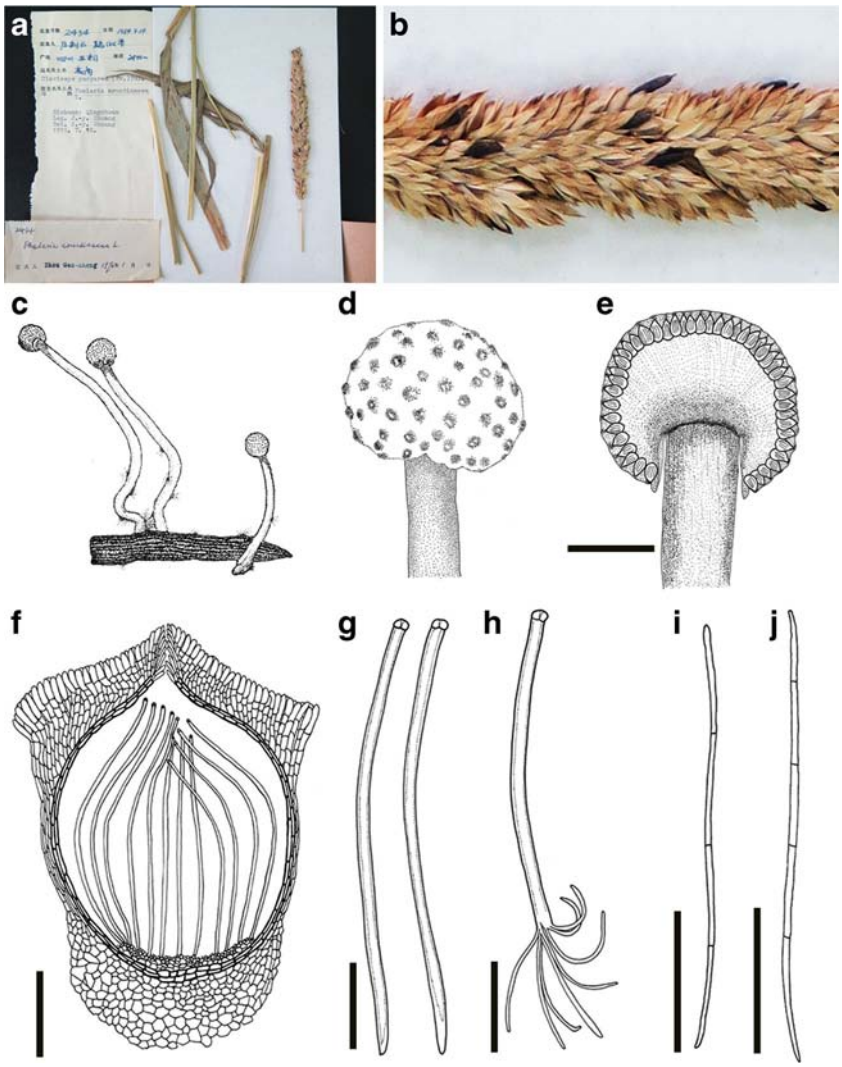


Fig. 40 ***Claviceps purpurea*** (Material examined: CHINA. Province of Sichuan, on *Phalaria arundinacea* L. (*Poaceae*). 19 September 1989, HMAS 65629, **holotype**) **a**, **b** Overview of sclerotium and host **c** Sclerotium with stromata **d** Part of stromata **e** Cross section of ascomata **f** Ascomata **g**, **h** Asci **i**, **j** Ascospores. Scale bars: **e** = 1 mm, **f** = 50 μm, **g**, **h** = 20 μm, **i**, **j** = 20 μm

Balansia Speg., Anal. Soc. cient. argent. 19(1): 45 (1885)

Type species: ***Balansia claviceps*** Speg., Anal. Soc. cient. argent. 19(1): 45 (1885)

Cavimalum Y Oshim. Doi, Dargan& K.S. Thind, Bull. natn. Sci. Mus., Tokyo, B 3(1): 23 (1977)

Type species: ***Cavimalum indicum*** Yoshim. Doi et al., Bull. natn. Sci. Mus., Tokyo, B 3(1): 24 (1977)

Chamaeleomyces Sigler, J. Clin. Microbiol. 48(9): 3186 (2010)

Type species: ***Chamaeleomyces granulomatis*** Sigler, J. Clin. Microbiol. 48(9): 3188 (2010)

Collarina Giraldo et al., in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 33: 271 (2014)

Type species: ***Collarina aurantiaca*** Giraldo et al., in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 33: 271 (2014)

Conoideocrella D. Johnson et al., Mycol. Res. 113(3): 286 (2009)

Type species: ***Conoideocrella luteorostrata*** (Zimm.) D. Johnson et al., Mycol. Res. 113(3): 286 (2009)

Corallocytostroma Y.N. Yu & Z.Y. Zhang, Acta Microbiol. Sin. 20(3): 232 (1980)

Type species: ***Corallocytostroma oryzae*** Y.N. Yu & Z.Y. Zhang, Actamicrobiol. Sin. 20(3): 234 (1980)

Diploöspora Grove, J. Bot., Lond. 54: 220 (1916)

Type species: ***Diploöspora rosea*** Grove, J. Bot., Lond. 54: 220 (1916)

Dussiella Pat., Bull. Soc. mycol. Fr. 6: 107 (1890)

Type species: ***Dussiella tuberiformis*** (Berk. & Ravenel) Pat., Bull. Soc. mycol. Fr. 4(3): 106 (1888)

Ephelis Fr., Summa veg. Scand., Section Post. (Stockholm): 370 (1849)

Type species: ***Ephelis mexicana*** Fr., Summa veg. Scand., Section Post. (Stockholm): 370 (1849)

Epichloë (Fr.) Tul. & C. Tul., Select. fung. carpol. (Paris) 3: 24 (1865)

Type species: ***Epichloë typhina*** (Pers.) Tul. & C. Tul., Select. fung. carpol. (Paris) 3: 24 (1865)

Epicrea Petr., Sydowia 4(1–6): 325 (1950)

Type species: ***Epicrea insignis*** Petr., Sydowia 4(1–6): 325 (1950)

Helminthascus Tranzschel, Trudy S. Petersb. Obschch. Est. Otd. Bot. 28: 331 (1898)

Type species: ***Helminthascus arachnophthorus*** Tranzschel [as 'arachnophthora'], Trudy S. Petersb. Obschch. Est. Otd. Bot. 28: 331 (1898)

Heteroepichloë E. Tanaka, C. Tanaka, Gafur & Tsuda, Mycoscience 43(2): 92 (2002)

Type species: ***Heteroepichloë bambusae*** (Pat.) E. Tanaka et al., Mycoscience 43(2): 92 (2002)

Hypocrella Sacc., Michelia 1(no. 3): 322 (1878)

Type species: ***Hypocrella discoidea*** (Berk. & Broome) Sacc., Michelia 1(no. 3): 322 (1878)

Konradia Racib., Parasit. Alg. Pilze Java's (Jakarta) 2: 15 (1900)

Type species: ***Konradia bambusina*** Racib., Parasit. Alg. Pilze Java's (Jakarta) 2: 15 (1900)

Loculistroma F. Patt. & Charles, Bull. Bureau Plant Industry U.S. Dep. Agric. 171: 11 (1910)

Type species: ***Loculistroma bambusae*** F. Patt. et al., Bull. U.S. Department of Agriculture, Bureau Plant Industry 171: 11 (1910)

Metacordyceps G.H. Sung et al., in Sung et al., Stud. Mycol. 57: 27 (2007)

Type species: ***Metacordyceps taii*** Z.Q. Liang & A.Y. Liu, in Liang et al., Acta Mycol. Sin. 10(4): 257 (1991)

Metarhiziopsis D.W. Li et al., Mycologia 100(3): 462 (2008)

Type species: ***Metarhiziopsis microspora*** D.W. Li et al., Mycologia 100(3): 462 (2008)

Metarhizium Sorokīn, Veg. Parasitenk. Mensch Tieren 2: 268 (1879)

Type species: ***Metarhizium anisopliae*** (Metschn.) Sorokīn, Rastitel'nye parazity cheloveka i zhivotnykh kak prichina zarazhykh bolezneĭ (Petersburg) 2: 268 (1883)

Metapochonia Kepler et al., in Kepler et al., Mycologia 106(4): 820 (2014)

Type species: ***Metapochonia suchlasporia*** (W. Gams & Dackman) Kepler et al., in Kepler et al., Mycologia 106(4): 820 (2014)

Moelleriella Bres., Boll. Soc. bot. ital. 44: 292 (1897)

Type species: ***Moelleriella sulphurea*** (Bres.) Bres., in Saccardo & Sydow, Syll. fung. (Abellini) 14(1): 626 (1899)

Mycomalus Möller, Bot. Mitt. Trop. 9: 300 (1901)

Type species: ***Mycomalus bambusinus*** Möller, Bot. Mitt. Trop. 9: 300 (1901)

Myriogenospora G.F. Atk., Bull. Torrey bot. Club 21(5): 225 (1894)

Type species: ***Myriogenospora paspali*** G.F. Atk., Bull. Torrey bot. Club 21(5): 225 (1894)

Neobarya Lowen, in Eriksson & Hawksworth, Syst. Ascom. 5(1): 121 (1986)

Type species: ***Neobarya parasitica*** (Fuckel) Lowen, in Eriksson & Hawksworth, Syst. Ascom. 5(1): 121 (1986)

Neoclaviceps J.F. White et al., Mycologia 93(1): 91 (2001)

Type species: ***Neoclaviceps monostipa*** J.F. White et al., in Sullivan et al., Mycologia 93(1): 92 (2001)

Neocordyceps Kobayasi, J. Jap. Bot. 59(6): 187 (1984)

Type species: ***Neocordyceps kohyasanensis*** Kobayasi, J. Jap. Bot. 59(6): 187 (1984)

Neotyphodium Glenn, C.W. Bacon & Hanlin, Mycologia 88(3): 377 (1996)

Type species: ***Neotyphodium coenophialum*** (Morgan-Jones & W. Gams) Glenn et al., in Glenn et al., Mycologia 88(3): 377 (1996)

Nigrocornus Ryley & Langdon, in Ryley, Mycology Series (New York) 19: 266 (2003)

Type species: ***Nigrocornus scleroticus*** (Pat.) Ryley, Mycology Series (New York) 19: 267 (2003)

Nomuraea Maubl., Bull. Soc. mycol. Fr. 19(3): 295 (1903)

Type species: ***Nomuraea prasina*** Maubl., Bull. Soc. mycol. Fr. 19(3): 296 (1903)

Orbiocrella D. Johnson et al., Mycol. Res. 113(3): 286 (2009)

Type species: ***Orbiocrella petchii*** (Hywel-Jones) D. Johnson et al., Mycol. Res. 113(3): 287 (2009)

Parepichloë J.F. White & P.V. Reddy, Mycologia 90(2): 231 (1998)

Type species: ***Parepichloë cinerea*** (Berk. & Broome) J.F. White & P.V. Reddy, Mycologia 90(2): 231 (1998)

Periglandula U. Steiner et al., in Steiner et al., Mycologia 103(5): 1137 (2011)

Type species: ***Periglandula ipomoeae*** U. Steiner et al., in et al., Mycologia 103(5): 1140 (2011)

Pochonia Bat. & O.M. Fonseca, Publicações Inst. Micol. Recife 462: 4 (1965)

Type species: ***Pochonia humicola*** Bat. & O.M. Fonseca, Publicações Inst. Micol. Recife 462: 5 (1965)

Pseudogibellula Samson & H.C. Evans, Acta bot. neerl. 22(5): 524 (1973)

Type species: *Pseudogibellula formicarum* (Mains) Samson & H.C. Evans, Acta bot. neerl. 22(5): 524 (1973)

Pseudomeria G.L. Barron, Can. J. Bot. 58(4): 443 (1980)

Type species: ***Pseudomeria mucosa*** G.L. Barron, Can. J. Bot. 58(4): 443 (1980)

Regiocrella P. Chaverri & K.T. Hodge, Mycologia 97(6): 1232 (2006) [2005]

Type species: ***Regiocrella camerunensis*** P. Chaverri & H.C. Evans, in Chaverri et al., Mycologia 97(6): 1232 (2006) [2005]

Romanoa Thirum., R.C. Ist. Sup. Sanitä, (Rome) 17: 1326 (1954)

Type species: ***Romanoa terricola*** Thirum., R.C. Ist. Sup. Sanitä, (Rome) 17(12): 1326 (1954)

Rotiferophthora G.L. Barron, Can. J. Bot. 69(3): 495 (1991)

Type species: ***Rotiferophthora globospora*** G.L. Barron, Can. J. Bot. 69(3): 495 (1991)

Samuelsia P. Chaverri & K.T. Hodge, in Chaverri et al., Stud. Mycol. 60: 59 (2008)

Type species: ***Samuelsia rufobrunnea*** P. Chaverri & K.T. Hodge, in Chaverri et al., Stud. Mycol. 60: 62 (2008)

Shimizuomyces Kobayasi, Bull. natn. Sci. Mus., Tokyo, B 7(1): 1 (1981)

Type species: ***Shimizuomyces paradoxus*** Kobayasi [as 'paradoxa'], Bull. natn. Sci. Mus., Tokyo, B 7(1): 1 (1981)

Sphacelia Lév., Mém. Soc. Linn. Paris 5: 578 (1827)

Type species: ***Sphacelia segetum*** Lév. Mém. Soc. Linn. Paris 5: 578 (1827)

Sphaerocordyceps Kobayasi, Bull. natn. Sci. Mus., Tokyo, B 7(1): 2 (1981)

Type species: ***Sphaerocordyceps palustris*** (Berk. & Broome) Kobayasi, Bull. Natn. Sci. Mus., Tokyo, B 7(1): 2 (1981)

Stereocrea Syd. & P. Syd., Annls mycol. 15(3/4): 216 (1917)

Type species: ***Stereocrea schizostachyi*** Syd. & P. Syd., Annls mycol. 15(3/4): 216 (1917)

Tyrannicordyceps Kepler & Spatafora, Index Fungorum 12: 1 (2012)

Type species: ***Tyrannicordyceps fratricida*** (Tanda & Kobayasi) Kepler & Spatafora, in Kepler et al., Index Fungorum 12: 1 (2012)

Ustilaginoidea Bref., Unters. Gesammtgeb. Mykol. (Liepzig) 12: 194 (1895)

Type species: ***Ustilaginoidea oryzae*** (Pat.) Bref., Unters. Gesammtgeb. Mykol. (Liepzig) 12: 194 (1895)

Accepted name in key

Albomyces I. Miyake ex I. Hino, Trans. Mycol. Soc. Japan 3: 113 (1962)

Type species: ***Albomyces take*** I. Hino, Trans. Mycol. Soc. Japan 3: 112 (1962)

Aschersonia Mont., Annls Sci. Nat., Bot., sér. 3 10: 121 (1848)

Type species: ***Aschersonia tahitensis*** Mont., Annls Sci. Nat., Bot., sér. 3 10: 122 (1848)

Key to genera of *Clavicipitaceae*

1. Host is a plant 2
1. Host is not a plant 29
2. Sexual morph produced 3
2. Asexual morph produced 22
3. Stromata stalked. 4
3. Stromata lacking stalks. 10
4. Ascospores yellow to green . . . . . ***Stereocrea***
4. Ascospores hyaline or some other colour 5
5. Ascospores with distinct septa 6
5. Ascospores, septa indistinct or lacking 9
6. Ascospores disarticulating . . . . . ***Balansia***
6. Ascospores no disarticulating 7
7. Asci with 2–6 ascospores . . . . . ***Shimizuomyces***
7. Asci with 8 ascospores. 8
8. Perithecia superficial . . . . . ***Tyrannicordyceps***
8. Perithecia immersed . . . . . ***Neocordyceps***
9. Stipe pale brown to orange brown . . . . . ***Claviceps***
9. Stipe reddish-brown . . . . . ***Neoclaviceps***
10. Host bamboo 11
10. Host grasses 17
11. Ascospores hyaline. 12
11. Ascospores some other colour 16
12. Ascospores multi-septate 13
12. Ascospores irregularly septate . . . . . ***Cavimalum***
13. Perithecia immersed, oval, pyriform or obpyriform . . 14
13. Perithecia superficial, cylindrical . . . . . ***Dussiella***
14. Stromata on woody culm, light brown or dark brown 15
14. Stromata half encircling the leaves, black . . . . . ***Heteroepichloë***
15. Ascospores disarticulating into part spores . . . . . ***Mycomalus***
15. Ascospores lacking part spores. . . . . ***Aciculosporium***
16. Ascospores filiform, yellowish, part spores, brown to black . . . . . ***Konradia***
16. Ascospores fusiform, olivaceous, 3 septate, lacking part spores. . . . . ***Loculistroma***
17. Stromata developing on inflorescences of grasses. . 18
17. Stromata developing on leaves, tillers or culms of grasses. 19
18. Part-spores unicellular, curved, needle-shaped, narrower at one end . . . . . ***Atkinsonella***
18. Part-spores 1-septate, not curved, elongate cylindrical . . . . . ***Balansia***
19. Ascospores breaking into part spores 20
19. Ascospores not breaking into part spores 21
20. Part spores 1-septate. . . . . ***Balansia***
20. Part spores aseptate . . . . . ***Myriogenospora***
21. Perithecia flask or obpyriform . . . . . ***Nigrocornus***
22. With conidiomata, with conidia 23
22. With synnemata, lacking conidia . . . . . ***Periglandula***
23. Conidia holoblastic 24
23. Conidia not holoblastic. 25
24. Conidiogenous cells, arising as integrated or discrete, cylindrical to narrowly obpyriform ***Corallocytostroma***
24. Conidiogenous cells arising as a palisade layer, slender, filiform. . . . . ***Ephelis***
25. Conidia 0–1-septate 26
25. Conidia 2-septate . . . . . ***Albomyces***
26. Conidia 1-septate, later swelling. . . . . ***Dussiella***
26. Conidia 1-celled, not swelling 27
27. Conidia verruculose . . . . . ***Ustilaginoidea***

27. Conidia smooth-walled 28
28. Conidia catenulate . . . . . ***Metarhiziopsis***
28. Conidia discrete . . . . . ***Neotyphodium***
29. Host insects, nematodes, rotifers, protozoans or soil. 30
29. Host Chameleon or other fungi 52
30. Sexual morph produced 31
30. Asexual morph produced 40
31. Stroma with stalk 32
31. Stroma lacking stalk. 34
32. Asci cylindrical, no appendant 33
32. Asci flexuous, filled with moniliform strings . . . . . ***Sphaerocordyceps***
33. Perithecia superficial on the stroma or clustered at the apex. . . . . ***Tyrannicordyceps***
33. Perithecia completely or half immersed in the stroma. . . . . ***Metacordyceps***
34. Perithecia flask-shaped or conical. 35
34. Perithecia obpyriform, subglobose or subcylindrical 36
35. Stromata superficial from the host, discrete, variously coloured. . . . . ***Conoideocrella***
35. Stromata surrounding host, crowd, ring-like, ochraceous . . . . . ***Orbiocrella***
36. Perithecia obpyriform or subglobose 37
36. Perithecia subcylindrical. . . . . ***Dussiella***
37. Stromata tissue changing colour in 3 % KOH 38
37. Stromata tissue not changing in 3 % KOH . . . . . ***Moelleriella***
38. Stromata tissue changing colour in 3 % KOH to brown, reddish or dark reddish. 39
38. Stromata tissue becoming purple in 3 % KOH . . . . . ***Regiocrella***
39. Stroma surface minutely pulverulent or pruinose. . . . . ***Hypocrella***
39. Stroma surface smooth or slightly pruinose . . ***Samuelsia***
40. Conidia green in mass . . . . . ***Metarhizium***
40. Conidia some other colour in mass. 41
41. Conidia with adhesive hapteron . . . . . ***Pseudomeria***
41. Conidia without adhesive hapteron. 42
42. Conidia 1-multi-septate 43
42. Conidia 1-celled. 45
43. Conidia, 1-septate, not dictyochlamydospores. . ***Dussiella***
43. Conidia dictyochlamydospores. 44
44. Phialides smooth . . . . . ***Metapochonia***
44. Phialides aculeate. . . . . ***Pochonia***
45. Conidia adhering in chains. 46
45. Conidia not as above 47
46. Conidiogenous cells flask-shaped, with short, narrow neck. . . . . ***Nomuraea***
46. Conidiogenous cells cylindrical to clavate, without a neck. . . . . ***Metarhizium***
47. Conidiogenous cells or conidia with slime 48
47. Conidiogenous cells or conidia without slime. 50
48. Conidia fusiform or fusoid, generally with acute ends 49
48. Conidia ovoid to ellipsoid, can be reniform or apiculate . . . . . ***Sphacelia***
49. Conidiogenous cells flask-shaped, formed in a thick compact palisade . . . . . ***Hypocrella***
49. Conidiogenous cells filiform, can branch at acute angles, not formed in a thick compact palisade . . . . . ***Aschersonia***
50. Phialides flask-shaped 51
50. Phialides cylindrical 52
51. Conidiophores irregularly branched . . . . . ***Regiocrella***
51. Conidiophores regularly branched . . . . . ***Moelleriella***
52. Phialides with a brownish funnel-shaped collarette . . . . . ***Collarina***
52. Phialides without a brownish funnel-shaped collarette. . . . . ***Samuelsia***
53. Host fungus 54
53. Host chameleons. . . . . ***Chamaeleomyces***
54. Host *Claviceps* . . . . . ***Epicrea***
54. Host *Hypocrella chusqueae* . . . . . ***Neobarya***

Clypeosphaeriaceae G. Winter [as 'Clypeosphaerieae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 554 (1886)

Facesoffungi number: FoF 01776

Hemibiotrophic or *saprobic* on woody or herbaceous plants. **Sexual morph**: *Pseudoclypeus* comprising both host and fungal tissues, black. *Ascomata* immersed to erumpent, rarely superficial, solitary or aggregated, globose to subglobose, coriaceous, brown to black, ostiolate, papillate. *Papilla* short, narrow, internally lined with hyaline, filamentous periphyses. *Peridium* comprising dark brown to light brown, thick-walled cells of *textura angularis*, inwardly hyaline. *Hamathecium* comprising numerous, hypha-like, septate, flexuose, paraphyses, embedded in a gelatinous matrix. *Asci* 8-spored, unitunicate, cylindrical to broadly cylindrical, pedicellate, with a wedge-shaped, J-, or J+ apical ring. *Ascospores* uniseriate to biseriate, hyaline to brown, ellipsoidal to fusiform, sometimes oval, straight or curved, unicellular or septate, wall smooth or ornamented or striate, sometimes with sheaths, appendages, rarely with germ slits or germ pores. **Asexual morph**: Undetermined.

Type: ***Clypeosphaeria*** Fuckel

Notes: The family *Clypeosphaeriaceae* was introduced by Winter (1887) to include *Anthostomella*, *Clypeosphaeria*, *Hypospila*, *Linospora* and *Trabutia*. Barr (1989) revived the family *Clypeosphaeriaceae* and included *Apiorhynchostoma*, *Clypeosphaeria*, *Endoxyla*, *Melomastia*, *Pseudovalsaria*, *Saccardoella* and *Urosporella*, which are related and morphologically similar to the family *Amphisphaeriaceae*.

However, Barr (1989) revisited the family and excluded all genera and retained *Clypeosphaeria* as the type of this monotypic family. Hawksworth et al. (1995) treated this family with *Apiorhynchostoma*, *Ceratostomella*, *Clypeosphaeria*, *Crassoascus*, *Duradens*, *Frondicola*, *Jobellisia*, *Melomastia* and *Pseudovalsaria* (Kang et al. 1999c; Smith et al. 2003). Lumbsch and Huhndorf (2010) accepted only *Apiorhynchostoma*, *Aquasphaeria*, *Brunneiapiospora*, *Clypeosphaeria*, *Crassoascus*, *Duradens*, *Palmomyces* and *Pseudovalsaria* in the family. Maharachchikumbura et al. (2015) and Senanayake et al. (2015) accepted *Apioclypea*, *Aquasphaeria*, *Brunneiapiospora*, *Clypeosphaeria*, *Crassoascus* and *Palmomyces* as genera of *Clypeosphaeriaceae*. In this paper we exclude *Aquasphaeria* which we place in Sordariomycetes genera *incertae sedis*.

Clypeosphaeria Fuckel, Jb. nassau. Ver. Naturk. 23–24: 117 (1870) [1869–70]

Facesoffungi number: FoF 02104; Fig. 41

Saprobic bark of dead wood. **Sexual morph**: Clypeus dome-shaped, well-developed, black. *Ascomata* 350–400 μm high, 380–450 μm wide, immersed under the clypeus, solitary, scattered, globose to subglobose, coriaceous, black. *Ostiole* central, papillate, papilla short, narrow, internally lined with hyaline, filamentous periphyses. *Peridium* 20–35 μm wide, comprising outer, brown, elongated, flat, cells of *textura angularis* and inner, hyaline, elongated, flat cells of *textura angularis*. *Hamathecium* comprising numerous, hypha-like, aseptate, unbranched, flexuose, paraphyses, tapering towards the apex. *Asci* 8-spored, unitunicate, cylindrical, short pedicellate, apex rounded, with a J+ apical ring. *Ascospores* uniseriate, dark brown, ellipsoidal to fusiform, unicellular, straight or slightly curved, not constricted at the septa, smooth-walled. **Asexual morph**: Undetermined.

Type species: ***Clypeosphaeria notarisii*** Fuckel, Jb. nassau. Ver. Naturk. 23–24: 117 (1870)

Notes: *Clypeosphaeria notarisii* was introduced by Fuckel and is discussed by Kang et al. (1999c). Barr (1989) mentioned that *Clypeosphaeria* has been synonymized under several genera. Hyde et al. (1998) treated *Clypeosphaeria* as a monotypic genus, excluding all other species. Currently 48 species have been listed under the genus *Clypeosphaeria* in Index Fungorum (2016). *Clypeosphaeria* is characterized by 0–5-pseudoseptate ascospores, without germ pores (Kang et al. 1999c).

Other genera included

Apioclypea K.D. Hyde, J. Linn. Soc., Bot. 116(4): 316 (1994)

Type species: ***Apioclypea livistonae*** K.D. Hyde, J. Linn. Soc., Bot. 116(4): 317 (1994)

Brunneiapiospora K.D. Hyde et al., Sydowia 50(1): 40 (1998)

Type species: ***Brunneiapiospora javensis*** K.D. Hyde et al., Sydowia 50(1): 50 (1998)

Crassoascus Checa et al., Mycotaxon 46: 300 (1993)

Type species: ***Crassoascus fusisporus*** Checa et al., Mycotaxon 46: 301 (1993)

Palmomyces K.D. Hyde et al. Sydowia 50(1): 59 (1998)

Type species: ***Palmomyces montaneus*** K.D. Hyde et al., Sydowia 50(1): 60 (1998)

Key to genera of *Clypeosphaeriaceae*

1. Ascomata erumpent 2
1. Ascomata immersed, clypeus, epiphyllous 2
2. Globose or sphaeroid, J+, fusoid asymmetric, clear brown ascospore, 5-celled, gattulate, apiculate ends . . . . . ***Crassoascus***
2. Globose or subglobose, overlapping uniseriate, apiosporous, with a mucilaginous sheath. 3
3. Clypeus, J+ or J-, hyaline ascospore. . . . . ***Apioclypea***
3. Subglobose 4
4. Subglobose or ovoid, clypeate, J+, ellipsoidal, brown ascospore, unicellular, 3–5 pseudosepta, rarely apiosporous, lacking a mucilaginous sheath . . . . . ***Clypeosphaeria***
4. Subglobose; Epiphyllous or Clypeus 5
5. Clypeus, J+ or J-, hyaline to light brown ascospore……..... ***Brunneiapiospora***
5. Epiphyllous, J-, biseriate, hyaline ascospore, obcalvate, 1-septate . . . . . ***Palmomyces***

Coniocessiaceae Asgari & Zare, Mycol. Progr. 10(2): 195 (2011)

Facesoffungi number: FoF 01296

Saprobic on grasses, soil and dung. **Sexual morph**: *Ascomata* small, less than 200 μm diam, superficial, subglobose to pyriform, glabrous or pilose, ostiolate, commonly with hypha-like ostiolar projections. *Peridium* thin, membranaceous, translucent or sometimes opaque, outer layer comprising pale-brown to dark brown cells of *textura intricata*. *Hamathecium* comprising septate, tapering, hyphae-like, thin-walled, filamentous, branched. paraphyses, abundant or few. *Asci* 4–spored, unitunicate, cylindrical to subcylindrical, pedicellate, without an apical ring. *Ascospores* uniseriate, dark brown to black, ellipsoidal, with narrowly rounded ends, smooth–walled, one-celled, with germ-slit, full length, straight. **Asexual morph**: Hyphomycetous. nodulisporium-like: *Conidiophores* micronematous to macronematous, simple or branched, smooth-walled or verrucose, hyaline. *Conidiogenous cells* integrated, terminal, discrete, elongating sympodially, with

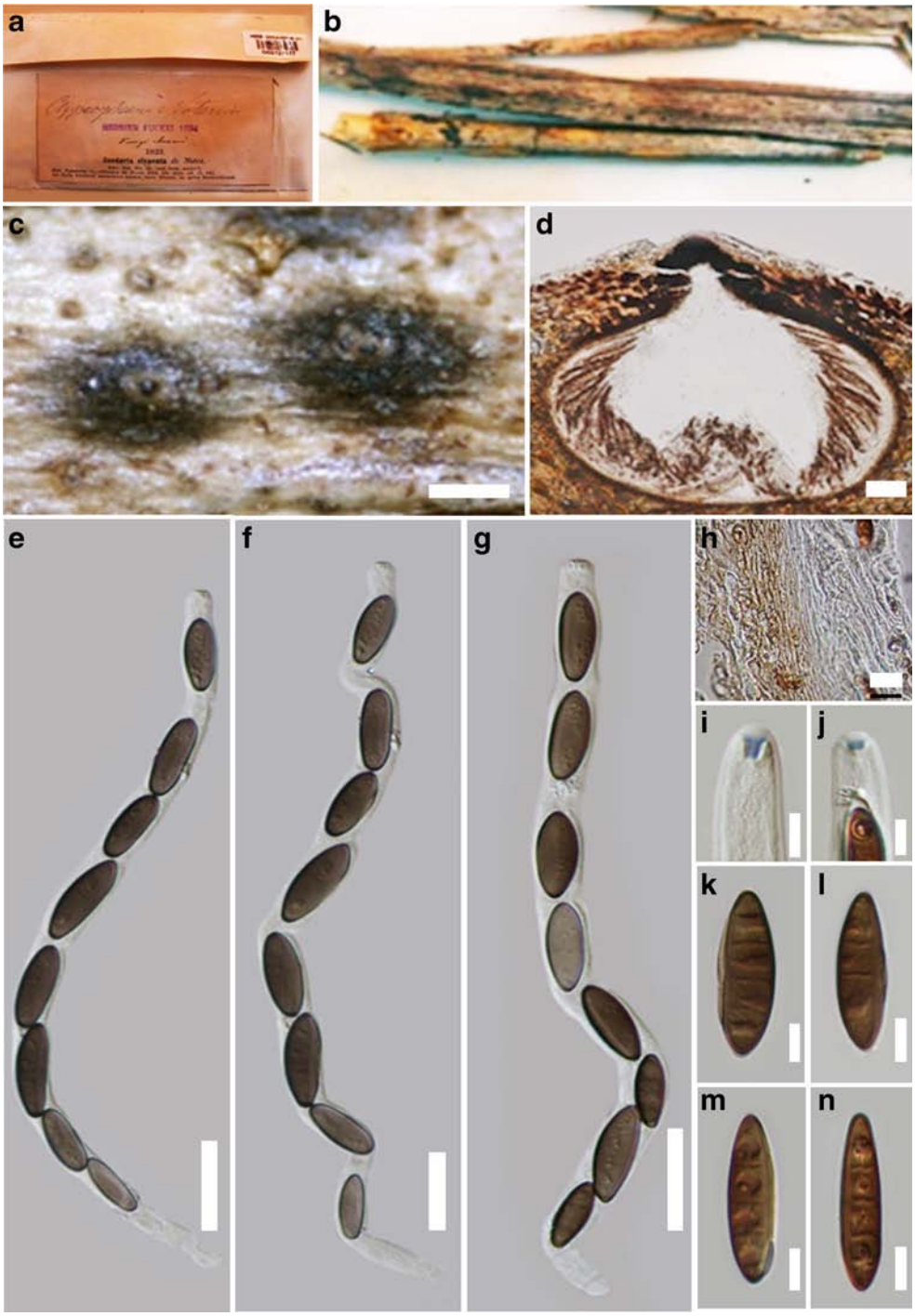


Fig. 41 ***Clypeosphaeria notarisii*** (Material examined: GERMANY, Forest of Oestriche, December 1823, Fuckel, G00127177, **holotype**) **a** Herbarium package **b** Herbarium material **c** Ascomata on the surface of host **d** Section of ascoma **e–g** Asci with ascospores **h** Peridium **i**, **j** Ascus apex with J+, subapical ring **k–n** Ascospores. Scale bars: **c** = 500 μm, **d** = 50 μm, **e–g** = 20 μm, **h**, **i–n** = 5 μm

persistent, conspicuous denticles, hyaline. *Conidia* globose, subglobose to pyriform, smooth-walled or verruculose, with rounded apex, hyaline, attenuated and truncated base and a more or less distinct projection at the point of attachment to the conidiogenous cells.

Type: ***Coniocessia*** Dania García et al.

Notes: The family *Coniocessiaceae* was introduced by Asgari and Zare (2011b) to accommodate the genus *Coniocessia* with a nodulisporium-like asexual morph. The family is unique in the order *Xylariales* in having a hyaline asexual morph with polyblastic conidiogenesis (nodulisporium-like), contrasting with the generally pigmented nodulisporium-like asexual morphs in *Xylariales* (Asgari and Zare 2011b). Members of *Coniocessiaceae* can be distinguished from *Xylariaceae* in possessing astromatic ascomata, and asci without apical structures (Asgari and Zare 2011b). Asgari and Zare (2011b) introduced four new species to *Coniocessia* and provided molecular data indicating

this was a distinct lineage of *Xylariales*, but closely related to the family *Diatrypaceae* according to their phylogenetic analysis. Thus they introduced the new family, which confirms its distinctness as a family and place it in the order *Xylariales*.

Coniocessia Dania García et al., in García et al., Mycol. Res. 110(11): 1284 (2006)

Facesoffungi number: FoF 01297; Figs 42, 43

Type species: ***Coniocessia nodulisporioides*** (D. Hawksw.) Dania García et al., in García et al., Mycol. Res. 110(11): 1285 (2006)

Notes: García et al. (2006) introduced the genus *Coniocessia* to accommodate the type species, *C. nodulisporioides* Dania García et al., by synonymising *Coniochaeta nodulisporioides* D. Hawksw., which was placed in *Xylariales* genera *incertae sedis*, based on morphological and sequences data of SSU and LSU rDNA genes (García et al. 2006).

Recently, Asgari and Zare (2011b) introduced four new species (*C. anandra* Asgari & Zare, *C. cruciformis* Asgari & Zare, *C. maxima* Asgari & Zare and *C. minima* Asgari & Zare) in the genus *Coniocessia* based on morphological and molecular data of ITS and LSU rDNA. All species of *Coniocessia* clustered into a single monophyletic clade (Asgari and Zare 2011b).

Coniochaetaceae Malloch & Cain, Can. J. Bot. 49: 878 (1971)

Facesoffungi number: FoF 01332

Saprobic on dung, plants litter or in soil, water, *pathogenic* on plants or *pathogens* of immune-compromised humans. **Sexual morph**: *Ascomata* perithecial or cleistotheciod, solitary to gregarious, superficial, semi-immersed or immersed, subglobose to globose, or pyriform, dark brown to black, glabrous or hairy brown to black, ostiolate or lacking ostioles. *Ostioles* periphysate, with or without setae. *Peridium* membranaceous to pseudoparenchymatous, rarely coriaceous; composed of several layers of cells of *textura angularis* or *textura intricata*, or less frequently cephalothecoid. *Hamathecium* comprising numerous, filiform, simple, septate, evanescent paraphyses. *Asci* (4-), 8- to multi-spored, unitunicate, cylindrical to fusoid or clavate, globose to subglobose, thin-walled, evanescent, short pedicellate, with a truncate to rounded apex, with a non-amyloid apical ring. *Ascospores* 1-seriate or irregularly arranged, hyaline, brown to dark brown, olive-greenish to dark olivaceous or black, ellipsoid to fusiform, broadly ellipsoidal to globose, lenticular or cruciform, with rounded to apiculate ends, flattened on one or both sides; 1-celled, with or without a germ slit, smooth walled or pitted. **Asexual morph**: Hyphomycetous. *Colonies* are frequently characterized by pink or orange and a yeast-like appearance. *Conidiophores* hyphae variable, frequently closely septate. *Conidiogenous cells* phialidic, polyblastic, of various size and morphology, phialides somewhat ampulliform, subulate or indistinguishable from a normal hyphal cell, collarettes present, but usually hard to distinguish, only occasionally somewhat flared. *Conidia* accumulating near the point of formation (in chains), hyaline, orange or pink in mass, elliptical to oblong-elliptical to reniform, 1-celled, smooth-walled.

Type: ***Coniochaeta*** (Sacc.) Cooke

Notes: The family *Coniochaetaceae* was introduced by Malloch and Cain (1971) to accommodate *Coniochaeta* and *Coniochaetidium*, and is typified by *Coniochaeta*. *Coniochaetaceae* is a single family within the order *Coniochaetales* in the subclass *Sordariomycetidae* (Huhndorf et al. 2004a; García et al. 2006). Two genera, *Coniochaeta* and *Barrina* are presently placed in the family based on morphological and phylogenetic analyses (Ramaley 1997; Huhndorf et al. 2004a; García et al. 2006; Kirk et al. 2008; Lumbsch and Huhndorf 2010; Wijayawardene et al. 2012; Khan et al. 2013; Miller et al. 2014; Maharachchikumbura et al. 2015). *Coniochaetaceae* is characterized by 4- to 8-, or multi-spored asci (Asgari and Zare 2011b), ascospores with longitudinal germ slit (Asgari et al. 2007; Ivanová and Bernadovičová 2013), and an asexual morph with phialidic or polyblastic conidiogenous cells (Asgari and Zare 2006; Asgari et al. 2007). This family occurs on various substrates and media: such as plants (wood, bark, leaves, leaf litter), animal dung, soil and strongly acidic water with high heavy metal concentrations and humans (Damm et al. 2010; Ivanová and Bernadovičová 2013; Khan et al. 2013).

Coniochaeta (Sacc.) Cooke, Grevillea 16 (no. 77): 16 (1887)

Facesoffungi number: FoF 01333, Figs 44, 45

Saprobic on plants litter, dung or in soil, water, *pathogenic* on plants or *pathogens* of immunocompromised humans. **Sexual morph**: *Ascomata* perithecial or cleistotheciod, solitary to gregarious, superficial or semi-immersed, pyriform and ostiolate or globose and non-ostiolate, setose, hairy or glabrous, dark brown to black or slightly pigmented. *Peridium* membranaceous to pseudoparenchymatous, rarely coriaceous; composed of several layers with the cells of *textura angularis*, *textura intricata*, or less frequently cephalothecoid. *Hamathecium* paraphysate or absent. *Paraphyses* when present numerous, hyaline, filiform, simple, septate, and evanescent. *Asci* 4-, 8- to multi-spored, unitunicate, cylindrical, clavate, sub-globose or globose, evanescent, short pedicellate, with a truncate to rounded apex, usually with a conspicuous to indistinct, non-amyloid, apical ring, thin-walled. *Ascospores* 1-seriate or irregularly arranged, narrowly ellipsoid to fusoid, broadly ellipsoidal to globose, lenticular or cruciform, with rounded to apiculate ends, flattened on one or both sides; hyaline, brown to dark brown, olive-greenish to dark olivaceous or black, 1-celled, with a cleft germ, smooth-walled or pitted. **Asexual morph**: Hyphomycetous.

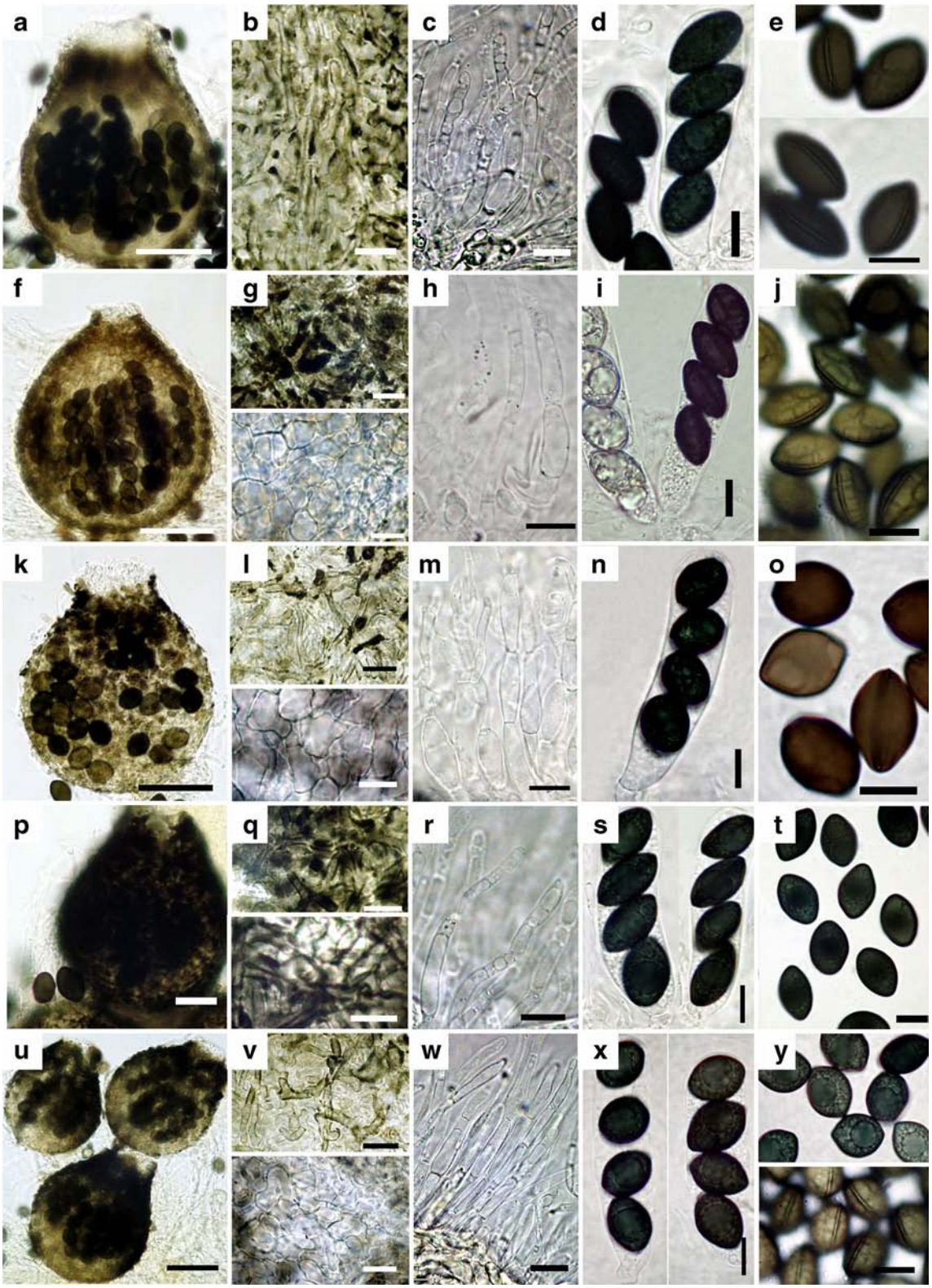


Fig. 42 ***Coniocessia*** **spp.** (Material examined: **a-e** IRAN, West Azerbaijan, Miandoab, on wheat seeds, B. Asgari. IRAN 14375F, **holotype** of *C. anandra*; **f–g** IRAN, Ardabil Bilesavar, on wheat straw, B. Asgari, IRAN 14374F, **holotype** of *C. cruciformis*; **k–o** SPAIN, Caceras, on goat dung, P. Blaser, May 1971. Received from CBS as *C. nodulisporioides*. IRAN 14377F, **holotype** of *C. maxima*; **p–t** IRAN, Parsabad, Ardabil, on wheat seeds, B. Asgari. IRAN 14376F, **holotype** of *C. minima*; **u–y** JORDAN, from soil, A. H. Moubasher, 1976, IMI 204247, **holotype** of *C. nodulisporioides*) **a**, **f**, **k**, **p**, **u** Ascomata **b**, **g**, **l**, **q**, **v** Peridium **c**, **h**, **m**, **r**, **w** Paraphyses **d**, **I**, **n**, **s**, **x** Asci **e**, **j**, **o**, **t**, **y** Ascus. Scale bars: **a**, **f**, **k**, **p**, **u** = 50 μm, **b–e**, **g–j**, **l–o**, **q–t**, **v–y** = 10 μm

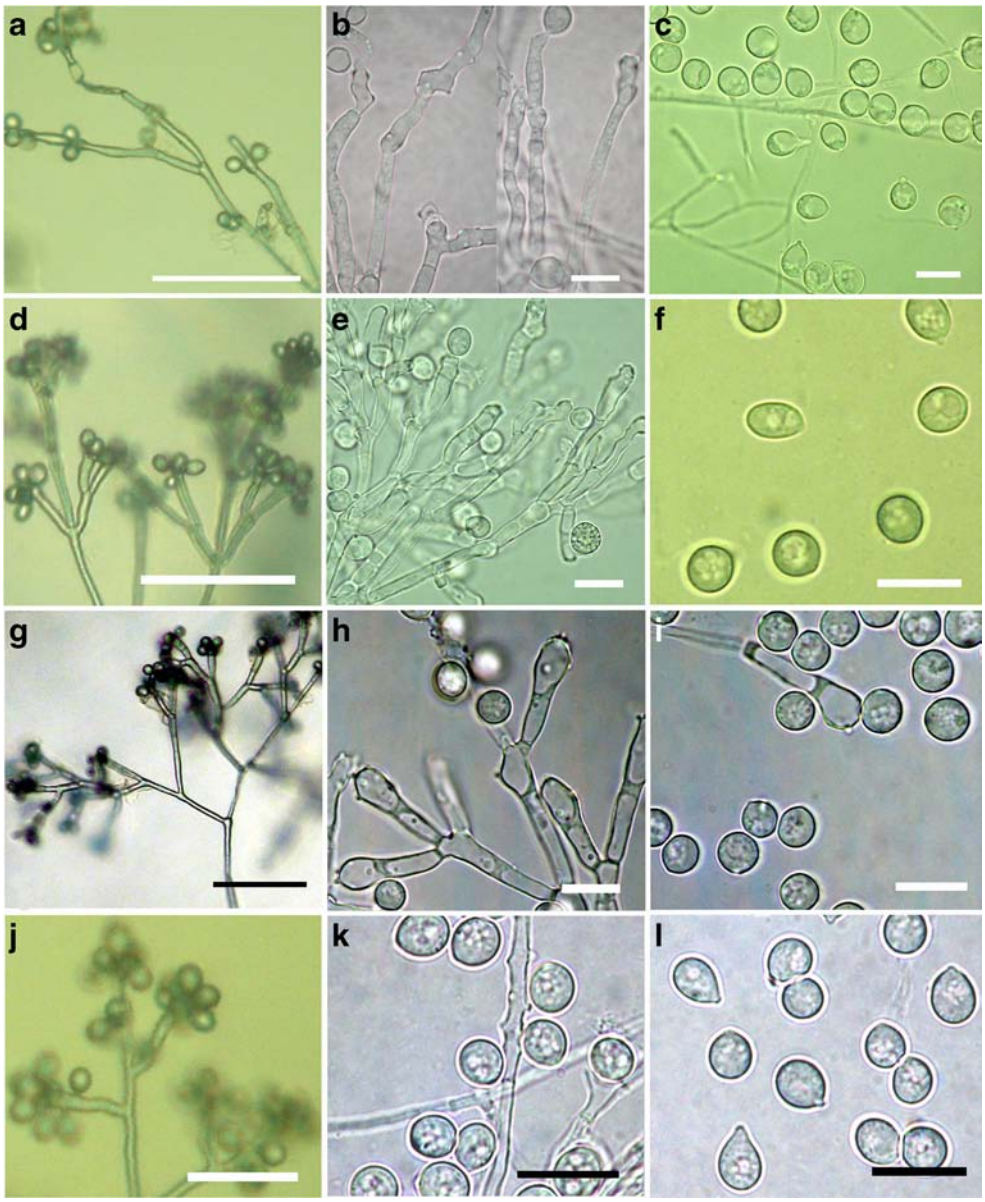


Fig. 43 Asexual morph of ***Coniocessia* spp.** (Material examined: **a-c** IRAN, Ardabil Bilesavar, on wheat straw, B. Asgari, IRAN 14374F, **holotype** of *C. cruciformis*; **d–f** SPAIN, Caceras, on goat dung, P. Blaser, May 1971. Received from CBS as *C. nodulisporioides*. IRAN 14377F, **holotype** of *C. maxima*; **g–i** IRAN, Parsabad, Ardabil, on wheat seeds, B. Asgari. IRAN 14376F, **holotype** of *C. minima*; **j–l** JORDAN, from soil, A. H. Moubasher, 1976, IMI 204247, **holotype** of *C. nodulisporioides*). **a**, **d**, **g**, **j** Asexual morph **b**, **e**, **h**, **k** Conidiophores and conidiogenous cells **c**, **f**, **i**, **l** conidia. Scale bars: **a**, **d**, **g** = 50 μm, **b–c**, **e-f**, **h-i**, **k–l** = 10 μm, j = 20 μm

Belonging to *Lecythophora*, *Verticillium*, *Paecilomyces*, and *Cladobotryum. Colonies* are frequently characterized by pink or orange, colony surface more or less smooth, slimy, usually without aerial hyphae, occasionally with short tufts of white hyphae in advancing zone. *Conidiophores* hyphae variable, frequently closely septate. *Conidiogenous cells* phialidic, phialides somewhat ampulliform, subulate or indistinguishable from a normal hyphal cell, terminal or lateral on hyphae, or intercalary hyphal cells producing phialidic openings directly or on a short extension; collarettes present but usually hard to distinguish, only occasionally somewhat flared. *Conidia* elliptical to oblong-elliptical to reniform, hyaline, orange or pinky in masse, 1-celled, smooth-walled.

Type species: ***Coniochaeta ligniaria*** (Grev.) Cooke, Grevillea 16(no. 77): 16 (1887)

Notes: The genus *Coniochaeta* (Sacc.) is typified by *C. ligniaria*, introduced by Greville (1823–1824) as *Sphaeria ligniaria*. Saccardo (1882) treated *Coniochaeta* as a subgenus under *Rosellinia* and it was raised to generic rank by Cooke in 1887 (Greville 1823–1824; Saccardo 1882; Asgari et al. 2007; Asgari and Zare 2011b). Asexual morphs of *Coniochaeta* are reported to belong to cladobotryum-like, *Lecythophora*, *n*odulisporium-like and *Paecilomyces*, which have phialidic and polyblastic conidiogenesis (Barr 1990; Asgari and Zare 2006; Asgari and Zare 2011b). *Coniochaeta* has 86 epithets listed in Index Fungorum (2016). *Coniomela*, *Cucurbitariella*, *Cucurbitula*, *Germslitospora*, *Pleosporopsis*, *Sphaerodermatella*, *Sphaerodermella*, *Sphaeropyxis*, *Coniochaetidium*, *Ephemeroascus* and *Poroconichaeta* are listed as synonyms of *Coniochaeta* (Huhndorf et al. 2004a;

Fig. 44 ***Coniochaeta ligniaria*** **(**Material examined: SWEDEN, Småland, Döderhult par., 2 km ENE of Bohult, on fire-place in coniferous forest, on hare dung (*Lepus*) in moist chamber, Stockholm, leg Nils Lundqvist, 30 May 1985, S F139191 (lgt 15438-g) **a** Herbarium material **b** Host (hare dung) **c** Ascomata on the host **d** Vertical section of ascoma **e** Ostioles with setae **f–g** Blunt setae **h–k** Asci **l** Asci and paraphyses **m–o** Ascospores. Scale bars: **c** = 100 μm, **d** = 30 μm, **e–n** = 10 μm

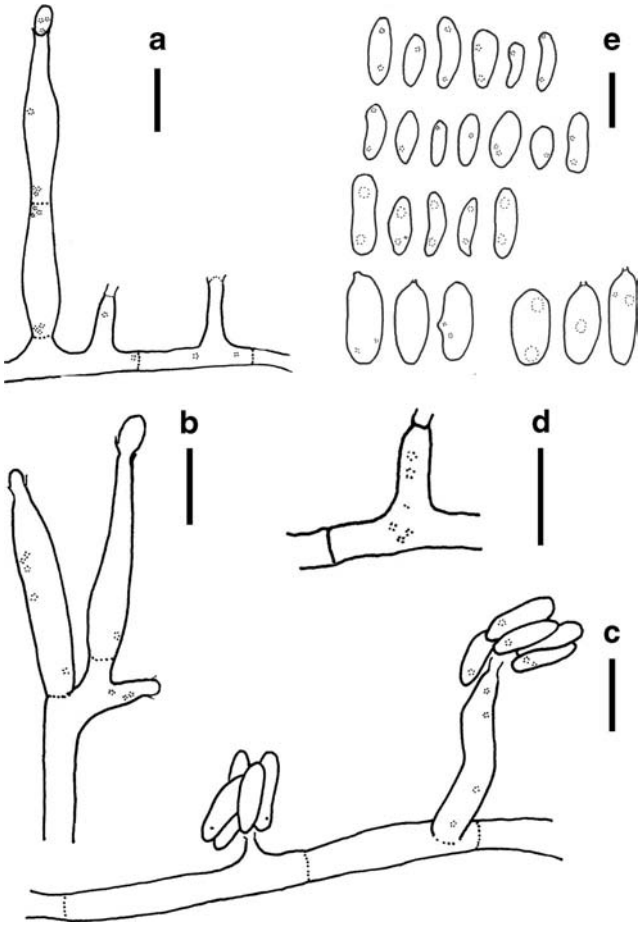


Fig. 45 ***Coniochaeta ligniaria*** (redrawn from Weber and Begerow 2002) **a–c** Conidiophores **d** Conidiogenous cell **e** Conidia. Scale bars: **a–e** = 10 μm

García et al. 2006; Kirk et al. 2008; Lumbsch and Huhndorf 2010; Wijayawardene et al. 2012; Khan et al. 2013; Miller et al. 2014; Maharachchikumbura et al. 2015). Previous phylogenetic studies have linked the type species *Coniochaeta ligniaria* and *Lecythophora lignicola* ITS, LSU, Actin and Beta-tubulin molecular data, as well as previous phylogenetic studies (Weber et al. 2002; Huhndorf et al. 2004a; García et al. 2006; Perdomo et al. 2013a, b). Khan et al. (2013) resolved the phylogenetic placement of *Lecythophora* species and synonymized the genus to *Coniochaeta*.

Other genus included

Barrina A.W. Ramaley, Mycologia 89(6): 962 (1997)

Type species: ***Barrina polyspora*** A.W. Ramaley, Mycologia 89(6): 963 (1997)

Key to genera of *Coniochaetaceae*

1. Ascomata immersed, ascospores hyaline. . . . . .***Barrina***

1. Ascomata superficial or semi-immersed, ascospores coloured . . . . . ***Coniochaeta***

Cordanaceae Nann., Repert. mic. uomo: 498 (1934)

Facesoffungi number: FoF 01673

Saprobic or *pathogenic* on wood and leaves of various shrubs, deciduous and evergreen trees, conifers, bamboo and grasses in terrestrial and rarely in freshwater habitats. **Sexual morph**: *Ascomata* perithecial, solitary or gregarious, superficial, globose to ovoid, sometimes with basal stroma, setose or glabrous, ostiolate, papillate, with periphyses. *Peridium* composed of 3–5 layers of cells of *textura prismatica*. *Hamathecium* comprising simple, unbranched, septate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical, short pedicellate, with or without an inconspicuous, non-amyloid, apical ring. *Ascospores* uniseriate, ellipsoid to fusiform, 1-septate, light brown to brown, sometimes with pores at the ends. **Asexual morph**: Hyphomycetous. *Colonies* effuse, dark brown to black. *Conidiophores* erect, mononematous, macronematous, brown, branched or unbranched, with a fertile apex. *Conidiogenous cells* polyblastic, denticulate. *Conidia* brown to dark brown, obovate or ellipsoidal, 1-septate, smooth, with or without germ pores at the end of the

conidia (description modified from Hughes (1955), Müller and Samuels (1982) and Hernández-Restrepo et al. (2014)).

Type: ***Cordana*** Preuss

Notes: The family *Cordanaceae* was established by Nannfeldt with *Cordana* as the type genus. Based on molecular data, Hernández-Restrepo et al. (2015a) introduced the order *Cordanales* to accommodate this family, which is easily distinguished from the species of its sister order *Coniochaetales* (*Coniochaetaceae*), in having a basal stroma, ascospores lacking germ slits and polyblastic asexual morphs (Hernández-Restrepo et al. 2015a). The family contains a single genus thus only the family description is given.

Cordana Preuss, Linnaea 24: 129 (1851)

Facesoffungi number: FoF 01674; Fig. 46

Notes: The genus *Cordana* was introduced by Preuss (1851), while describing the species *Cordana polyseptata* Preuss, *C. pauciseptata* Preuss and *C. pedunculata* Preuss. Later a fourth species *C. parvispora* Preuss was also described (Preuss 1852), but in both publications, a type was not designated. Saccardo (1877) retained only *C. pauciseptata* in *Cordana* selecting it as the lectotype and classifying the other three *Cordana* species under *Acrothecium*. Kuntze (1891) disagreed with this classification and renamed the genus as *Preussiaster* in honour of its first author. *Cordana pauciseptata* was reclassified as *Preussiaster pauciseptatus* (Preuss) O. Kuntze and the three species placed by Saccardo (1877) under *Acrothecium* were also added (Kuntze 1891). However, Hughes (1955) stated that any three of the specimens originally described by Preuss (1851) should be the lectotype. After studying the type material of *Cordana*

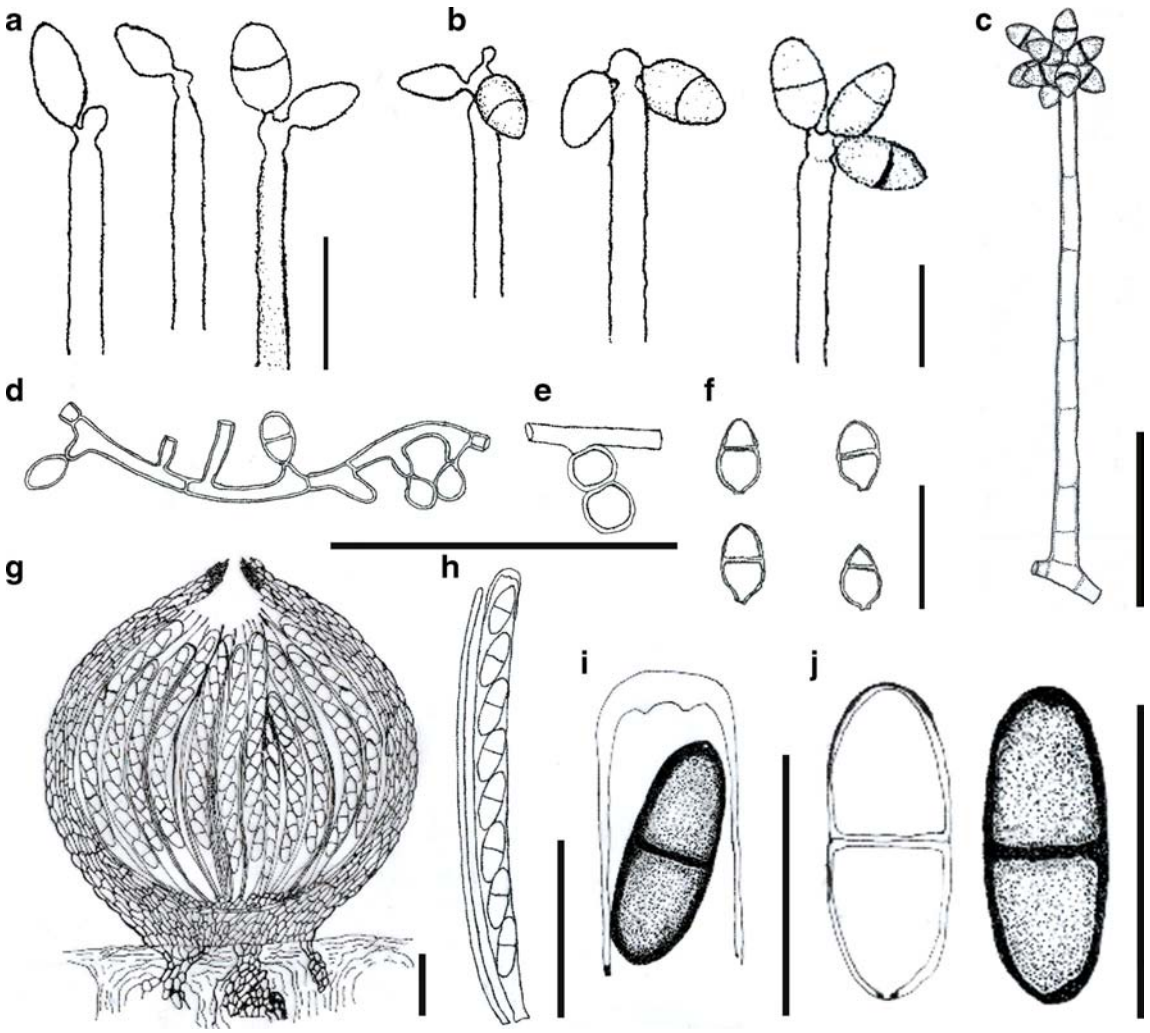


Fig. 46 ***Cordana pauciseptata*** (redrawn from Hughes 1955) **a**, **b** Conidiophores with developing conidia on MEA (DAOM 33990) **c** Conidiophore with proliferated conidia on PDA (DAOM 28664) **d**, **e** Hypha bearing chlamydospores on MEA (DAOM 33990) **f** Mature conidia (DAOM 33990). Sexual morph *Porosphaerella cordanophora*, the first species reported to have a *Cordana* asexual morph (redrawn from Müller and Samuels 1982) **g** Vertical section of ascoma **h** Asci with ascospores **i** Non amyloid apical ring of asci with a mature ascospore **j** Ascospores. Scale bars: **a**, **b**, **e**–**j** = 10 μm, **c**, **d** = 20 μm

pauciseptata, Hughes (1955) re-described and illustrated it as *Brachysporium polyseptatum* (= *Brachysporium bloxami*), which resulted in *C. pauciseptata* being an older epithet for the species. However, this type material was reported to be lost and an epitype was designated by Hernández-Restrepo et al. (2014).

Cordana species are characterized by brown, septate conidiophores with swollen conidiogenous zones, terminal and intercalary conidiogenous cells, and pale brown to brown, 1-septate or aseptate conidia (Hernández-Restrepo et al. 2015a). Müller and Samuels (1982) linked *Porosphaerella cordanophora* to *Cordana pauciseptata*, the type species of *Cordana* using culture studies. Romero and Samuels (1991) published a second species in *Porosphaerella* (*P. setosa* A.I. Romero & Samuels), but no asexual morph was reported. Fernández and Huhndorf (2004) established that *Porosphaerella borinquensis* was linked to *Pseudobotrytis terrestris* as the asexual morph formed *in vitro*. From its asexual morph the genus is known to be cosmopolitan. Molecular studies have shown that *Cordanaceae* is closely related to *Coniochaetales* (Réblová and Winka 2000; Huhndorf et al. 2004a; Réblová and Seifert 2007; Hernández-Restrepo et al. 2014; Zelski et al. 2014; Maharachchikumbura et al. 2015). Hernández-Restrepo et al. (2014) accepted 19 species in this genus and provided a key for their identification. *Cordana* species have been recorded from various temperate and tropical regions in the world, including Africa, South America, South East Asia and New Zealand.

Type species: ***Cordana pauciseptata*** Preuss, Linnaea 24: 129 (1851)

Cordycipitaceae Kreisel ex G.H. Sung et al., in Sung et al., Stud. Mycol. 57: 48 (2007)

Facesoffungi number: FoF 01314

Parasites or *pathogens* of scale insects or mosses, or saprobes in leaf litter and upper soil layers. **Sexual morph**: *Stromata* or *subiculum*, fleshy, pallid, or brightly coloured. *Perithecia* superficial to completely immersed, oriented at right angles to the surface of the stroma. *Asci* mostly 8–spored, cylindrical, with thickened ascus apex. *Ascospores* usually cylindrical, multi-septate, disarticulating into part-spores or remaining intact at maturity. **Asexual morph**: See notes.

Type: ***Cordyceps*** Fr.

Notes: The family name *Cordycipitaceae* was first used by Kreisel (1969), while Wehmeyer (1976) used *Cordycipitoideae* as a sub-family for *Clavicipitaceae* based on the type genus *Cordyceps*. *Cordycipitaceae* was validly segregated from *Clavicipitaceae* by Sung et al. (2007), based on morphology and multi-gene phylogenetic analyses. Most of the species in the family are entomogenous and produce superficial to partially immersed to completely immersed perithecia, on a fleshy stroma or subicula, that are pallid or brightly coloured (Sung et al. 2007). Sung et al. (2007) assigned eleven genera (including *Ascopolyporus*, *Cordyceps*, *Hyperdermium* and *Torrubiella Beauveria*, *Engyodontium*, *Isaria*, *Lecanicillium*, mariannaea-like, *Microhilum* and *Simplicillium*) to this family, while currently Index Fungorum (2016) lists 14 genera.

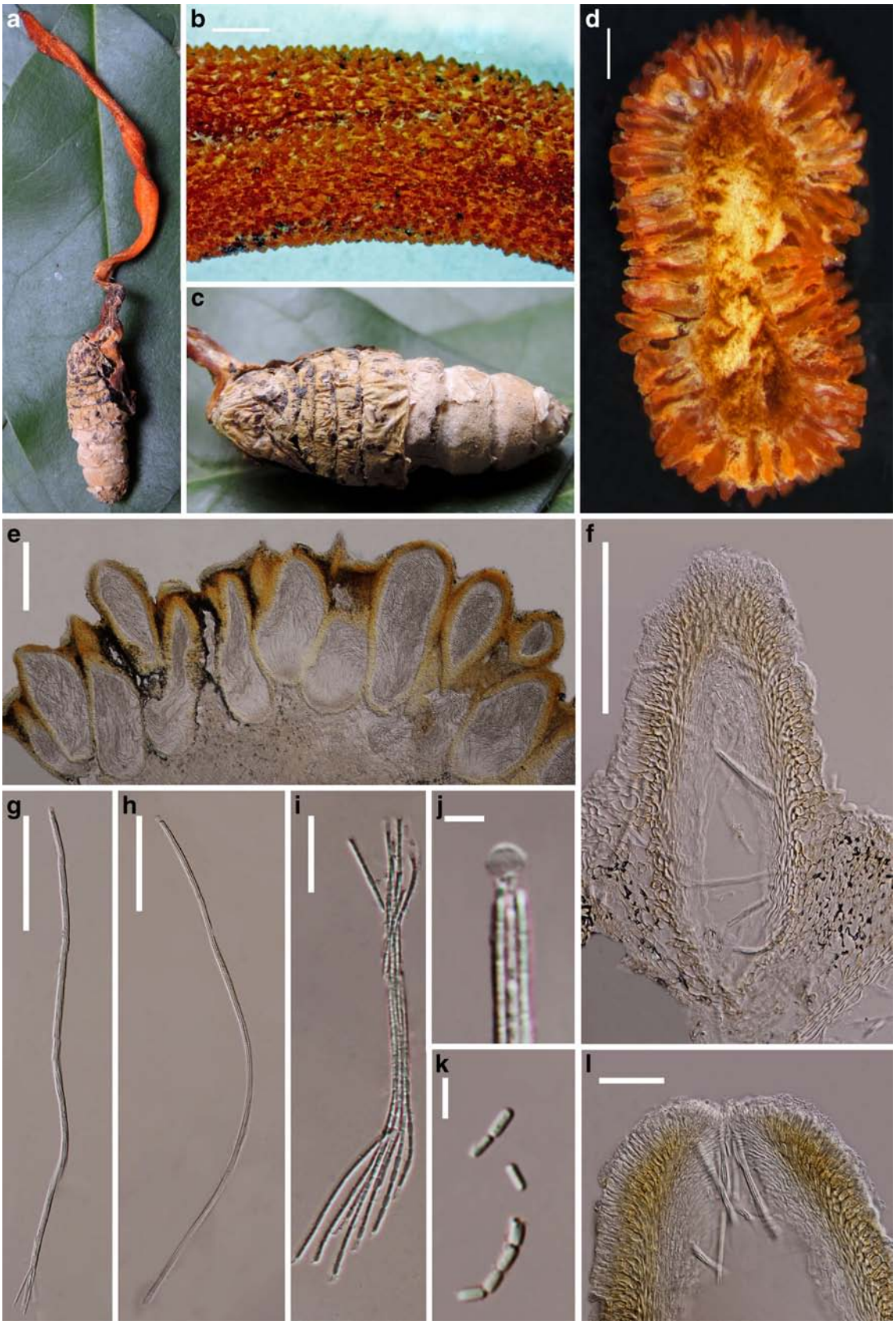
Akanthomyces was first introduced by Lebert (1858) and later revised by Mains (1950). Most of the known *Akanthomyces* species are parasites of insects or spiders, except *Akanthomyces johnsonii* (Massee) Vincent et al., which was isolated from leaves and stems (Hsieh et al. 1997; Huang et al. 1999). *Gibellula* was established by Cavara (1894) because of its unusual conidiogenous cells. Since then, a number of species have been described from spiders (Petch 1932a; Mains 1950; Samson and Evans 1973, 1977; Humber and Rombach 1987; Hsieh et al. 1997). *Pseudogibellula* was separated from *Gibellula* as conidia were produced singly on sympodial conidiogenous cells and is common on a wide range of arthropod hosts and grows freely on agar media (Samson and Evans 1973). The asexual morph genera *Pseudogibellula*, *Gibellula* and *Granulomanus* are exclusively associated with *Torrubiella* (Johnson et al. 2009). *Rotiferophthora* was described by Barron (1991) based on distinct morphological differences from *Diheterospora* and *Verticillium*, and this was confirmed by Zare et al. (2001) and Sung et al. (2007).

The asexual morph of this family is linked to *Beauveria*, *Isaria*, *Lecanicillium* and *Torrubiella* (Sung et al. 2007; Kepler et al. 2013). The genus *Lecanicillium* is characterized by slender aculeate phialides that are produced singly or in whorls and usually arising from prostrate aerial hyphae; single-celled, globose, hyaline to subhyaline conidia are produced mostly at the tip of phialides and remain attached in heads of fascicles as glioid masses (Zare and Gams 2001; Zare et al. 2001). Some *Lecanicillium* species are known to be asexual morph forms of *Cordyceps* and *Torrubiella* (Petch 1932a; Evans and Samson 1982; Zare and Gams 2001; Zare et al. 2001). Some asexual morphs of *Akanthomyces*, *Gibellula*, *Hirsutella*, *Isaria*, and *Simplicillium* have been linked to *Torrubiella* (Samson et al. 1988). Some species of *Cordyceps* produce asexual morphs that are linked to *Beauveria*, which produce basally-inflated conidiogenous cells that produce conidia sympodially on divergent denticles (de Hoog 1972). Some species from *Isaria* are the asexual morphs of *Cordyceps* and *Torrubiella* (Sung et al. 2007). In this genus the usually hyaline conidia are produced in dry chains from short flask-shaped phialides (Bischoff and White 2003).

Cordyceps Fr., Observ. mycol. (Havniae) **2**: 316 (cancellans) (1818)

Facesoffungi number: FoF 01317; Figs 47, 48

Parasitic on arthropods, worldwide. **Sexual morph**: *Stromata* or *subiculum* pallid or brightly pigmented, fleshy,


a
b
c
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◀ **Fig. 47** ***Cordyceps militaris*** **– sexual morph** (Material examined: CHINA, Province of Liao-Ling, on dead larva. 18 June 2014, Ting Chi Wen TL 2014091004, MFU 15-3202) **a** Overview of stromata and host **b** Yellow, half superficial ascomata on stroma **c** Host **d** Cross section showing the stroma and ascomata **e**, **f** Ascomata **g–i** Asci **j** Cap of ascus **k** Part spores **l** Asci with ostioles. Scale bars: **b** = 1000 μm, **d** = 400 μm, **e**, **g**, **h** = 1000 μm, **f**, **i**, **l** = 500 μm, **j** = 50 μm, **k** = 2 μm

stromata growing from the heads of adult *Lepidoptera*, usually simple, rarely branched, *Stipe* flexuous, white. *Fertile head* rounded, differentiated from stipe. *Ascomata* perithecial, superficial to completely immersed, ordinal in arrangement, elongate or ampulliform, with the ostioles opening on the surface of the head. *Peridium* comprising three layers. *Asci* hyaline, cylindrical, with thickened apex. *Ascospores* hyaline, cylindrical, multi-septate, disarticulating into part-spores or non-disarticulating, rarely possessing a thread-like structure connecting the fusiform ends. **Asexual morph**: Hyphomycetous. *Colonies* positive pale, reverse yellowish. Hyphae hyaline, narrow, septate, branched. *Conidiophores* verticillately or singly branched. *Conidiogenous cells* phialidic, solitary, verticillate, hyaline, inflated at the base, rarely cylindrical, tapering to a narrow tip, and lacking a collarette. *Conidia* hyaline, smooth, subglobose to ovoid.

Type species: ***Cordyceps militaris*** (L.) Fr., Observ. mycol. (Havniae) 2: 317 (cancellans) (1818)

Notes: The genus name *Cordyceps* was validly published by Link (1833) and first given as the group name by Fries in 1818 as *Cordylia* (Rogers 1954). *Cordyceps* includes about 280 species (Index Fungorum 2016) and was formally moved to *Cordycipitoideae* in 2007 (Sung et al. 2007). Sung et al. (2007) transferred some species from *Cordyceps* into several genera including *Ophiocordyceps* (*Ophiocordycipitaceae*), *Tolypocladium* (*Ophiocordycipitaceae*) as *Elaphocordyceps*, *Metacordyceps* (*Clavicipitaceae*), *Claviceps* (*Clavicipitaceae*), *Tyrannicordyceps* (*Clavicipitaceae*), *Epichloë* (*Clavicipitaceae*), *Podostroma* (*Hypocreaceae*) and *Podocrea* (*Hypocreaceae*).

Other genera included

Akanthomyces Lebert, Z. Wiss. Zool. 9: 449 (1858)

Type species: ***Akanthomyces aculeatus*** Lebert, Z. Wiss. Zool. 9: 449 (1858)

Ascopolyporus Möller, Bot. Mitt. Trop. 9: 300 (1901)

Type species: ***Ascopolyporus polychrous*** Möller, Bot. Mitt. Trop. 9: 300 (1901)

Beejasamuha Subram. & Chandrash., Can. J. Bot. 55(3): 247 (1977)

Type species: ***Beejasamuha samala*** Subram. & Chandrash., Can. J. Bot. 55(3): 248 (1977)

Beauveria Vuill., Bull. Soc. bot. Fr. 59: 40 (1912)

Type species: ***Beauveria bassiana*** (Bals.-Criv.) Vuill., Bull. Soc. bot. Fr. **12**: 40 (1912)

Coremiopsis Sizova & Suprun, Vestn. Moskov. Univ., Ser. biol. 12(2): 55 (1957)

Type species: ***Coremiopsis rosea*** Sizova & Suprun, Vestn. Moskov. Univ., Ser. biol. 2: 55 (1957)

Engyodontium de Hoog, Persoonia 10(1): 53 (1978)

Type species: ***Engyodontium parvisporum*** (Petch) de Hoog, Persoonia 10(1): 53 (1978)

Gibellula Cavara, Atti Ist. bot. R. Univ. Pavia, 2 Sér. 3: 347 (1894)

Type species: ***Gibellula pulchra*** Cavara [as '*pulcra*'], Atti Ist. bot. R. Univ. Pavia, 2 Sér. **3**: 347 (1894)

Granulomanus de Hoog & Samson, Persoonia 10(1): 70 (1978)

Type species: ***Granulomanus aranearum*** (Petch) de Hoog & Samson, in de Hoog, Persoonia 10(1): 70 (1978)

Hyperdermium J.F. White et al., Mycologia **92**(5): 910 (2000)

Type species: ***Hyperdermium bertonii*** (Speg.) J.F. White et al., in Sullivan et al., Mycologia **92**(5): 910 (2000)

Isaria Pers., *Neues Mag. Bot.* **1**: 121 (1794)

Type species: ***Isaria farinosa*** (Holmsk.) Fr., Syst. mycol. (Lundae) **3**(2): 271 (1832)

Lecanicillium W. Gams & Zare, Nova Hedwigia **72**(3–4): 332 (2001)

Type species: ***Lecanicillium lecanii*** (Zimm.) Zare & W. Gams, in Gams & Zare, Nova Hedwigia **72**(3–4): 333 (2001)

Microhilum H.Y. Yip & A.C. Rath, J. Invert. Path. **53**(3): 361 (1989)

Type species: ***Microhilum oncoperae*** H.Y. Yip & A.C. Rath, J. Invert. Path. **53**(3): 362 (1989)

Pseudogibellula Samson & H.C. Evans, Acta bot. neerl. **22**(5): 524 (1973)

Type species: ***Pseudogibellula formicarum*** (Mains) Samson & H.C. Evans, Acta bot. neerl. **22**(5): 524 (1973)

Rotiferophthora **G.L. Barron**, *Can. J. Bot.* **69**(3): 495 (1991)

Type species: ***Rotiferophthora globospora*** G.L. Barron, Can. J. Bot. **69**(3): 495 (1991)

Simplicillium W. Gams & Zare, Nova Hedwigia 73(1–2): 38 (2001)

Type species: ***Simplicillium lanosiniveum*** (J.F.H. Beyma) Zare & W. Gams [as 'Simplicillium lanosoniveum'], (2001)

Syspastospora P.F. Cannon & D. Hawksw., J. Linn. Soc., Bot. 84(2): 152 (1982)

Type species: ***Syspastospora parasitica*** (Tul.) P.F. Cannon & D. Hawksw., J. Linn. Soc., Bot. 84(2): 152 (1982)

Torrubiella Boud., Revue mycol., Toulouse **7**: 226 (1885)

Type species: ***Torrubiella aranicida*** Boud., Revue mycol., Toulouse **7**: 226 (1885)

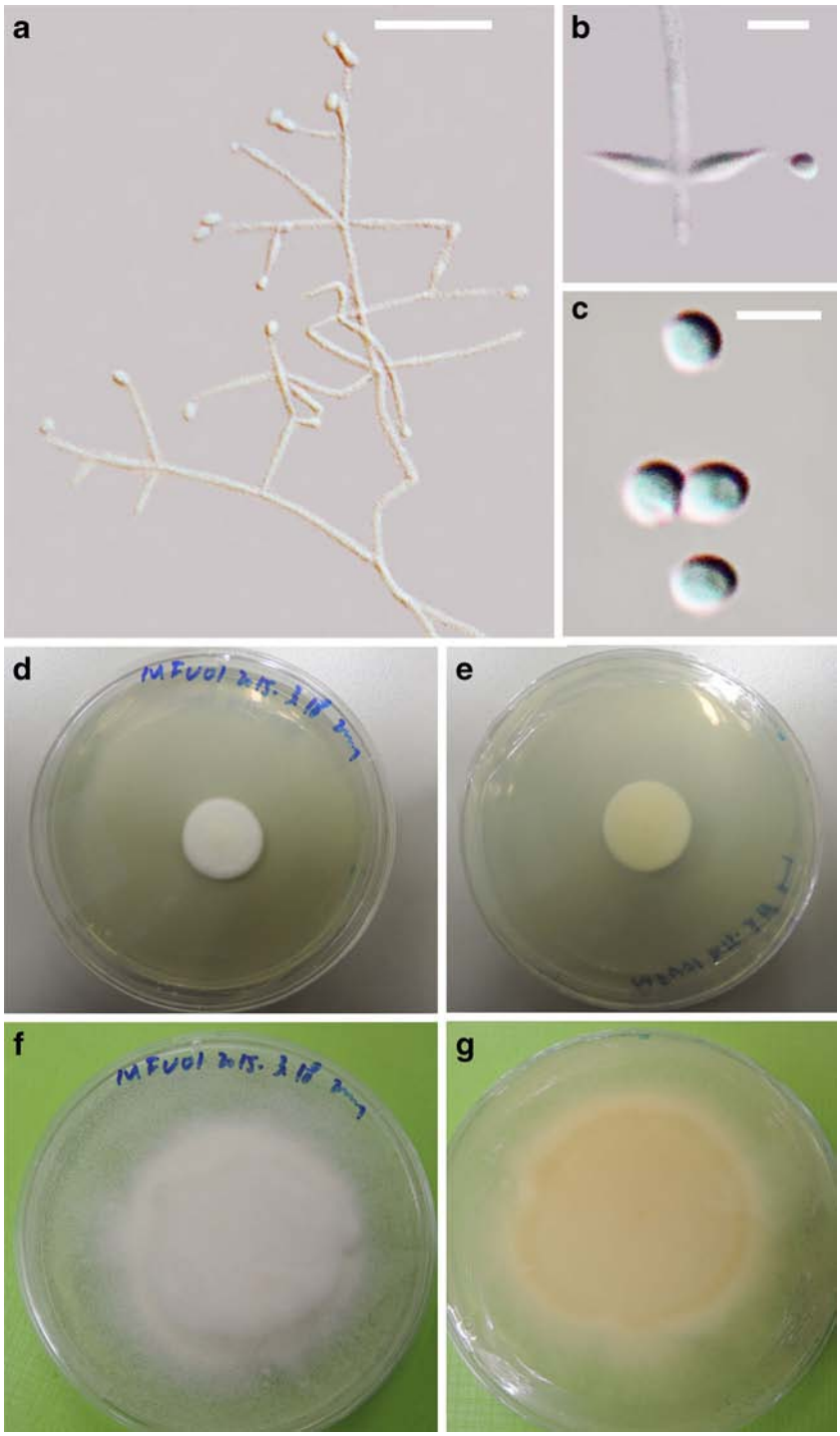


Fig. 48 ***Cordyceps militaris* - asexual morph** (Material examined: CHINA, Province of Liao-Ling, on dead larva. 28 February 2015, Yuan Pin Xiao MFLU) **a**, **b** Conidiophores and developing conidia **c** Conidia **d** Culture from above on PDA medium after 7 days **e** Culture from below on PDA medium after 7 days **f** Culture from above on PDA medium after 40 days **g** Culture from below on PDA medium after 40 days. Scale bars: **a** = 20 μm, **b**, **c** = 5 μm

Key to genera of *Cordycipitaceae*

1. Sexual morph 2
   1. Asexual morph 5
   2. On insects 3
   2. On insects hidden within plants or on plants 4
   3. Stromata with stipe . . . . . ***Cordyceps***
   3. Stromata without stipe . . . . . ***Torrubiella***
   4. Stromata with 1–3 perithecia per stroma ……...……***Hyperdermium***
   4. Stromata crowded . . . . . ***Ascopolyporus***
5. Always with synnemata, only on insects 6
5. Synnemata not present; on insects, nematodes, other micro fauna, or other fungi or mycetozoans in soil . . . 11
6. Vesiculate conidiophores arising from synnematous conidiomata 7

6. Conidiogenous cells lacking vesicles 8
7. Conidiogenous cells phialidic, on spiders . . . ***Gibellula***
7. Conidiogenous cells sympodial, with short denticles; on insects . . . . . ***Pseudogibellula***
8. Conidiogenous cells monophialidic 9
8. Conidiogenous cells polyphialidic . . . . . ***Beauveria***
9. Synnemata determinate, with a terminal capitulum of conidiophores, not on spiders 10
9. Synnemata indeterminate, with conidiophores emerging from an extended conidiogenous layer, on spiders ……..…***Akanthomyces***
10. Conidia produced in dry chains; phialidic; on insects .....***Isaria***
10. Conidia produced in slime masses; denticulate, on arthropods or in soil . . . . . ***Engyodontium***
11. No resting structures produced, not parasites of delloid rotifers 12
11. Resting structures formed, parasites of delloid rotifers ***Rotiferophthora***
12. Conidiogenous cells monoblastic or monophialidic, with a single conidiogenous locus 13
12. Conidiogenous cells polyblastic, producing conidia from more than one conidiogenous locus 15
13. Conidiophores with a single verticil; phialides pointed ……...14
13. Conidiophores with several layers of verticils, phialides flask-shaped . . . . . ***Isaria***
14. Phialides single, at right angles to subtending hyphae ……..…***Simplicillium***
14. Phialides usually in whorls of 2 or more, not at right angles to subtending hyphae ***Lecanicillium***
15. Rachis with an acropetal, zigzag sequence of slender denticles . . . . . ***Beauveria***
15. Rachis with more or less swollen portions of the conidiogenous cells . . . . . ***Microhilum***

Coronophoraceae Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 116: 624 (1907)

Facesoffungi number: FoF 01117

Saprobic on plant stems or wood in terrestrial habitats, or *parasitic* on other fungi. **Sexual morph**: *Ascomata* perithecial, gregarious or solitary, superficial, black, sub-immersed or erumpent through bark of host, ovoid to subglobose, carbonaceous, coriaceous or membranaceous, smooth, with tubercula or hairs, laterally collapsing when dry, short neck present or absent, with or without ostioles. *Peridium* thick (30–80 μm), composed of three layers, outer layer comprising dark tissues, thin (10–30 μm), carbonaceous; middle layer comprising dark brown to brown cells of *textura angularis*, thick (20–50 μm), membranaceous and the inner layer comprising hyaline cells of *textura prismatica*, thin (5–10 μm), membranaceous. *Hamathecium* composed of numerous, hyaline, septate, unbranched, filamentous paraphyses. *Asci* with numerous ascospores, unitunicate, thin-walled, clavate to cylindrical, long pedicellate, apex blunt, without an apical ring. *Ascospores* crowded, hyaline, cylindrical to allantoid, slightly curved, aseptate, smooth-walled, mostly with guttules. **Asexual morph**: Undetermined.

Coronophora Fuckel, Fungi rhenani exsic., fasc. 10: no. 961 (1864)

Facesoffungi number: FoF 01118, Fig. 49

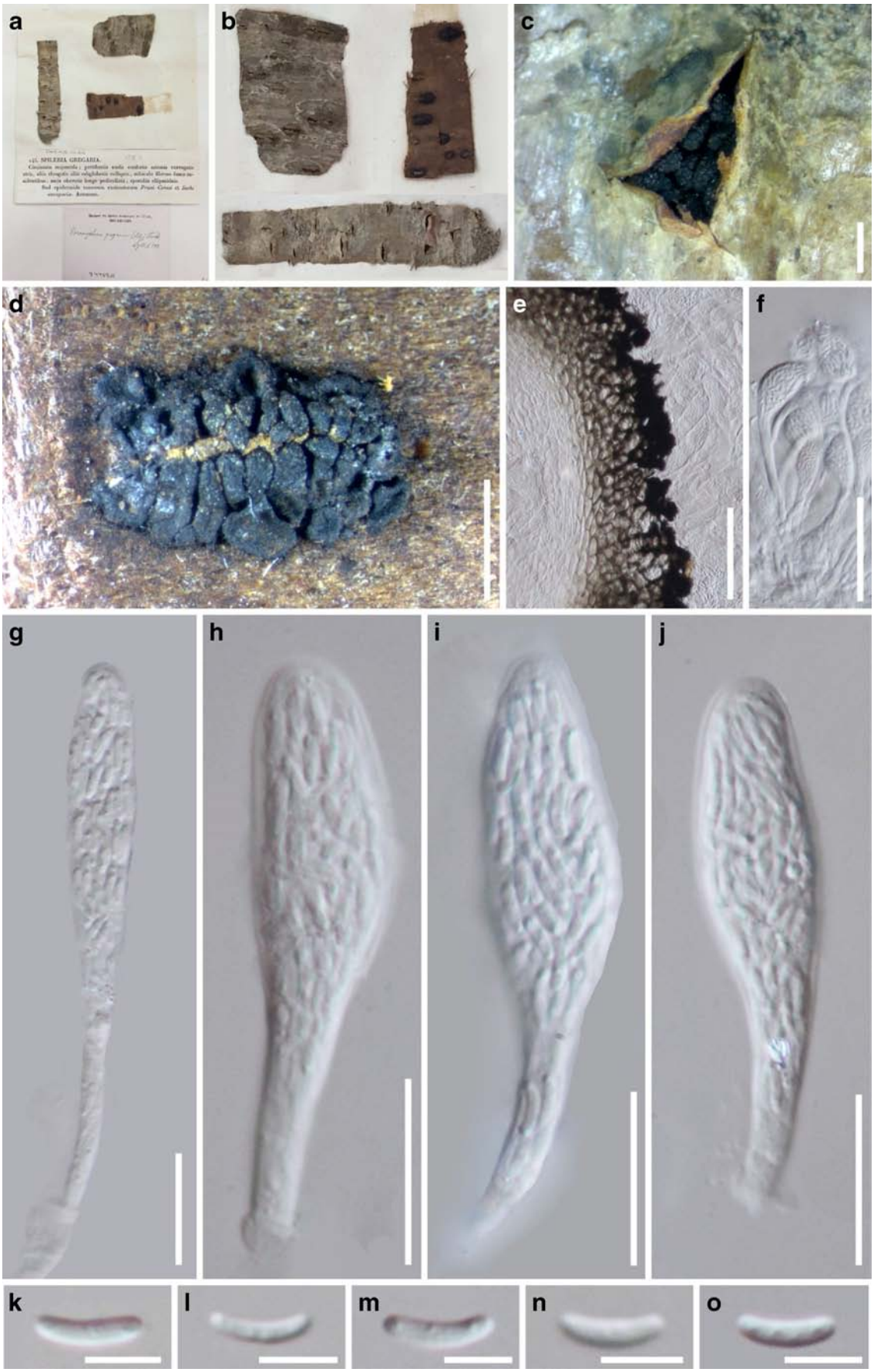
Type species: ***Coronophora gregaria*** Fuckel, Jb. nassau. Ver. Naturk. 23–24: 229 (1870) [1869–70]

Notes: The monotypic family *Coronophoraceae* was introduced by von Höhnel (1907). The family was placed in *Sordariales* based on lack of ostioles, while other characteristics were similar to *Lasiosphaeriaceae*, e.g. *Lasiosphaeria noonaedaniae* (Carroll and Munk 1964). *Coronophoraceae* was reported as a synonym of *Nitschkiaceae* and has been variously referred to *Coronophorales* or placed in the order *Sordariales* (Huhndorf et al. 2004b). Mugambi and Huhndorf (2010), used TEF and RPB2 sequence dataset, which included the type species, *C. gregaria*, to show that *Coronophoraceae* is a distinct family from *Nitschkiaceae*. The genus *Coronophora* was introduced by Fuckel (1864) and includes 26 epithets (Index Fungorum 2016). *Coronophora* is characterized by immersed, erumpent ascomata, clavate asci and allantoid ascospores. Although the family *Coronophoraceae* was reported as lacking ostioles (Carroll and Munk 1964), an ostiole is present in *C. consobrina* P. Karst. (Fuckel 1870).

Cryphonectriaceae Gryzenh. & M.J. Wingf., in Gryzenhout et al., Mycologia 98(2): 246 (2006)

Facesoffungi number: FoF 01382

Saprobic or *pathogenic* in forest trees and economic crops. **Sexual morph**: *Ascostromata* scattered, immersed or erumpent, aggregated, oval to circular from above, comprising two layers, outer layer of yellowish orange to light brown cells, purpling in KOH and inner layer of hyaline cells, mixed with plant cells. *Ascomata* immersed, aggregated, several in one stromata, globose to subglobose, brown, with long neck, or ostiolar canal sometimes immersed in stromatic tissues, or superficial, necks covered in umber stromatic tissue of *textura porrecta*, inner wall of the necks or ostiolar canal with hyaline, filamentous periphyses. *Peridium* comprising inner layer of small, hyaline cells of *textura angularis* and outer layer of small, brown cells of *textura angularis*. *Hamathecium* comprising a few cellular paraphyses and parenchymatous cells, attached at the base and asci dissolving at maturity. *Asci* 8-spored, unitunicate, cylindrical-fusoid to clavate, pedicellate, with distinct, J- refractive ring. *Ascospores* overlapping uniseriate to biseriate, oval to fusiform, 1-median-septate, rarely 2-septate, not constricted at the septa, hyaline, smooth-walled. **Asexual morph**: Coelomycetous. *Conidiomata* occurring as a part of ascomata as conidial locules or solitary structures, uni- to multi-loculate,


a
b
c
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◀ **Fig. 49** ***Coronophora gregaria*** (Material examined: BELGIUM, on bark of *Prunus cerasus* L. and *Sorbus aucuparia* L., Autumn, BR no. 5020094489111) **a** Material label **b** Host substrate **c** Ascomata erumpent through bark of host **d** Ascomata without bark of host **e** Peridium **f** Paraphyses with asci **g-j** Asci. **k-o** Ascospores. Notes: Figs d-f, h-n are strained in 3 % KOH. Scale bars: **d** = 2 mm, **c** = 1 mm, **e–f** = 50 μm, **g–j** = 20 μm, – = 5 μm

pyriform, subglobose to pulvinate, necks absent or present, if present, with one to several attenuated necks, superficial or semi-immersed, orange to fuscous-black. *Conidiophores* cylindrical, aseptate, hyaline, sometimes reduced to conidiogenous cells. *Conidiogenous cells* lining the inner cavity of the conidioma, phialidic, sometimes with inflated bases, ampulliform, inconspicuous, with attenuated or truncate apices, hyaline, smooth. *Conidia* minute, sometimes both micro and macro conidia present, broadly ellipsoid to fusoid, obovoid-cylindrical to allantoid, aseptate, hyaline.

Type: ***Cryphonectria*** (Sacc.) Sacc. & D. Sacc.

Notes: The family *Cryphonectriaceae* was introduced to accommodate the *Cryphonectria-Endothia* complex and other allied genera (Gryzenhout et al. 2006). This family is typified by *Cryphonectria parasitica* (Murrill) M.E. Barr, which is a serious pathogen causing chestnut blight. Members of this family can be distinguished from other families of *Diaporthales* by having orange stromatic tissues, which are purple in KOH and yellowing in lactic acid. Most members of this family are plant pathogens and form cankers, blights and dieback in economically important plants and forest trees. Castlebury et al. (2002), in a study based on LSU sequence data of a large number of genera in the *Diaporthales*, recognized six major lineages within the order, namely, *Gnomoniaceae sensu-stricto*, *Melanconidaceae sensu-stricto*, *Schizoparme* complex including the asexual genera *Coniella* and *Pilidiella*, *Cryphonectria-Endothia* complex (a precursor to the *Cryphonectriaceae*), *Valsaceae sensu-stricto*, and *Diaporthaceae sensu-stricto. Cryphonectriaceae* was formally established by Gryzenhout et al. (2006) when analyzing both LSU sequence data of fungal taxa in *Diaporthales*. Initially *Chrysoporthe*, *Rostraureum*, *Cryphonectria*, *Endothia* and *Amphilogia* were placed in the family. *Aurantiosacculus*, *Aurapex*, *Aurifilum*, *Celoporthe*, *Chrysocrypta*, *Chrysoporthe*, *Chrysoporthella*, *Cryptometrion*, *Diversimorbus*, *Endothiella*, *Foliocryphia*, *Holocryphia*, *Immersiporthe*, *Latruncellus*, *Luteocirrhus*, *Mastigosporella*, *Microthia*, *Prosopidicola* and *Ursicollum* have since been added to the family.

Cryphonectria (Sacc.) Sacc. & D. Sacc., Syll. fung. (Abellini) 17: 783 (1905)

Facesoffungi number: FoF 02105; Fig. 50

Saprobic or *pathogenic* on forest trees and economic crops. **Sexual morph**: *Ascostromata* comprising erumpent to superficial, orange epistromatic portion and immersed, hyaline, parenchymatous portion. *Ascomata* perithecial, immersed, globose to subglobose, 4–6 aggregated in a single stroma, with black to brown ostiole, ostiolar canal slender, covered with orange to fuscous-black stromatic tissue. *Hamathecium* aparaphysate, comprising parenchymatous tissues. *Asci* 8-spored, unitunicate, fusiform to cylindrical, apex blunt, base with small pedicel. *Ascospores* overlapping uniseriate or biseriate, hyaline, ellipsoid to fusiform, 1-septate. **Asexual morph**: Coelomycetous. *Conidiomata* eustromatic, erumpent, pyriform to pulvinate, orange to fuscous black, occurring in the same stroma as ascomata. *Conidiophores* cylindrical to bottle-shaped, unbranched, hyaline. *Conidiogenous cells* phialidic, simple or branched. *Conidia* hyaline, minute, generally ovoid to cylindrical, aseptate.

Type species: ***Cryphonectria parasitica*** (Murrill) M.E. Barr, Mycologia Memoirs 7: 143 (1978)

Notes: *Cryphonectria* is typified by *C. parasitica* the causal agent of chestnut blight (Anagnostakis 1987; Heiniger and Rigling 1994). This genus consists of 17 species (Index Fungorum 2016). Castlebury et al. (2002) showed some *Endothia* species to be the asexual morph of *Cryphonectria. Cryphonectria* was synonymized under *Endothia* (Kobayashi 1970), however Barr (1978) separated these two genera based on the variation of ascospore septation and stromatal morphology and transferred many *Endothia* species to *Cryphonectria. Cryphonectria parasitica*, *C. cubensis* (Bruner) Hodges and *C. eucalypti* M. Venter & M.J. Wingf. are serious pathogens of American chestnut and *Eucalyptus*. However, other taxa are saprobes (Roane et al. 1986).

Other genera included

Amphilogia Gryzenh.et al., Taxon 54(4): 1017 (2005)

Type species: ***Amphilogia gyrosa*** (Berk. & Broome) Gryzenh. et al., in Gryzenhout et al., Taxon 54(4): 1017 (2005)

Aurantiosacculus Dyko & B. Sutton, in Dyko et al., Mycologia 71(5): 922 (1979)

Type species: ***Aurantiosacculus eucalypti*** (Cooke & Massee) Dyko & B. Sutton, in Dyko et al., Mycologia 71(5): 922 (1979)

Aurapex Gryzenh. & M.J. Wingf., Mycologia 98(1): 112 (2006)

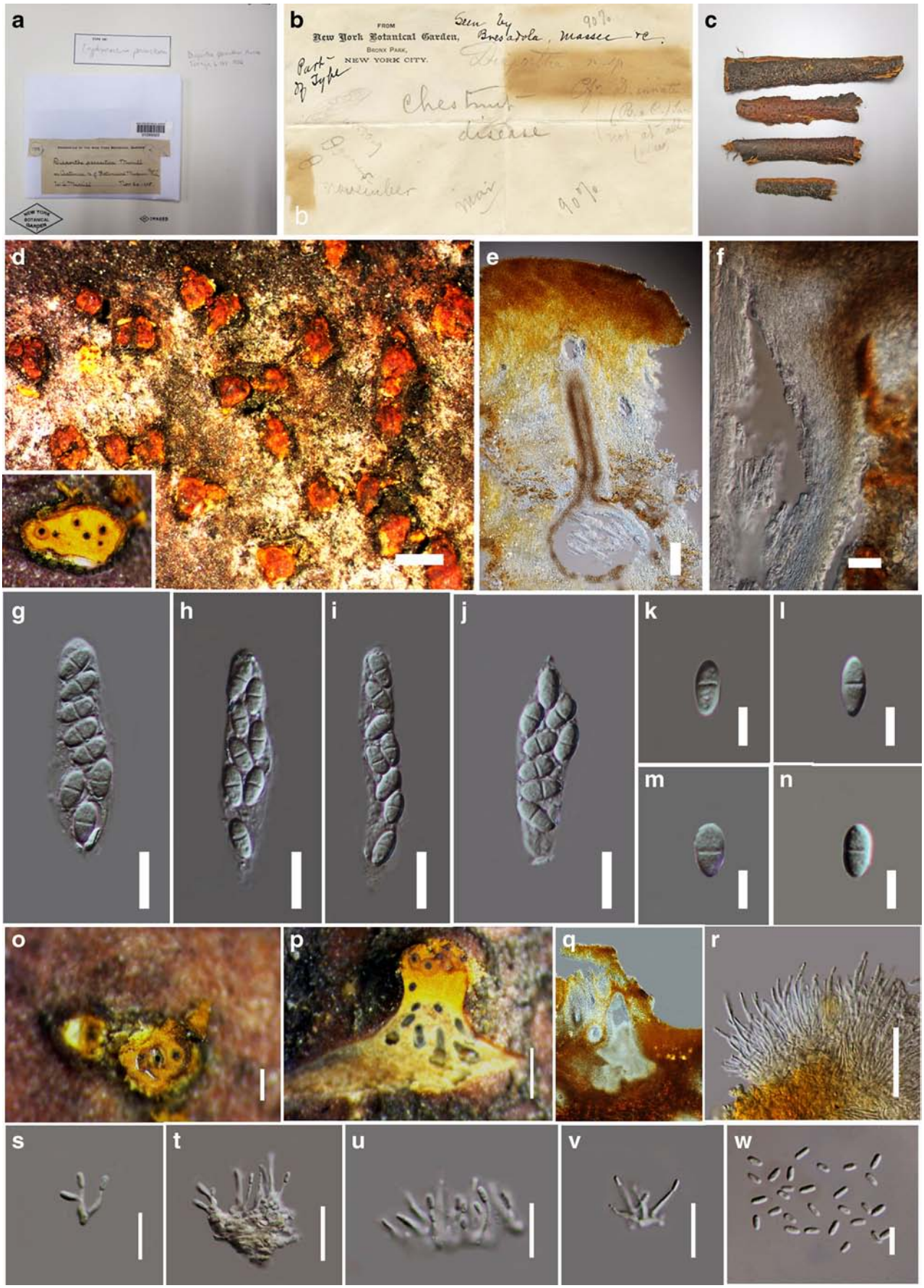
Type species: ***Aurapex penicillata*** Gryzenh. & M.J. Wingf., in Gryzenhout et al., Mycologia 98(1): 112 (2006)

Aurifilum Begoude et al., in Begoude et al., Antonie van Leeuwenhoek 98(3): 273 (2010)

Type species: ***Aurifilum marmelostoma*** Begoude et al., in Begoude et al., Antonie van Leeuwenhoek 98(3): 273 (2010)

Celoporthe Nakab. et al., Stud. Mycol. 55: 261 (2006)

Type species: ***Celoporthe dispersa*** Nakab.et al., in Nakab. et al., Stud. Mycol. 55: 261 (2006)


a
b
FROM
New York Botanical Garden,
BRONX PARK,
NEW YORK CITY.
Part of Type
Chestnut
disease
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d
e
f
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◀ **Fig. 50** ***Cryphonectria parasitica*** (Material examined: USA, New York. Bronx Co., Bronx, North of Botanical Museum, Bronx Park, on *Castanea dentata* (Marsh.) Borkh. (*Fagaceae*), 26 November 1905, W.A. Murrill, 01293321, 01293322 (NY, type of *Diaporthe parasitica*). **a**, **b** Herbarium packet **c** Herbarium specimen **d** Ascostromata on substrate and horizontal section of ascostroma **e** Cross section of ascoma **f** Peridium **g–j** Asci **k–n** Ascospores **o–p** Conidiostromata **q** Cross section of conidioma **r-v** Conidia attached to the conidiophores **w** Conidia. Scale bars: **d** = 1 cm, **e–f** = 100 μm, **g–n** = 10 μm, **o** = 200 μm, **p** = 500 μm, **q** = 100 μm, **r–w** = 10 μm

Chromendothia Lar.N. Vassiljeva, Mikol. Fitopatol. 27(4): 5 (1993)

Type species: ***Chromendothia appendiculata*** Lar.N. Vassiljeva, Mikol. Fitopatol. 27(4): 5 (1993)

Chrysocrypta P.W. Crous & B.A. Summerell, in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 28: 165 (2012)

Type species: ***Chrysocrypta corymbiae*** P.W. Crous & B.A. Summerell, in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 28: 165 (2012)

Chrysofolia Crous & M.J. Wingf., Persoonia, Mol. Phyl. Evol. Fungi 34: 207 (2015)

Type species: ***Chrysofolia colombiana*** Crous, Rodas & M.J. Wingf., Persoonia, Mol. Phyl. Evol. Fungi 34: 207 (2015)

Chrysoporthe Gryzenh. & M.J. Wingf., Stud. Mycol. 50(1): 129 (2004)

Type species: ***Chrysoporthe cubensis*** (Bruner) Gryzenh. & M.J. Wingf., in Gryzenhout et al., Stud. Mycol. 50(1): 130 (2004)

Cryptometrion Gryzenh. & M.J. Wingf., Australas. Pl. Path. 39(2): 166 (2010)

Type species: ***Cryptometrion aestuescens*** Gryzenh. & M.J. Wingf., Australas. Pl. Path. 39(2): 166 (2010)

Diversimorbus S.F. Chen et al., Fungal Biol. 117: 300 (2014)

Type species: ***Diversimorbus metrosiderotis*** S.F. Chen et al., Fungal Biol. 117: 301 (2014)

Endothia Fr., Summa veg. Scand., Section Post. (Stockholm): 385 (1849)

Type species: ***Endothia gyrosa*** (Schwein.) Berk. [as 'gyrosum'], Outl. Brit. Fung. (London): 384 (1860)

Foliocryphia Cheew. & Crous, Persoonia 23: 65 (2009)

Type species: ***Foliocryphia eucalypti*** Cheew. & Crous, Persoonia 23: 65 (2009)

Holocryphia Gryzenh. & M.J. Wingf., in Gryzenhout et al., Stud. Mycol. 55: 48 (2006)

Type species: ***Holocryphia eucalypti*** (M. Venter & M.J. Wingf.) Gryzenh. & M.J. Wingf., in Gryzenhout et al., Stud. Mycol. 55: 48 (2006)

Immersiporthe S.F. Chen et al., in Chen et al., Pl. Path. 62: 674 (2013)

Type species: ***Immersiporthe knoxdaviesiana*** S.F. Chen et al., in Chen et al., Pl. Path. 62: 674 (2013)

Lasmenia Speg., Anal. Soc. cient. argent. 22(4): 199 (1886)

Type species: ***Lasmenia balansae*** Speg. [as 'balanse'], Anal. Soc. cient. argent. 22(2): 152 (1886)

Latruncellus M. Verm. et al., in Vermeulen et al., Mycologia 103(3): 562 (2011)

Type species: ***Latruncellus aurorae*** M. Verm., et al., in Vermeulen et al., Mycologia 103(3): 562 (2011)

Luteocirrhus C. Crane & T.I. Burgess IMA Fungus 4(1): 115 (2013)

Type species: ***Luteocirrhus shearii*** C. Crane & T.I. Burgess IMA Fungus 4(1): 115 (2013)

Mastigosporella Höhn. Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 123: 135 (1914)

Type species: ***Mastigosporella hyalina*** (Ellis & Everh.) Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 123: 135 (1914)

Microthia Gryzenh. & M.J. Wingf., Stud. Mycol. 55: 44 (2006)

Type species: ***Microthia havanensis*** (Bruner) Gryzenh. & M.J. Wingf., in Gryzenhout, et al., Stud. Mycol. 55: 44 (2006)

Prosopidicola Crous & C.L. Lennox, Stud. Mycol. 50(1): '187' [191] (2004)

Type species: ***Prosopidicola mexicana*** Crous & C.L. Lennox, in Lennox et al., Stud. Mycol. 50(1): '187' [191] (2004)

Rostraureum Gryzenh. & M.J. Wingf., Mycol. Res. 109(9): 1039 (2005)

Type species: ***Rostraureum tropicale*** Gryzenh. & M.J. Wingf., Mycol. Res. 109(9): 1040 (2005)

Ursicollum Gryzenh. & M.J. Wingf., Stud. Mycol. 55: 44 (2006)

Type species: ***Ursicollum fallax*** Gryzenh. & M.J. Wingf., in Gryzenhout et al., Stud. Mycol. 55: 46 (2006).

Key to genera of *Cryphonectriaceae*

1. Conidiomata orange……. 2
1. Conidiomata uniformly brown to black, with or without orange necks……. 14
2. Sexual morph known……..... 3
2. Sexual morph not known……..... 17
3. Ascospores brown…….…….....…….. ***Chromendothia***
3. Ascospores hyaline…….....…… 4
4. Conidiomata pulvinate to globose, ascospores septate or aseptate…....…....…….....….. 5
4. Conidiomata conical, rostrate, pyriform or convex, with or without a neck, ascospores septate……..…..... 10
5. Ascospores septate…….....……..... 6
5. Ascospores aseptate…….……...…. 9
6. Ascostromata superficial, conidiomata paraphysate..... 7
6. Ascostromata erumpnt, conidiomata aparaphysate 8
7. Perithecia valsoid……..... ***Diversimorbus***

7. Perithecia diatrypoid…..............……..……… ***Microthia***
8. Conidiomata usually larger than 350 μm, uni- to multi-loculate, ascospores with median septum…….. ***Cryphonectria***
8. Conidiomata usually smaller than 350 μm diam, unilocular, ascospores with median to submedian septum……..…........….…..….…..…....….. ***Cryptometrion***
9. Stromata strongly developed, large, erumpent, mostly superficial, numerous conidial locules, no paraphyses ……………......…………………………....... ***Endothia***
9. Stromata small to medium, semi-immersed, few conidial locules or one convoluted locule, paraphyses present…………..............................……..........………… ***Holocryphia***
10. Conidiomata with necks, ……………………..……… 11
10. Conidiomata without necks, ….………............…… 13
11. Conidiomata with prominent, delimited neck…....... 12
11. Conidiomata with neck continuous with base, rostrate, white sheath of tissue surrounding perithecial necks.....……….…………….…………….……… ***Rostraureum***
12. Conidiomata rostrate to pyriform with large base, neck attenuated or not, sexual morph Undetermined .... ***Ursicollum***
12. Conidiomata conical with constricted, fattened neck, shaped like a chess pawn……...................…. ***Latruncellus***
13. Conidiomata conical, uniformly orange…. ***Amphilogia***
13. Conidiomata convex, with blackened ostiolar openings……………..….….…..….…....…..….……… ***Aurifilum***
14. Conidiomata uniformly black when mature…..….... 15
14. Conidiomata black with orange neck, teleomorph Undetermined……....…..…………………….….. ***Aurapex***
15. Sexual morph reported…………...………...……….. 16
15. Sexual morph not reported……….….…….…..……. 22
16. Conidiomata base tissue of *textura globulosa* when sectioned longitudinally, perithecial necks long and covered with dark tissue, emerging from orange stroma….…...…….….…....…….….…......… ***Chrysoporthe***
16. Conidiomata base tissue prosenchymatous, apices of conidiomata can be orange to scarlet when young, perithecial necks short, orange to umber stroma.…… ***Celoporthe***
17. Chlamydospores present……........……..… ***Lasmenia***
17. Chlamydospores absent…………………………… 18
18. Conidiomata pulvinate……………………..……… 19
18. Conidiomata globose to subglobose……..……..…. 20
19. Conidiomata uniloculate with necks.….…. ***Endothiella***
19. Conidiomata multi-loculate without necks …………………………………..........***Immersiporthe***
20. Conidiogenous cells subcylindrical to lageniform……….…….…….………….…….……. ***Aurantiosacculus***
20. Conidiogenous cells ampulliform……………....… 21
21Conidia fusoid-ellipsoid, apex acutely rounded…………………………………...….. ***Chrysocrypta***
21Conidia ellipsoid, straight to allantoids…... ***Chrysofolia***
22. Conidiophores brown………...……… ***Prosopidicola***
22 Conidiophores hyaline………..................………… 23
23. Conidiomata with one to four attenuated necks………...…..……………….…..… ***Chrysoporthella***
23. Conidiomata with or without necks……....………. 24
24. Conidiophores irregularly branched……. ***Foliocryphia***
24. Conidiophores unbranched…….….......................… 25
25. Conidia cylindrical or slightly allantoid……………………….………....... ***Luteocirrhus***
25. Conidia narrowly ellipsoid to fusiform….…………….…....………….... ***Mastigosporella***

Diaporthaceae Höhn. ex Wehm., Am. J. Bot. 13: 638 (1926)

Facesoffungi number: FoF 01383

Pathogenic, *endophytic* or *saprobic* on terrestrial and rarely submerged plants. **Sexual morph**: *Stromata* present or absent. If present, pulvinate, erumpent, flat or slightly convex, orbicular, circular or somewhat irregular, sclerotioid, subhyaline, stromatic disk coriaceous, whitish to brownish black, with or without black zone or a crust consisting of fungus tissue, solitary or containing up to 10 ascomata in a stroma. *Ascomata* perithecial, immersed to erumpent, solitary or aggregated in a valsoid configuration, globose or compressed, coriaceous, black, ostiolate, papillate. *Papilla* short or long, erumpent, convergent, cylindrical to conical, black, internal wall covered by hyaline periphyses, composed of vertically arranged parenchymatous tissues. *Peridium* comprising outer layer of flattened, thick-walled, dark brown cells of *textura angularis* and inner layer of hyaline, thin-walled cells of *textura angularis. Hamathecium* comprising septate, unbranched, cylindrical paraphyses, tapering upwards. *Asci* 8-spored, unitunicate, clavate, oblong-clavate to broadly fusoid, sessile, with a distinct apical ring. *Ascospores* biseriate to partially biseriate, ellipsoid, oblong to fusoid, unicellular or 1-septate, constricted at septum, with cap-like appendages at both ends or without appendages, hyaline, dark to blackish brown, sometimes narrowly rounded ends and multi-guttulate, smooth-walled. **Asexual morph**: *Conidiomata* acervular or pycnidial, globose, initially immersed, erumpent at maturity, solitary, scattered, coriaceous, black, elongated ostiolar neck, often with yellowish, conidial mass extruding from ostiole. *Peridium* comprising 3–4 layers of light brown cells of *textura angularis. Conidiophores* arising from the inner layer of the locule, ampulliform, cylindrical, straight to sinuous, septate, palisades, simple, branched, hyaline to pale brown, smooth, bearing conidia acrogenously. *Conidiogenous cells* enteroblastic, phialidic, cylindrical, terminal, slightly tapering towards the apex, sometime with a small collarette, determinate. *Alpha conidia* abundant, ovate, fusoid to ellipsoidal, aseptate, hyaline, smooth, base sub-truncate, straight to curved, occasionally slightly sigmoid, pale brown, aseptate, smooth, with many guttules, hyaline, sometimes with short

appendages at both ends. *Beta conidia* fusiform to hooked, aseptate, hyaline, smooth, base sub-truncate.

Type: ***Diaporthe*** Nitschke.

Notes: The family *Diaporthaceae* was established by von Höhnel (1917) and was accommodated in the order *Diaporthales*. Wehmeyer (1975) confined this family to include *Diaporthe* and *Mazzantia*. Later, *Diaporthaceae* was synonymized under *Valsaceae* (Barr 1978). However, analysis of LSU sequence data of diaporthalean taxa showed the distinct placement of *Diaporthaceae* in *Diaporthales* where it formed a well-supported clade. This family previously only accommodated *Diaporthe* (*Phomopsis*) and *Mazzantia* (Castlebury et al. 2002). *Pustulomyces*, isolated from decaying bamboo culms, was placed in *Diaporthaceae* by Dai et al. (2014b), based on combined analysis of LSU, SSU and TEF sequence data. The phylogenetic placement of *Phaeodiaporthe* has been confirmed within *Diaporthaceae* by Voglmayr and Jaklitsch (2014) based on analysis of LSU sequence data. Maharachchikumbura et al. (2015) listed *Allantoporthe*, *Apioporthella*, *Clypeoporthella*, *Diaporthe*, *Diaporthella*, *Leucodiaporthe*, *Mazzantia*, *Mazzantiella*, *Ophiodiaporthe* and *Pustulomyces* as genera of *Diaporthaceae*.

Diaporthe Nitschke, Pyrenomyc. Germ. 2: 240 (1870);

Facesoffungi number: FoF 02106 Fig. 51

Pathogenic, *endophytic* or *saprobic* on plants. **Sexual morph**: *Ascomata* perithecial, deeply immersed, aggregated, globose, subglobose or irregular, coriaceous, black, papillate, ostiolate. *Papilla* tapering towards the host surface, internally covered by hyaline, periphyses. *Peridium* comprising brown, thick-walled, cells of *textura angularis*. *Hamathecium* without paraphyses. *Asci* unitunicate, 8-spored, elongate to clavate, apex with distinct, J- apical ring, sessile. *Ascospores* overlapping uniseriate, elongated to elliptical, hyaline, 1-septate, often 4 guttulate, with larger guttules at center and smaller ones at the ends, smooth-walled. **Asexual morph**: *Conidiomata* pycnidia, globose, initially immersed, erumpent at maturity, black, elongated neck, often with yellowish conidial mass extruding from ostiole. *Peridium* comprising 3–4 layers of light brown cells of *textura angularis*. *Conidiophores* ampulliform, straight to sinuous, unbranched, hyaline, smooth. *Conidiogenous cells* phialidic, cylindrical, terminal, slightly tapering towards the apex. *Alpha conidia* abundant, ovate to ellipsoidal, aseptate, mostly biguttulate, hyaline, smooth, base sub-truncate. *Beta conidia* fusiform, aseptate, hyaline, smooth, base sub-truncate.

Type species: ***Diaporthe eres*** Nitschke, Pyrenomyc. Germ. 2: 245 (1870)

Notes: The genus *Diaporthe* was introduced by Nitschke (1867) to include taxa in the *Sphaeriales* with stromata often with blackened zones in the substrate, ellipsoid to fusiform ascospores and enclosed, unilocular pycnidia that contain spermatia, stylospores and conidia (Wehmeyer 1933). *Diaporthe* has a worldwide distribution and the species are saprobes, pathogens and endophytes. *Phomopsis* was previously known as the asexual morph and as these genera were linked Udayanga et al. 2012a, b; 2014). Rossman et al. (2015) based on principle of priority gave *Diaporthe* over *Phomopsis*, to resolve nomenclatural problems.

Other genera included

Allantoporthe Petr., Hedwigia 62: 289 (1921)

Type species: ***Allantoporthe tessella*** (Pers.) Petr., Hedwigia 62: 289 (1921)

Apioporthella Petr., Annls mycol. 27(5/6): 401 (1929)

Type species: ***Apioporthella bavarica*** Petr., Annls mycol. 27(5/6): 401 (1929)

Clypeoporthella Petr., Annls mycol. 22(1/2): 149 (1924)

Type species: ***Clypeoporthella brencklei*** Petr., Annls mycol. 22(1/2): 149 (1924)

Diaporthella Petr., Annls mycol. 22(1/2): 30 (1924)

Type species: ***Diaporthella aristata*** (Fr.) Petr., Annls mycol. 22(1/2): 30 (1924)

Leucodiaporthe M.E. Barr & Lar.N. Vassiljeva, in Vasilyeva, Rossman & Farr, Mycologia 99(6): 917 (2008) [2007]

Type species: ***Leucodiaporthe acerina*** M.E. Barr & Lar.N. Vassiljeva, Mycologia 99(6): 919 (2008) [2007]

Mazzantia Mont., Bull. Soc. bot. Fr. 2: 525 (1855)

Type species: ***Mazzantia galii*** (Fr.) Mont., Syll. gen. sp. crypt. (Paris): 246 (1856)

Ophiodiaporthe Y.M. Ju et el., Mycologia 105(4): 868 (2013)

Type species: ***Ophiodiaporthe cyatheae*** Y.M. Ju et al., Mycologia 105(4): 868 (2013)

Phaeodiaporthe Petr., Annls mycol. 17(2/6): 99 (1920) [1919]

Type species: ***Phaeodiaporthe keissleri*** Petr., Annls mycol. 17(2/6): 99 (1920) [1919]

Pustulomyces D.Q. Dai et al., in Dai et al., Cryptog. Mycol. 35(1): 64 (2014)

Type species: ***Pustulomyces bambusicola*** D.Q. Dai et al., in Dai et al., Cryptog. Mycol. 35(1): 64 (2014)

Stenocarpella Syd. & P. Syd., Annls mycol. 15(3/4): 258 (1917)

Type species: ***Stenocarpella zeae*** Syd. & P. Syd., Annls mycol. 15(3/4): 258 (1917)

Key to genera of *Diaporthaceae*

1. Coelomycetes 2
   1. Ascomycetes 3
   2. Conidia elongate fusiform to sigmoid. . . ***Pustulomyces***

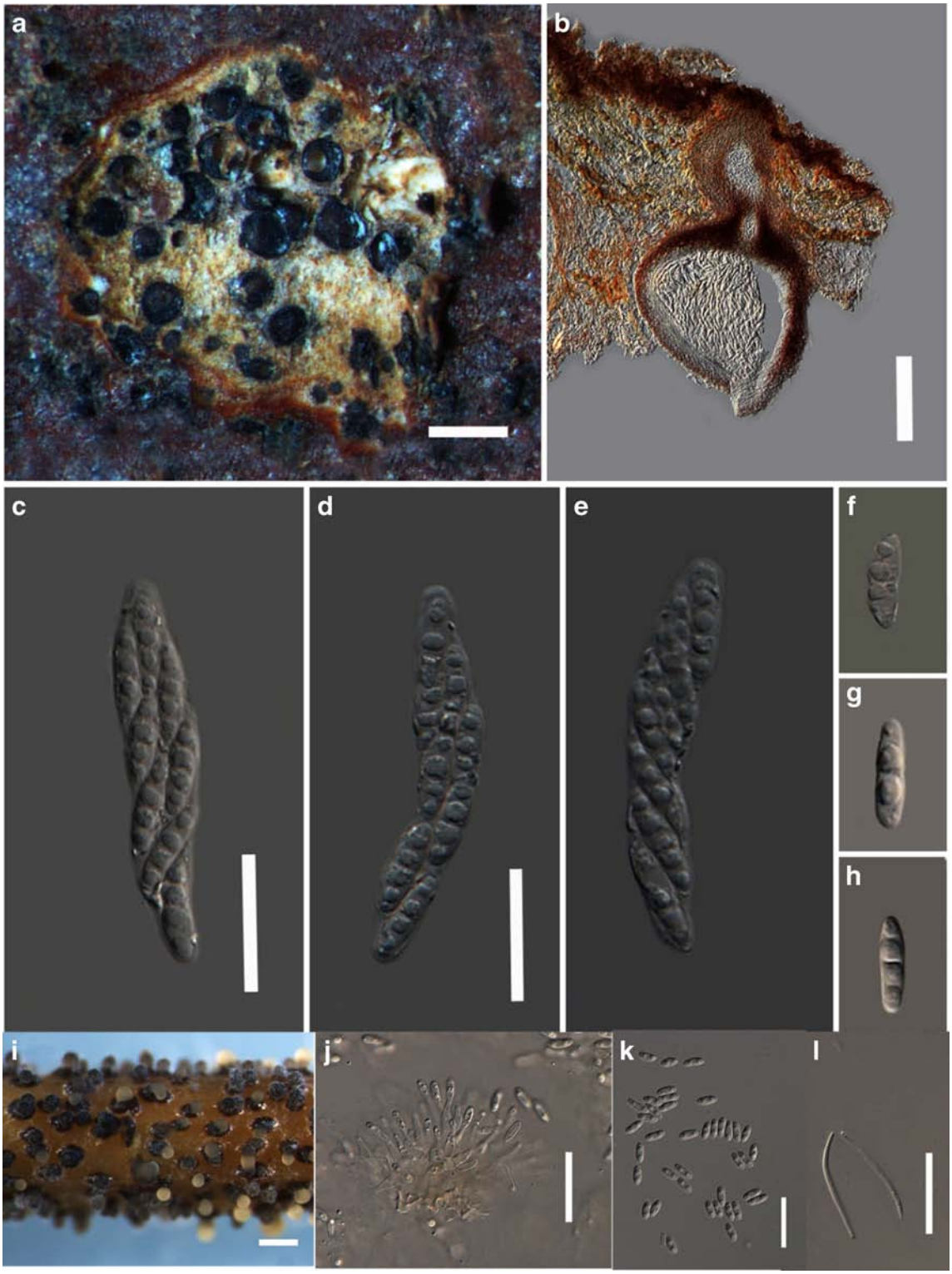

Fig. 51 ***Diaporthe eres*** (Material.: B 70 0009145 **lectotype** specimen (**a-h**) see Udayanga et al. 2014 for details (**i–l**) Ar5193, ex-epitype) **a** Ascomata on substrate **b** Cross section of ascoma **c–e** Asci **f–h** Ascospores **i** Conidiomata **j** Conidia attached to the conidiogenous cells **k** Alpha conidia **l** Beta conidia. Scale bars: **a** = 500 μm, **b** = 100 μm, **c–e, i–l** = 20 μm, **f–h** = 10 μm

2. Conidia subcylindrical to narrowly ellipsoid ……..…….... ***Stenocarpella***
3. Ascomata solitary……...……. ***Clypeoporthe***
3. Ascomata aggregated…….....….. 4
4. Stromata without blackened zone in substrate and brownish stromatic disk.....… .....***Diaporthella***

4. Stromata with blackened zone in substrate and brown to blackish stromatic disk.…..... 5
5. Ascospores brown…….....…..... ***Phaeodiaporthe***
5. Ascospores hyaline…..…… 6
6. Septa submedian……..... ***Apioporthella***
6. Septa median……..…….....…… 7
7. Ascomata more than 20 in a stromata…….....… 8
7. Ascomata 1 to very few(less than 20) in a stromata……..…….....…….....…… 9
8. Ascospores overlapping uniseriate, elongate to elliptical, often with 4-guttules, larger guttules at the center and smaller ones at the ends…….....…… ***Diaporthe***
8. Ascospores biseriate, fusoid, without guttules…..... ***Allantoporthe***
9. Ascospores bi-celled…….....…… ***Ophiodiaporthe***
9. Ascospores unicellular…….....…….. 10
10. Asci oblong-clavate, ascospores elliptic to fusoid ……..……..... 11
10. Ascospores ovoid…..…… ***Leucodiaporthe***
11. Perithecia with long neck…..…….. ***Clypeoporthella***
11. Perithecia with very short or almost lacking neck …….....…….....***Mazzantia***

Diatrypaceae Nitschke [as 'Diatrypeae'], Verh. naturh. Ver. preuss. Rheinl. 26: 73 (1869)

Facesoffungi number: FoF 00679

Saprobic or *pathogenic* on woody plants in terrestrial and aquatic habitats. **Sexual morph**: *Stromata* eustromatic or pseudostromatic, well-developed, immersed to erumpent, rarely superficial, mostly black or dark brown, with somewhat carbonaceous outer layer, inner layer pale, loosely packed, parenchymatous. *Ascomata* perithecial, immersed in stromatic tissues, mostly brown to black, globose to sub-globose, with ostiolar necks. *Ostioles* sulcate, inner layer covered with hyaline, periphyses. *Peridium* consists of two layers, an inner hyaline layer and an outer layer of brown to black cells of *textura angularis*. *Hamathecium* comprising long, wide, branched, septate, paraphyses. *Asci* 8-spored or polysporous, rarely 1-spored or 2-spored, unitunicate, cylindrical, clavate to pyriform, fusiform, with a very long stalk, with a more or less truncate apex, with a J- or J+ apical ring. *Ascospores* crowded, most hyaline to light brown, rarely jet-black, allantoid, ellipsoidal, globose or filiform. **Asexual morph**: Coelomycetous, non stromatic, occurring on host as acervuli. *Conidiomata* acervuli sub cortical, erumpent, yellow to red, with branched conidiophores and in culture as pycnidia, superficial, solitary or aggregated, yellow, dark brown to black, subconical, globose to subglobose, and thick peridium, comprising brown, thick-walled cells of *textura angularis* with branched conidiophores, arising from pseudoparenchymatous cells or interwoven hyphae. *Conidiogenous cells* in dense palisades, cylindrical, straight or curved, apically distorted or annulated. *Conidia* filiform, curved, or rarely straight with flattened base and blunt apex, hyaline. (Pollack and Uecker 1974; Hyde and Jones 1992; Klaysuban et al. 2014; Senanayake et al. 2015)

Type: ***Diatrype*** Fr., Summa veg. Scand.

Notes: The family *Diatrypaceae* was typified by *Diatrype*. It is characterized by perithecial ascomata embedded in a black stroma, long stalked asci and allantoid ascospores (Glawe and Rogers 1984; Rappaz 1987). It comprised 15 genera: *Anthostoma*, *Cryptosphaeria*, *Cryptovalsa*, *Diatrype*, *Diatrypella*, *Diatrypasimilis*, *Echinomyces*, *Eutypa*, *Eutypella*, *Leptoperidia*, *Monosporascus*, *Pedumispora*, *Peroneutypa*, *Phaeoisaria* and *Quaternaria* in Maharachchikumbura et al. (2015). Detailed taxonomic reviews for the family were provided by Trouillas et al. (2011) and Mehrabi et al. (2015) and sequence data is lacking for only *Echinomyces*, *Leptoperidia*, *Peroneutypa* and *Quaternaria* (Senanayake et al. 2015). Recent papers with sequence data providing backbones trees are Carmaran et al. (2006) and Trouillas et al. (2010). The placement of species in genera is very confused with many genera being polyphyletic and the family is in need of a thorough monographic revision based on molecular data and morphology. These fungal taxa produce extracellular ligninolytic enzymes, cellulose and catalyse the hydrolysis of cellulose, break down of lignin in the cell walls of plants. Therefore, some species in the family have the physiological capacity in decay wood (Trouillas et al. 2011; Mehrabi et al. 2015).

Diatrype Fr., Summa veg. Scand., Section Post. (Stockholm) 384 (1849)

Facesoffungi number: FoF 00702 Figs 52, 53

Saprobic on bark of woody hosts. **Sexual morph**: *Stromata* scattered or aggregated on host, sometime spread on large area of host, erumpent to superficial, orbicular, disc-like plane or convex, sometime spread on host evenly, arising through the cracks in bark or epidermis or spread beneath the epidermis, edges of cracks remaining as pointed, angular parts, with numerous perithecia immersed in one stroma, ostiole opening through host bark and appearing as black spots, composed of an outer layer of dark brown, small, tightly packed, thin parenchymatous cells and an inner layer of yellowish white, large, loosely packed, parenchymatous cells. *Ascomata* perithecia, immersed in stromatic tissues, aggregated, pale brown, globose to sub-globose, narrowing towards the apex and very narrow at the base of ostiolar canal, thin walled, ostiolate. *Ostiolar canal*, periphysate, ostiolar opening covered with carbonaceous, black cells, apex wider than base. *Periphyses* hyaline, filamentous, short, bent towards the cavity. *Peridium* thin, comprising an outer layer of brown, thick walled cells of *textura angularis* and a thin, inner strata of hyaline, thick walled cells of *textura angularis*. *Paraphyses* arising from base of perithecia, composed of long, wide, globose to ovoid thin-walled cells, branched, septate, and slightly constricted at septa, narrowing and tapering towards the apex,

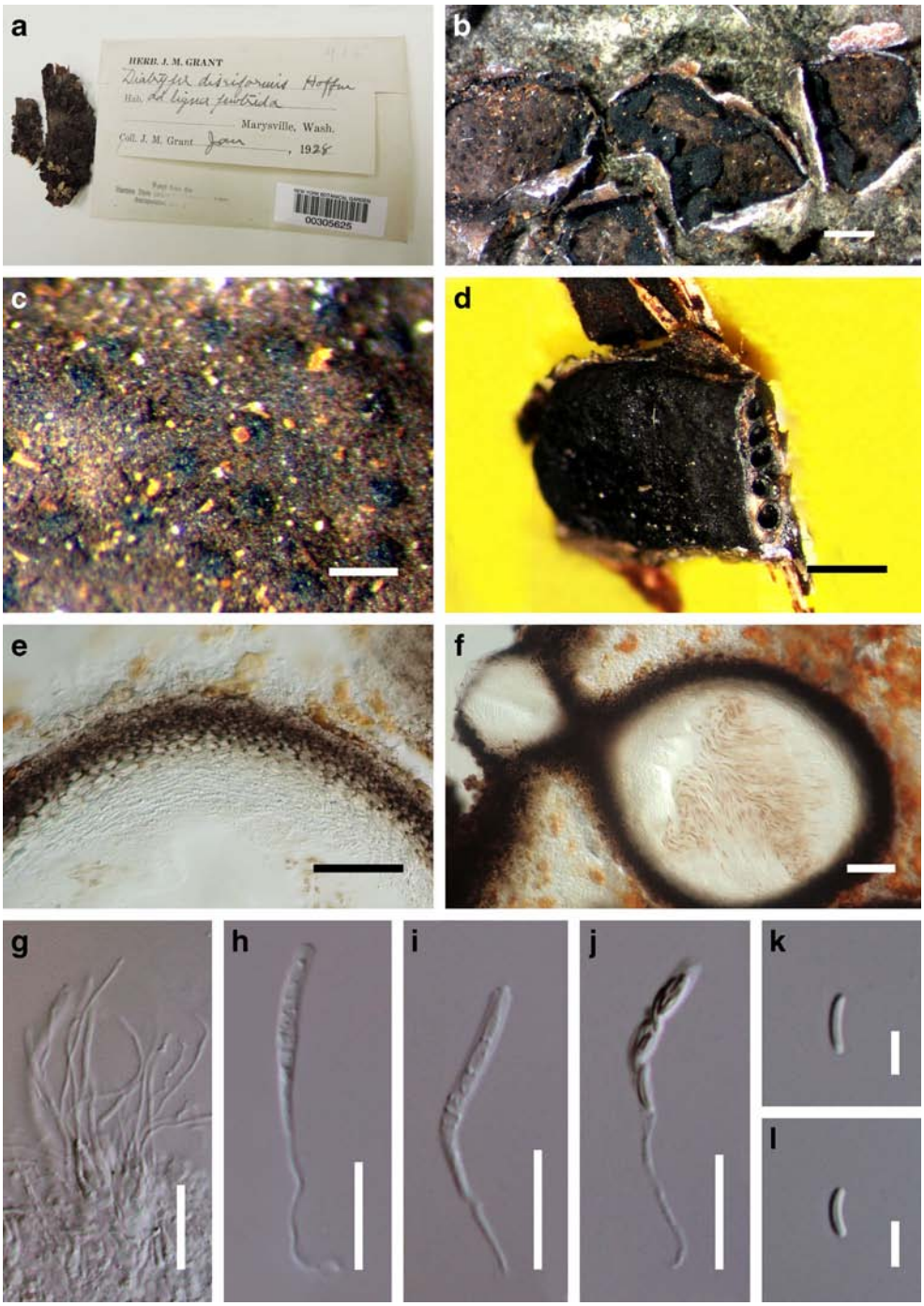

Fig. 52 ***Diatrype disciformis*** **(**Material examined: USA, Washington, Snohomish Co. Marysville. J.M. Grant, January 1928, NY 00305625**) a** Herbarium material **b** Stromata on substrate **c** Ostioles appear on stroma **d** Ascomata formed in a stroma **e** Peridium **f** Cross section of ascoma **g** Paraphyses **h–j** Asci **k–l** Ascospores. Scale bars: **b–c** = 1000 μm, **d** = 200 μm, **e–f** = 50 μm, **g–j** = 15 μm, **k–l** = 5 μm

apex blunt. *Asci* unitunicate, 8-spored, with very long, narrow, thin walled stalk, with cylindrical, thick walled, swollen upper portion, apex flat, with J-, cylindrical, conspicuous apical ring, attached to the base by stalk. *Ascospores* biseriate, hyaline, allantoid, unicellular, thin walled, with small, fat globules at each end, smooth walled. **Asexual morph**: *Conidiomata* appears as brownish yellow, watery, bubble-like, conidial mass rounded from white, mycelia clumps, pycnidial, superficial, solitary or aggregated, subconical, yellow, dark brown to black, globose to subglobose, shiny, smooth surface. *Peridium* thick, consisting of brown, thick-walled, *textura angularis* cells. *Conidiophores* branched, arising from pseudoparenchymatous cells or interwoven hyphae. *Conidiogenous cells* dense palisades, cylindrical, straight or curved, apically distorted or annulated. *Conidia* filiform, curved or rarely straight with flattened base and blunt apex, hyaline. (Senanayake et al. 2015)

Type species: ***Diatrype disciformis*** (Hoffm.) Fr., Summa veg. Scand., Section Post. (Stockholm): 385 (1849)

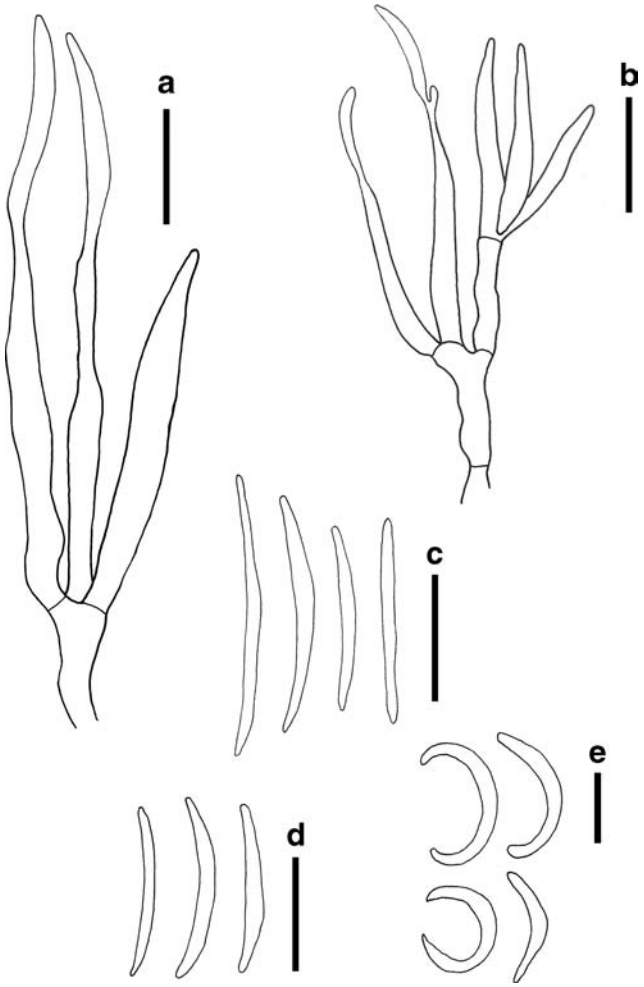

Fig. 53 Asexual morph of *Diatrype* (a, b, d *Libertella betulina*, taken from Sutton 1980; c *Diatrype subaffixa*, taken from Chlebicki and Krzyzanowska 1995; e *Diatrype disciformis*, taken from Rappaz 1987) **a**, **b** conidiophore **c**–**e** conidia. Scale bars: **a**–**e** = 10 μm

Notes: *Diatrype* was established by Fries (1849) with *Diatrype disciformis* (Hoffm.) Fr. as the type species. It commonly inhabits decaying wood. A few species are reported as pathogens that form cankers on forest trees (Senanayake et al. 2015). Species in this genus are quite resistant to harsh conditions. The asexual morph of *Diatrype* is reported as *Libertella*-like and *Dumortieria*-like (Kirk et al. 2008; Wijayawardene et al. 2012; Senanayake et al. 2015).

Other genera included

Anthostoma Nitschke, Pyrenomyc. Germ. 1: 110 (1867)

Type species: ***Anthostoma decipiens*** (DC.) Nitschke, Pyrenomyc. Germ. 1: 111 (1867)

Cryptosphaeria Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 231 (1863)

Type species: ***Cryptosphaeria millepunctata*** Grev., Fl. Edin.: 360 (1824)

Cryptovalsa Ces. & De Not. ex Fuckel, Jb. nassau. Ver. Naturk. 23–24: 212 (1870) [1869–70]

Type species: ***Cryptovalsa protracta*** (Pers.) De Not., Sfer. Ital.: 40 (1863)

Diatrypella (Ces. & De Not.) De Not. Sfer. Ital.: 29 (1863)

Type species: ***Diatrypella verruciformis*** (Ehrh.) Nitschke 1867

Diatrypasimilis J.J. Zhou & Kohlm.et al. Mycologia 102(2): 432 (2010)

Type species: ***Diatrypasimilis australiensis*** J.J. Zhou & Kohlm., et al., Mycologia 102(2): 432 (2010)

Echinomyces Rappaz, Mycol. helv. 2(549): 547 (1987)

Type species: ***Echinomyces obesa*** (Syd.) Rappaz, Mycol. helv. 2(3): 548 (1987)

Eutypa Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 52 (1863)

Type species: ***Eutypa lata*** (Pers.) Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 56 (1863)

Eutypella (Nitschke) Sacc., Atti Soc. Veneto-Trent. Sci. Nat., Padova, Sér. 4 4: 80 (1875)

Type species: ***Eutypella cerviculata*** (Fr.) Sacc., Syll. fung. (Abellini) 1: 146 (1882)

Leptoperidia Rappaz, Mycol. helv. 2(547): 544 (1987)

Type species: ***Leptoperidia macropunctata*** (Rehm) Rappaz, Mycol. helv. 2(3): 545 (1987)

Monosporascus Pollack & Uecker, Mycologia 66(2): 348 (1974)

Type species: ***Monosporascus cannonballus*** Pollack & Uecker, Mycologia 66(2): 348 (1974)

Pedumispora K.D. Hyde & E.B.G. Jones, Mycol. Res. 96(1): 78 (1992)

Type species: ***Pedumispora rhizophorae*** K.D. Hyde & E.B.G. Jones, Mycol. Res. 96(1): 78 (1992)

Peroneutypa Berl., Icon. fung. (Abellini) 3(3–4): 80 (1902)

Type species: ***Peroneutypa bellula*** (Desm.) Berl., Icon. fung. (Abellini) 3(3–4): 81 (1902)

Phaeoisaria Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 330 [56 repr.] (1909)

Type species: ***Phaeoisaria bambusae*** Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 329 [55 repr.] (1909)

Quaternaria Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 104 (1863)

Type species: ***Quaternaria persoonii*** Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 105, tab. 12, fig. 16–25 (1863).

Key to genera of *Diatrypaceae*

1. Sexual morph 2
   1. Asexual morph: hyphomycetous forming synnemata with hyaline or coloured, ovoid to ellipsoidal, aseptate conidia . . . . . ***Phaeoisaria***

2. Ascospores globose, elongate fusiform, or oblong to ellipsoidal 3
2. Ascospores allantoid 5
3. Ascospores elongate fusiform, septate ***Pedumispora***
3. Ascospores aseptate 4
4. Ascospores globose, with 1–2 spores in each ascus ***Monosporascus***
4. Ascospores oblong to ellipsoidal, with 8 spores in each ascus . . . . . ***Diatrypasimilis***
5. Asci with more than 8 spores 6
5. Asci with 8 spores 7
6. Ascostromata erumpent through host surface, discoid. . . . . ***Diatrypella***
6. Ascostromata immersed, erumpent through host surface by sulcate ostioles, eutypoid. . . . . ***Cryptovalsa***
7. Ascostromata semi-immersed to erumpent through the host periderm (ectostromatic) 8
7. Ascostromata deeply immersed in the host periderm (entostromatic) 10
8. Ascomata erumpent through the ectostromata, with long cylindrical, prominent ostioles in the center ***Anthostoma***
8. Ascomata immersed in pustulate, effuse, acervuloid, or discoid ectostromata. 9
9. Ectostromata composed of carbonaceous cells, acervuloid . . . . . ***Echinomyces***
9. Ectostromata composed of pseudoparenchymatous cells, discoid . . . . . ***Diatrype***
10. Ascomata clustered, forming valsoid configuration, breaking through entostroma by short to long necks. . 11
10. Ascomata scattered, arranged in linear entostroma, with short to long necks. 12
11. Entostromata slightly raised on the host, with long cylindrical, packed necks . . . . . ***Eutypella***
11. Entostromata immersed in the host, with, individually, protruding necks at the center. . . . . ***Quaternaria***
12. Ascomata forming very long necks, through the host surface . . . . . ***Peroneutypa***
12. Ascomata forming short papilla protruding the host surface 13
13. Peridium thin-walled, composed of a single layer of melanized cells, difficult to separate from the entostroma. . . . . ***Leptoperidia***
13. Peridium thick-walled, compose of two distinct layers, separating from entostroma 14
14. Asci generally spindle-shaped, with sub-olivaceous to brown ascospores. . . . . ***Cryptosphaeria***
14. Asci cylindric-clavate, with pale yellow ascospores. . . . . ***Eutypa***

Etheirophoraceae Rungjind. et al., in Jones et al., Cryptog. Mycol. 35(2): 134 (2014)

Facesoffungi number: FoF 01281

Saprobic on intertidal wood and bark in marine habitats. **Sexual morph**: *Ascomata* subglobose to globose or pyriform, light brown to dark brown or black, immersed, oblique or vertical to the host surface, clypeate, coriaceous, ostiolate, periphysate, papillate. *Peridium* comprising several layers of brown to dark brown cell layers of *textura angularis*. *Paraphyses* numerous, hyaline, mostly unbranched, attached to the apex of the ascomatal cavity, in a gelatinous matrix. *Asci* 8-spored, unitunicate, thin-walled, cylindrical to oblong, pedicellate, J-, persistent. *Ascospores* 1–2-seriate, hyaline, ellipsoidal, 1-many septate, constricted at the septa, with a filamentous appendage at one or both ends. *Appendages* bristle-like, origin undetermined. **Asexual morph**: Undetermined.

Type: ***Etheirophora*** Kohlm. & Volkm.-Kohlm.

Notes: This family was introduced to accommodate the genera *Etheirophora* (*E. bijubata* Kohlm. & Volkm.-Kohlm., *E. blepharospora* Kohlm. and Volkm.-Kohlm., *E. unijubata* Kohlm. & Volkm.-Kohlm.) and *Swampomyces* Kohlm. & Volkm.-Kohlm. (*S. armeniacus* Kohlm. & Volkm.-Kohlm., *S. triseptatus* K.D. Hyde & Nakagiri), which grouped together in a well-supported clade in an analysis of LSU and SSU sequence data (Jones et al. 2014). However, the genera *Etheirophora* and *Swampomyces* are not congeneric. They form a sister clade with *Falcocladium* species (*Falcocladiaceae*) in an unsupported clade in Hypocreomycetidae, order *incertae sedis*. This was also shown by Maharachchikumbura et al. (2015) in an enlarged data set. Subsequently, Jones et al. (2015) introduced the order *Torpedosporales* to accommodate the families *Etheirophoraceae*, *Juncigenaceae* and *Torpedosporaceae*. The order *Torpedosporales* forms a sister clade to the orders *Falcocladiales*, *Coronophorales* and *Melanosporales* with high statistical support.

Etheirophora Kohlm. & Volkm.-Kohlm., Mycol. Res. 92(4): 414 (1989)

Facesoffungi number: FoF 02107; Fig. 54

Saprobic on dead mangrove wood and bark. **Sexual morph**: *Ascomata* immersed in wood, solitary, light coloured or dark brown to black, subglobose to globose or pyriform, elongate, clypeate, coriaceous, ostiolate, papillate, periphysate. *Peridium* composed of several layers of brown to dark brown cells of *textura angularis*. *Paraphyses* numerous, septate, rarely branched in a gelatinous matrix, hyaline. *Asci* 8-spored, unitunicate, thin-walled, persistent, cylindrical to oblong, pedicellate, J⁻, sometimes apically thickened. *Ascospores* 1–2-seriate, clavate, ellipsoidal, 1–3-septate, hyaline, some slightly constricted at the septa, with or without appendages. **Asexual morph**: Undetermined.

Type species: ***Etheirophora bijubata*** Kohlm. & Volkm.-Kohlm., Mycol. Res. 92(4): 414 (1989)

Notes: Kohlmeyer and Volkmann-Kohlmeyer (1989) introduced the genus *Etheirophora* (type species *E. bijubata*) to

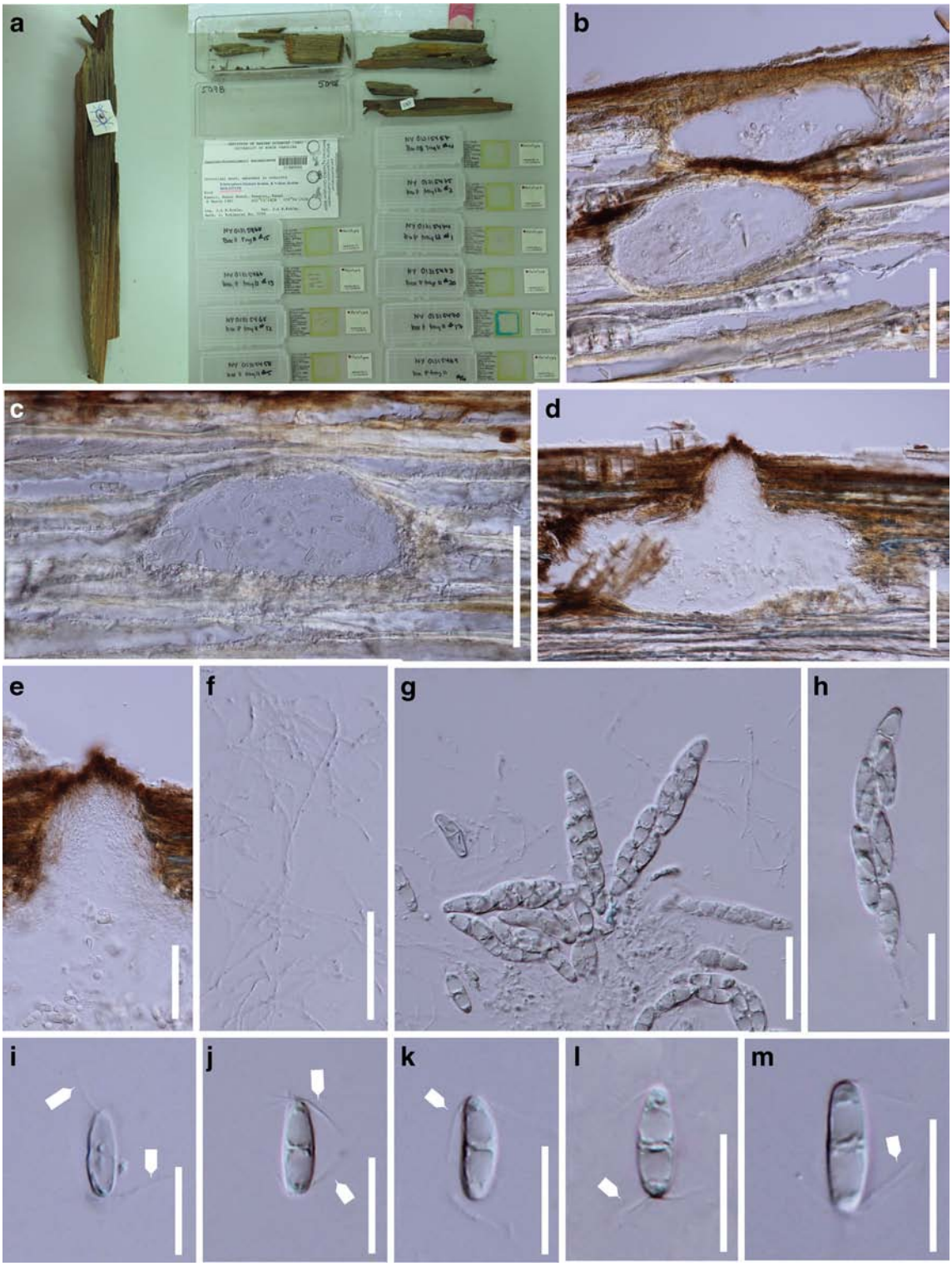

Fig. 54 ***Etheirophora bijubata*** (Material examined: USA, Hawaii, Haena Beach, Hanalei, Kauai (Pacific Ocean), 22° 13′ 18″N, 159° 34′ 16″W (22.222, −159.571), intertidal wood embedded in concrete, collected by J. Kohlmeyer 5098 with B. Kohlmeyer; 8 May 1987, NY 01315470, microslide from **holotype**) **a** Herbarium material label **b–d** Ascomata cross sections **e** Section of apical region of ascoma **f** Paraphyses **g–h** Asci **i–m** Ascospores with apical appendages. Scale bars: **b–d** = 100 μm, **e** = 50 μm, **f–h** = 20 μm, **i–m** = 10 μm

accommodate three marine species from tropical locations, including a species previously referred to as *Keissleriella blepharospora* Kohlm. & E. Kohlm. The genus was assigned to the order *Sphaeriales* by Kohlmeyer and Volkmann-

Kohlmeyer (1989) and to the *Halosphaeriales* by Hawksworth et al. (1995) and Kirk et al. (2001). Schoch et al. (2007), based on molecular and morphological data, referred it to the TBM clade comprising *Bertia*, *Melanospora* and *Torpedospora*, within Hypocreomycetidae, with affinities to the *Coronophorales*. *Etheirophora* grouped with a range of unresolved taxa, *Juncigena*, *Swampomyces* and *Torpedospora* and the asexual genera *Glomerulispora* and *Moheitospora*, in the TBM clade with high bootstrap value (Abdel-Wahab et al. 2010). Jones et al. (2014) demonstrated that the genus *Etheirophora* and two *Swampomyces* species formed a distinct clade in the Hypocreomycetidae and introduced the family *Etheirophoraceae*.

Other genera included

Swampomyces Kohlm. & Volkm.-Kohlm., Bot. Mar. 30(3): 198 (1987)

Type species: ***Swampomyces armeniacus*** Kohlm. & Volkm.-Kohlm., Bot. Mar. 30(3): 200 (1987)

Key to the genera of *Etheirophoraceae*

1. Ascospores with polar appendages ***Etheirophora***

1. Ascospores lacking appendages ***Swampomyces***

Falcocladiaceae Somrithipol et al., in Jones et al., Cryptog. Mycol. 35(2): 134 (2014)

Facesoffungi number: FoF 01288

Saprobic on leaf litter and leaves. **Sexual morph**: Undetermined. **Asexual morph**: Hyphomycetous. *Conidiomata* sporodochial or synnematal or penicilliate, directly arising from the mycelium or a stroma or from microsclerotia, thick-walled, with aseptate, stipe extensions, that terminates in hyaline, thin-walled sphaeropendunculate vesicles. *Conidiophores* up to three series of branches per conidiomata, branches hyaline, aseptate to multi-septate, smooth-walled, subcylindrical. *Conidiogenous cells* in whorls, ampulliform with elongated necks and minute collarettes, phialidic. *Conidia* hyaline, aseptate to 1-septate, smooth-walled, falcate, with short apical and basal appendages.

Type: ***Falcocladium*** S.F. Silveira et al.

Notes: Although the morphology of the genus *Falcocladium* has been well-studied and documented (Crous et al. 1994, 1997, 2007; Somrithipol et al. 2007), studies at the molecular level are few. Crous et al. (1994) described the genus *Falcocladium* with *F. multivesiculatum* S.F. Silveira et al. as the type species and subsequently introduced further new species in *F. sphaeropedunculatum* Crous & Alfenas and *F. thailandicum* Crous & Himaman. In a preliminary molecular study, by comparing sequences of *F. thailandicum* with sequences in GenBank, Crous et al. (2007) suggested an affinity with the order *Hypocreales*. Jones et al. (2014) showed that the genus *Falcocladium* is monophyletic and is well-separated from the order *Hypocreales*. Jones et al. (2014) introduced the family *Falcocladiaceae* based on SSU and LSU sequence data to accommodate the genus *Falcocladium* and suggested further taxon sampling to determine its ordinal position. The *Falcocladiaceae* group in the *Hypocreomycetidae* with the family *Etheirophoraceae* as a sister subclade, could not be accommodated in any order (Jones et al. 2014), but subsequently Maharachchikumbura et al. (2015) introduced the order *Falcocladiales* to accommodate the family *Falcocladiaceae*.

Falcocladium S.F. Silveira et al., Mycotaxon 50: 447 (1994)

Facesoffungi number: FoF 02108; Fig. 55

Saprobic on leaves, and leaf litter, associated with tropical forests. **Sexual morph**: Undetermined. **Asexual morph**: *Conidiomata* sporodochial or synnematal or penicilliate when formed on aerial mycelium, single to aggregate, arising directly from the mycelium or from a stroma of thick walled, red-brown chlamydospores, with hyaline, aseptate, thick walled, stipe extensions, arising from any position on a conidiomatal branch, or in the position of phialide, sometimes more than one occurring in the same penicilliate conidioma. *Conidiophores* up to three series of branches, branches hyaline, aseptate to multi-septate, subcylindrical. *Conidiogenous cells* in groups of 2–6, ampulliform, with inconspicuous collarettes. *Conidia* hyaline, aseptate to 1-septate, falcate, with acute, short apical and basal appendages.

Type species: ***Falcocladium multivesiculatum*** S.F. Silveira et al., Mycotaxon 50: 448 (1994).

Notes: *Falcocladium* species are found on a wide range of host substrates including *Eucalyptus grandis*, *E. camaldulensis* leaves and leaf litter associated with tropical forests (Somrithipol et al. 2007). Unique characters of the genus *Falcocladium* include white sporodochia, thick-walled, aseptate stipe extensions, that terminate in thin-walled vesicles and conidia that are hyaline, aseptate to 1-septate, falcate and with short apical and basal appendages (Crous et al. 1994; Somrithipol et al. 2007). Species are delineated by the morphology of the terminal vesicle, conidial measurements and septation (Somrithipol et al. 2007). A multi-gene molecular study established the monophyly of *Falcolcadium* species, and their inclusion in a new family *Falcocladiaceae* (Jones et al. 2014) and ordinal placement in the *Falcocladiales* (Maharachchikumbura et al. 2015). The order forms a sister clade to the *Coronophorales* and *Melanosporales* with high statistical support (Maharachchikumbura et al. 2015).

Flammocladiaceae Crous et al., in Crous et al., Sydowia 67: 103 (2015)

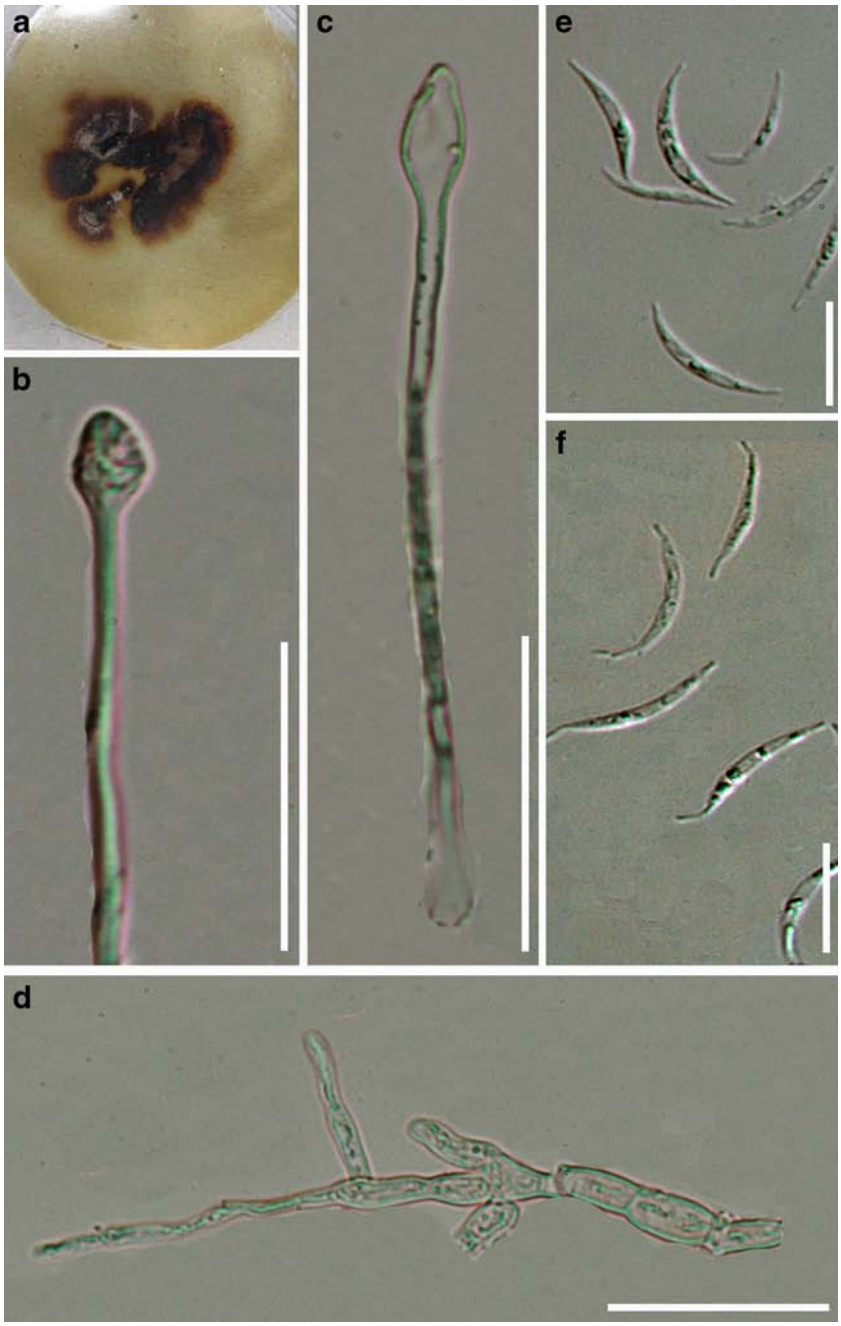

Fig. 55 ***Falcocladium multivesiculatum*** (Material examined: BRAZIL. Espirito Santo, Aracruz, from *Eucalyptus grandis* W. Hill ex Maiden (*Myrtaceae*) leaf litter, Silvaldo F. Silveira, January 1993, PREM 51541, **holotype**) **a** Herbarium material of *F. multivesiculatum* (dried culture on MEA) **b**, **c** Stipe extensions **d** Conidiomata on mycelium **e** Conidia. Scale bars: **b**, **c** = 100 μm, **d**, **e** = 5 μm

Facesoffungi number: FoF 01902; Fig. 56

Saprobic on twigs of *Acer platanoides* **Sexual morph**: *Ascomata* perithecial, pale luteous to yellow-orange, aggregated in clusters, linked by a stromatic base, covered in a dirty white crustose layer, not discolouring in 3 % KOH, turning pale luteous to dirty white, with a characteristic papillate, periphysate ostiolar area; wall of smooth, 3–4 layers of subhyaline textura angularis. *Asci* 8-spored, fusoid-ellipsoidal to subclavate, unitunicate. *Ascospores* fasciculate, hyaline, fusoid-ellipsoidal with obtuse ends, septate, warty, not or slightly constricted at septa. **Asexual morph**: Coelomycetous. *Conidiomata* sporodochial, determinate, hyaline, becoming orange. *Conidiophores* subcylindrical, septate, branched. *Conidiogenous cells* subcylindrical, terminal and intercalary, hyaline, smooth, proliferating sympodially at apex. *Conidia* slimy, solitary, hyaline, smooth, granular to guttulate, straight to gently curved, subcylindrical to narrowly obclavate (Crous et al. 2015b).

Type: ***Flammocladiella*** Crous et al. in Crous et al., Sydowia 67: 103 (2015)

Type species: ***Flammocladiella aceris*** Crous et al.

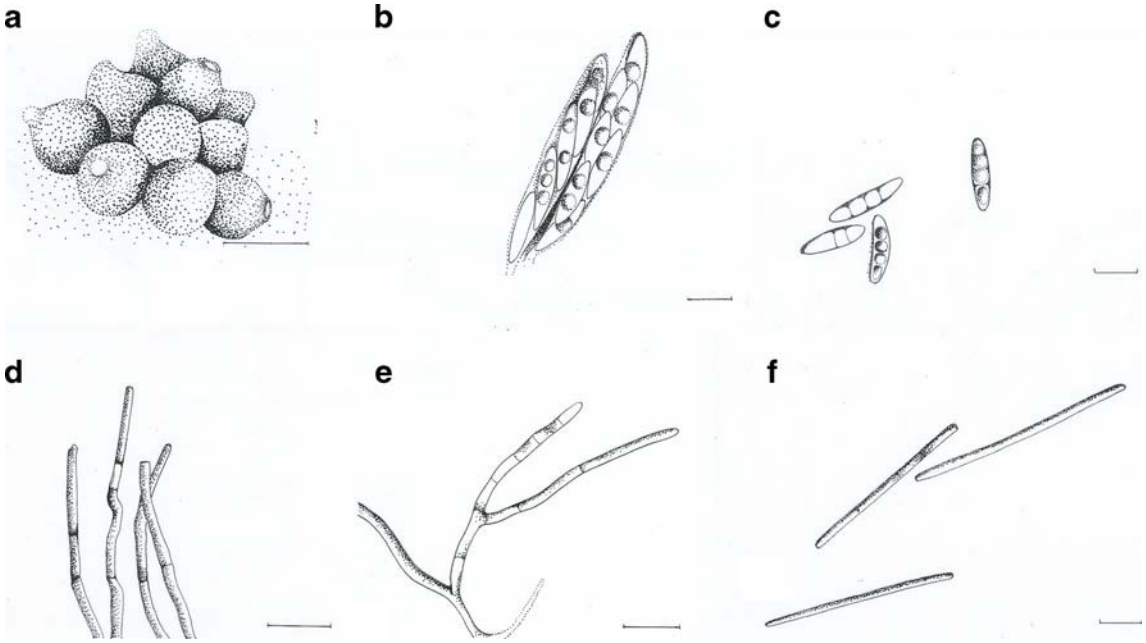

Fig. 56 ***Flammocladiella aceris*** (CBS 138906, **ex-type**) (redrawn from Crous et al. 2015b). **a** Ascomata arranged in rosette on host tissue **b** Asci **c** Ascospores **d**, **e** Conidiophores with conidiogenous cells **f** Conidia. Scale bars: **a** = 250 μm, **b–e** = 10 μm

Notes: Based on LSU sequence data Crous et al. (2015b) introduced *Flammocladiaceae* in the *Hypocreales*. *Flammocladiella* has phylogenetic affinities with members of the *Clavicipitaceae* and *Ophiocordycipitaceae*. However it is easily distinguished from other members of *Hypocreales* based on its yellowish ascomata that aggregate in clusters on a single stromatic base, covered by a crustose layer, having a papillate, periphysate ostiolar region, and a sporodochial asexual morph forming flame-like conidial masses (Crous et al. 2015b).

Glomerellaceae Locq. ex Seifert & W. Gams, in Zhang et al. Mycologia 98(6): 1083 (2007)

Facesoffungi number: FoF 01100

Parasitic, *endophytic* and *saprobic* on plant leaves, stems and fruits. **Sexual morph**: *Ascomata* solitary or gregarious, globose to subglobose, dark brown to black, ostiole periphysate. *Peridium* composed of pale to medium brown, flattened cells of *textura angularis*. *Hamathecium* composed of paraphyses. *Asci* 8-spored, unitunicate, cylindrical to subfusoid, short pedicellate, with a refractive, J-, apical ring. *Ascospores* uniseriate to overlapping biseriate, hyaline, unicellular, oval, fusiform or rhomboid. **Asexual morph**: Coelomycetous. *Conidiomata* acervular, conidiophores and setae formed on cushions of pale to medium brown, roundish to angular cells, comprising thick-walled hyphae. *Setae* straight, constricted and slightly wavy. *Conidiophores* hyaline to pale brown. *Conidiogenous cells* enteroblastic, hyaline to pale brown, cylindrical to ellipsoidal, doliform to ampulliform, collarette distinct, periclinal thickening visible to conspicuous. *Conidia* unicellular, hyaline, cylindrical, clavate, falcate, forming appressoria when germinating.

Type: ***Colletotrichum*** Corda

Notes: *Glomerellaceae* is a monotypic family comprising mainly pathogens. Chadefaud (1960) introduced the ordinal name *Glomerellales* including *Colletotrichum* (= *Glomerella*) and three other genera in a non-ranked group "Eu-Glomérellales", but this was not validly published. Previously, *Colletotrichum* was placed in family *Phyllachoraceae*, but has long been considered to be an outlier due to its non-stromatic nature (Cannon 1991). The family *Glomerellaceae* was introduced by Locquin (1984), but was invalidly published. Uecker (1994), based on preliminary sequence-based studies, along with ontogenetic studies, confirmed that *Colletotrichum* does not belong in the same order as *Phyllachora*. Kirk et al. (2001) placed *Glomerellaceae* with an uncertain position in *Sordariomycetidae*. Zhang et al. (2006) validated the family *Glomerellaceae* with a Latin description, while placing it within the *Hypocreomycetidae*. Kirk et al. (2008) placed this family in an uncertain position in the subclass *Hypocreomycetidae*. Réblová et al. (2011) further elucidated the phylogenetic position of *Glomerellaceae* by analysis of combined ITS, LSU, SSU and RPB2 sequence data. The order *Glomerellales* was validated by Réblová et al. (2011), who provided a Latin diagnosis. Two new families, *Australiascaceae* and *Reticulascaceae* occupied a common clade with *Glomerellaceae* (Réblová et al. 2011) in *Glomerellales*.

The family *Glomerellaceae* was established based on the genus *Glomerella* (Zhang et al. 2006), which had been

synonymized under its asexual morph *Colletotrichum* (Maharachchikumbura et al. 2015).

Colletotrichum Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 3(12): 41 (1831)

Facesoffungi number: FoF 01094; Figs 57, 58

Parasitic, *endophytic* and *saprobic* on plant leaves, stems, fruits. **Sexual morph**: *Ascomata* solitary or gregarious, globose to subglobose, dark brown to black, ostiole periphysate. *Peridium* composed of pale to medium brown flattened cells of *textura angularis*. *Hamathecium* composed of hyaline, septate paraphyses, branched at the base, rounded at the tips. *Asci* 8-spored, unitunicate, cylindrical to subfusoid, short pedicellate, with an inamyloid, refractive ring at the apex. *Ascospores* uni- to biseriate, aseptate, hyaline, oval, fusiform or rhomboid, one end ± acute and one ended round or both ends rounded, sometimes slightly curved, smooth-walled. **Asexual morph**: Coelomycetous. *Conidiomata* acervular, conidiophores and

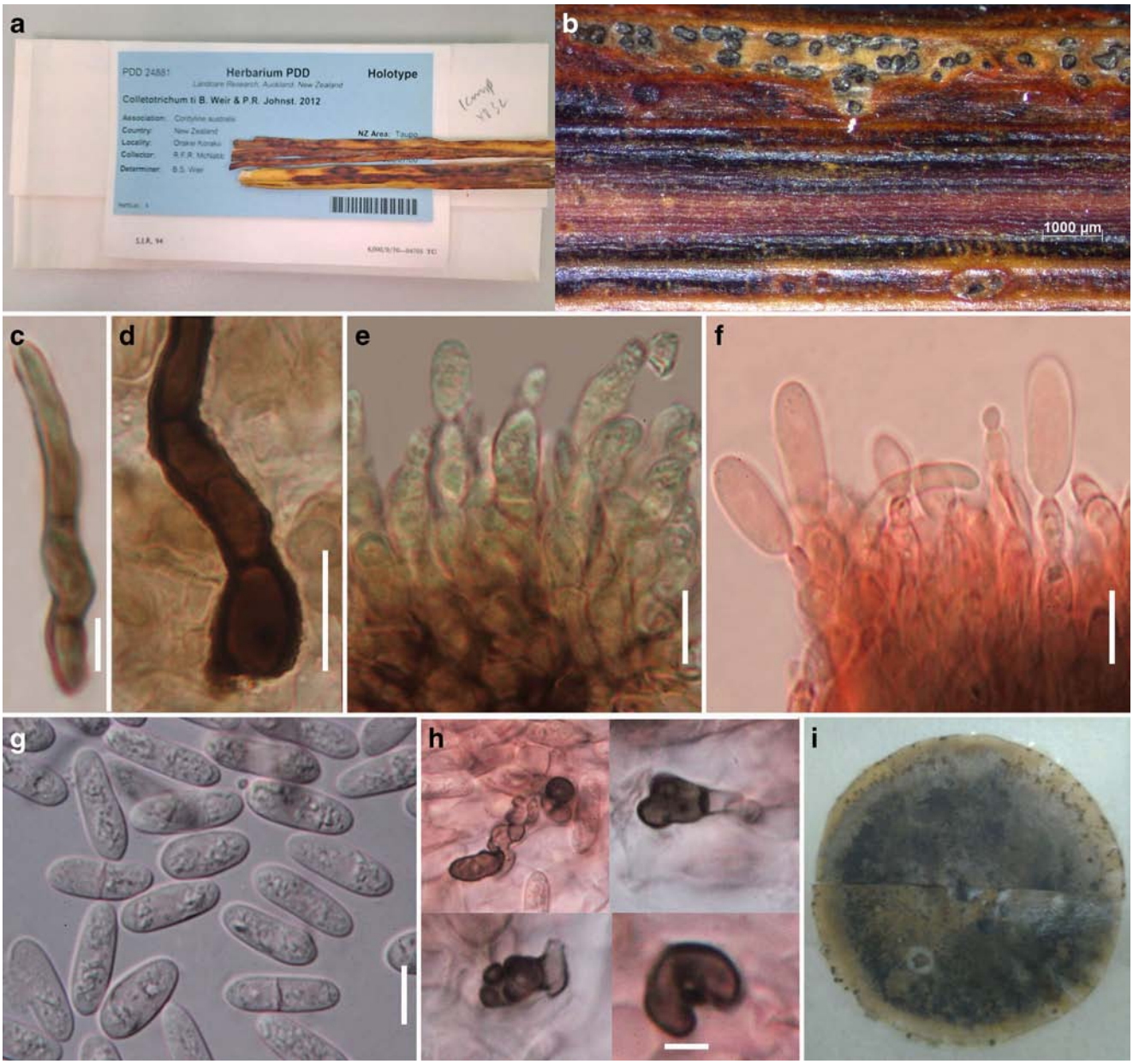

Fig. 57 ***Colletotrichum ti*** (Material examined: NEW ZEALAND, Taupo, Orakei Korako on *Cordyline australis* (Forst. f.) Hook. f. (*Asparagaceae*), July 1965, R.F.R. McNabb, PDD 30206, **holotype**). **a**, **b**, **e** Holotype **c**, **d**, **f**, **g**, **h**, **i** Ex-holotype culture **a** Herbarium details **b** Lesions of the dried herbarium specimen with black conidiomata **c** Young setae **d** Base of the setae **e** Conidiophores and conidiogenous cells **f** Conidiophores and conidiogenous cells stained with Congo Red reagent **g** Hyaline conidia with broadly rounded ends **h** Appressoria **i** Ex-holotype culture. Scale bars: **d** = 20 µm, **c**, **e**–**g** = 10 µm, **h** = 5 µm

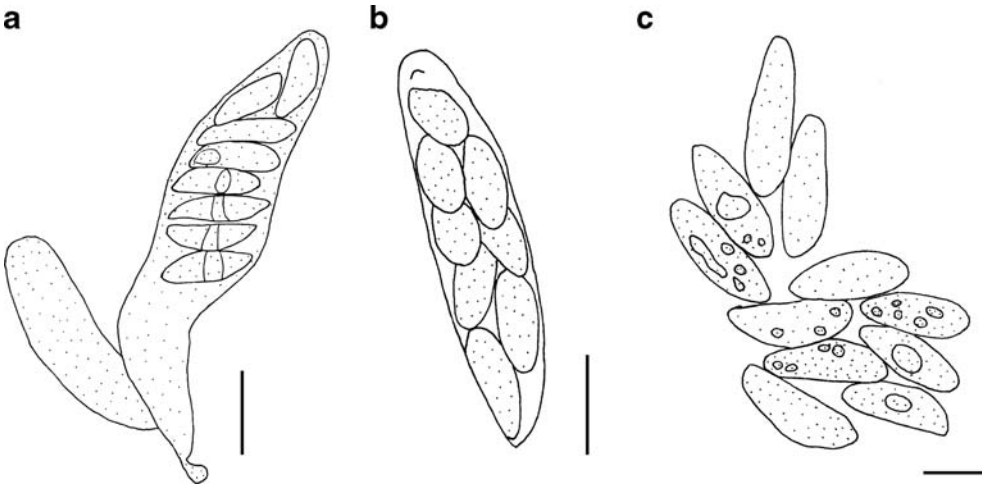

Fig. 58 Sexual morph of ***Colletotrichum karstii*** (**Holotype** redrawn from Yang et al. 2011) **a** Immature asci **b** Mature ascus **c** Hyaline ascospores. Scale bars: **a–c** = 10 μm

setae formed on cushions of pale to medium brown, roundish to angular cells. *Setae* may or may not be present, if present usually emerging from darkened hyphae, straight, constricted and slightly wavy, hyaline, pale brown to medium brown, dark chestnut to black, basal cell often paler, hyaline towards the tip, smooth-walled or verruculose, towards the tip often verruculose, 1–6-septate, often septate only at the base, base cylindrical, conical or slightly inflated, tip ± rounded to ± acute. *Conidiophores* hyaline to pale brown, simple or septate, branched or unbranched, smooth-walled, *Conidiogenous cells* enteroblastic, hyaline to pale brown, smooth-walled, cylindrical, ellipsoidal, doliform or ampulliform, collarette distinct, periclinal thickening visible to conspicuous, *Conidia* hyaline, smooth-walled, aseptate, cylindrical, clavate, falcate, straight or slightly curved, apex acute to rounded, sometimes reduced in to filiform appendage, base rounded to truncate, forms appressoria when germinating.

Type species: ***Colletotrichum lineola*** Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 3(12): 41 (1831)

Notes: The genus *Colletotrichum* was introduced by Corda (1831) for *C. lineola* Corda (Damm et al. 2009; Cannon et al. 2012b). *Colletotrichum* being an asexual fungal genus was included in morphological classifications of the Ascomycota due to its sexual genus *Glomerella* (Cannon et al. 2012b). Ainsworth (1971) listed *Colletotrichum* as a member of the family *Phyllachoraceae*. However, Barr (1976a) included *Colletotrichum* in the family *Melogrammataceae*, but Hawksworth et al. (1983) placed *Colletotrichum* in its traditional position in the family *Phyllachoraceae*, which was adopted by Hawksworth et al. (1995). However, due to its astromatic nature *Colletotrichum* had been considered to be an outlier within the family *Phyllachoraceae* (Cannon et al. 2012b). Preliminary studies together with ontogenetic research confirmed that *Colletotrichum* and *Phyllachora* do not belong in the same family (Uecker 1994). Kirk et al. (2001, 2008) placed *Colletotrichum* in the family *Glomerellaceae*. The first attempt to place *Colletotrichum* within a molecular phylogenetic system was carried out with the use of 18S rDNA sequence data (Illingworth et al. 1991; Berbee and Taylor 1992). Winka and Eriksson (2000) considered *Colletotrichum* to be more closely related to *Hypocreomycetidae*. The study of Wanderlei-Silva et al. (2003) showed *Colletotrichum* to be a sister group to *Hypocreales*. Zhang et al. (2006) confirmed the phylogenetic position of *Colletotrichum* within the *Hypocreomycetidae*. Maharachchikumbura et al. (2015) also confirmed the position of *Colletotrichum* in the family *Glomerellaceae*.

Colletotrichum species are phytopathogens causing anthracnose disease of many crops and fruits worldwide (Hyde et al. 2009a, b; Cannon et al. 2012b; Hyde et al. 2014). Species of *Colletotrichum* are also important as endophytes of living plant tissues (Manamgoda et al. 2013; Hyde et al. 2014). Species of *Colletotrichum* have been studied extensively as model organisms in genetic research (Cannon et al. 2012b). Some species of *Colletotrichum* have been defined using ITS sequences data, but ITS alone is insufficient for resolving *Colletotrichum* species well. Multi-marker phylogenetic analysis, epitypification and knowledge of species complexes have contributed to a better understanding of the genus (Cai et al. 2009; Hyde et al. 2014).

Gnomoniaceae G. Winter [as 'Gnomonieae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 570 (1886)

Facesoffungi number: FoF 01903

Saprobic on bark and leaves of overwintered plants. **Sexual morph**: *Ascomata* immersed to erumpent, solitary or aggregated, globose to subglobose, black, coriaceous, thin-walled, with one or more long, central or eccentric necks with hyaline periphyses. *Peridium* comprising few layers of brown, thick-walled cells of *textura angularis. Hamathecium* comprising hyaline, septate, cellular paraphyses. *Asci* 8-spored, unitunicate, oval, fusiform to almost filiform, short stalked, with a distinct, J- apical ring. *Ascospores* biseriate, overlapping uniseriate to fasciculate, oval, fusiform, ovoid to subulate, small, unicellular to 1-septate, rarely multi-septate, ends

mostly rounded, rarely pointed, appendages absent or subulate, navicular or whip-shaped, smooth. **Asexual morph**: *Conidiomata* formed on the bark together with perithecia, acervuli, subcuticular, flat. *Conidiophores* simple, hyaline, annellations not clearly visible. *Conidiogenous cells* phialidic. *Conidia* one-celled, acrogenous, filiform or fusiform, curved, hyaline, thin walled, obtusely crescent.

Type: ***Gnomonia*** Ces. & De Not.

Notes: *Gnomoniaceae* was introduced by Winter in 1886 with *Gnomonia gnomon* (Tode) J. Schröt., as the type. This family is characterized by immersed, rarely erumpent or superficial ascomata, without a stroma, or aggregated with a rudimentary stroma. *Gnomoniaceae* comprises microfungal species reported as pathogens and endophytes in leaves of herbaceous or woody trees (Rossman et al. 2007). Mejía et al. (2011) reported *Betulaceae*, *Fagaceae*, and *Salicaceae* as common host families. *Gnomoniaceae* groups with *Melanconidaceae* as a sister clade in *Diaporthales*, and comprises 32 genera (Maharachchikumbura et al. 2015).

Gnomonia Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 231 (1863)

Facesoffungi number: FoF 02109; Fig. 59

Saprobic on overwintered, fallen or attached leaves of shrubs, usually *epiphyllous* or on petioles, rarely *hypophyllous*. **Sexual morph**: *Ascomata* perithecial, solitary, without stroma

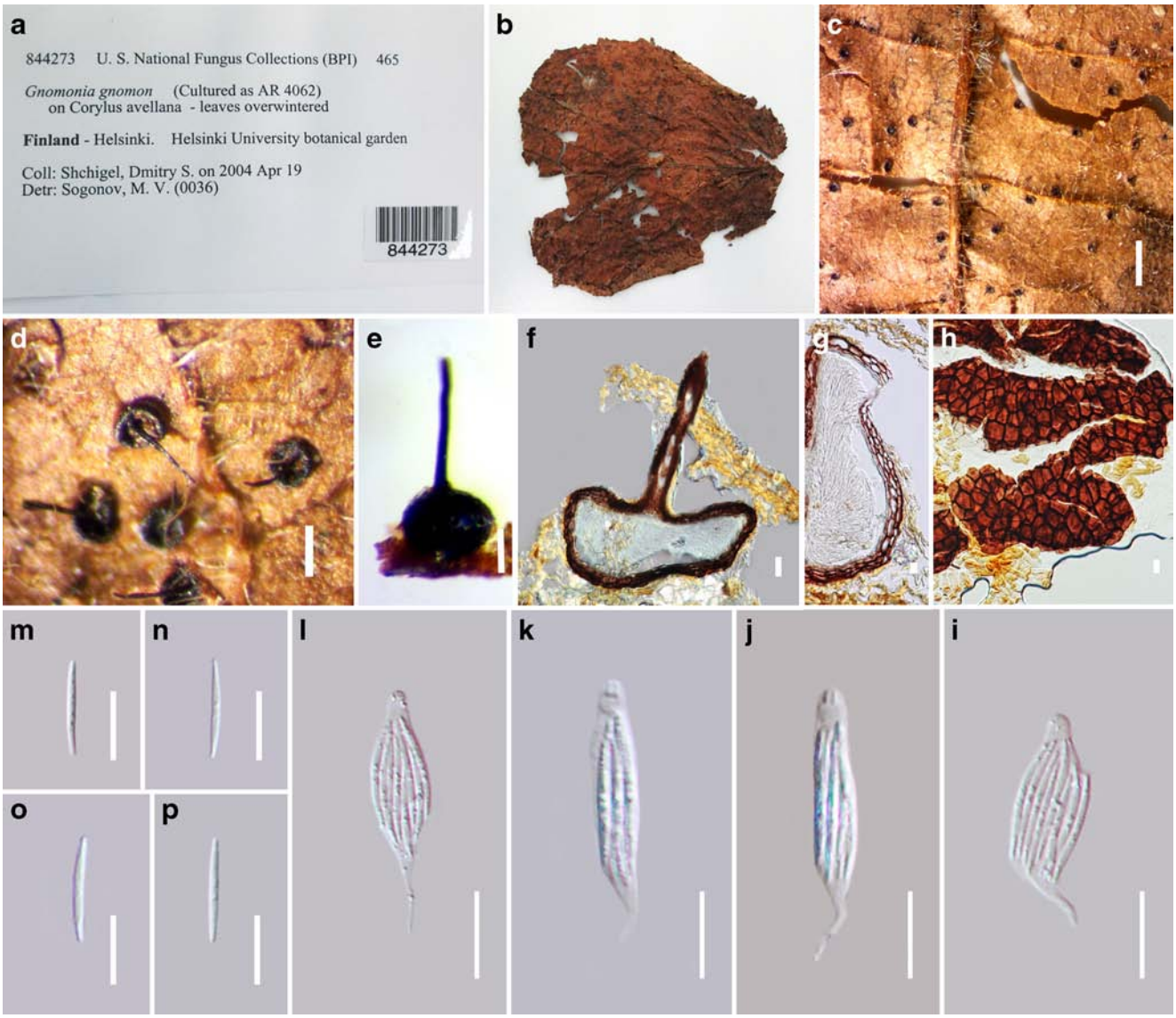

Fig. 59 ***Gnomonia gnomon*** (Material examined: FINLAND, Helsinki, Helsinki University Botanical Garden, overwintered fallen leaves of *Corylus avellana* L. (*Betulaceae*), 2004 April 19, Shchigel, Dmitry S., BPI 844273, **epitype**) **a** Packet of herbarium **b** Herbarium specimen **c**, **d** Ascomata on substrate **e** Rehydrated ascoma in water **f** Cross section of ascoma **g–h** Peridium **i-l** Asci **m-p** Ascospores. Scale bars: **c** = 1 mm, **d** = 200 μm, **e** = 1 mm, **f** = 20 μm, **g**, **h** = 10 μm, **i–l** = 20 μm, **m–p** = 10 μm

or sometime very poorly developed stromatic tissues, black, initially immersed, later become erumpent, rarely partly erumpent, sometimes wide opening with pinkish white powdery collar around the neck, globose to subglobose when moist, bowl-shaped when dry, with 1–3 necks *Necks* central to marginal, never truly lateral, slightly curved, longer, sometimes almost absent. *Asci* 8-spored, unitunicate, oval to fusiform, short stalked, with J- apical ring. *Ascospores* overlapping uniseriate or irregularly multi-seriate, one septate, fusiform to acerose, ends narrowly rounded, appendages ovoid, subulate or acicular with diffuse ends or rarely absent. **Asexual morph**: Undetermined.

Type species: ***Gnomonia gnomon*** (Tode) J. Schröt., in Cohn, Krypt.-Fl. Schlesien (Breslau) 3.2(4): 390 (1897) [1908]

Notes: *Gnomonia* was introduced by Cesati and De Notaris (1863) and typified by *Gnomonia gnomon*. This genus is characterized by having non-stromatic solitary, thin-walled, immersed perithecia with long necks and ascospores with one median septum. Species of *Gnomonia* occur on overwintered leaves and plant twigs. *Gnomonia* comprises 273 species (Index Fungorum 2016).

Other genera included

Alnecium Voglmayr & Jaklitsch, Persoonia, Mol. Phyl. Evol. Fungi 33: 76 (2014)

Type species: ***Alnecium auctum*** (Berk. & Broome) Voglmayr & Jaklitsch, Persoonia, Mol. Phyl. Evol. Fungi 33: 76 (2014)

Ambarignomonia Sogonov, Stud. Mycol. 62: 35 (2008)

Type species: ***Ambarignomonia petiolorum*** (Schwein.) Sogonov, Stud. Mycol. 62: 36 (2008)

Amphiporthe Petr., Sydowia 24(1–6): 257 (1971) [1970]

Type species: ***Amphiporthe hranicensis*** (Petr.) Petr., Sydowia 24(1–6): 257 (1971) [1970]

Anisomyces Theiss. & Syd., Annls mycol. 12(3): 270 (1914)

Type species: ***Anisomyces papilloideoseptatus*** (Henn.) Theiss. & Syd., Annls mycol. 12(3): 270 (1914)

Apiognomonia Höhn., Ber. dt. bot. Ges. 35: 635, 637 (1917)

Type species: ***Apiognomonia veneta*** (Sacc. & Speg.) Höhn., Hedwigia 62: 47 (1920)

Apioplagiostoma M.E. Barr, Mycol. Mem. 7: 101 (1978)

Type species: ***Apioplagiostoma populi*** (E.K. Cash & Waterman) M.E. Barr, Mycol. Mem. 7: 102 (1978)

Asteroma DC., in de Candolle & Lamarck, Fl. franç., Edn 3 (Paris) 5/6: 162 (1815)

Type species: ***Asteroma phyteumae*** DC., in de Candolle & Lamarck, Fl. franç., Edn 3 (Paris) 6: 162 (1815)

Bagcheea E. Müll. & R. Menon, Phytopath. Z. 22(4): 417 (1954)

Type species: ***Bagcheea castaneae*** E. Müll. & R. Menon, Phytopath. Z. 22(4): 418 (1954)

Clypeoporthe Höhn., Sber. Akad. Wiss. Wien, Math. -naturw. Kl., Abt. 1 128: 584 (1919)

Type species: ***Clypeoporthe monocarpa*** Höhn., Sber. Akad. Wiss. Wien, Math. -naturw. Kl., Abt. 1 128: 584 (1919)

Cryptosporella Sacc., Michelia 1(no. 1): 30 (1877)

Type species: ***Cryptosporella hypodermia*** (Fr.) Sacc., (1877)

Cylindrosporella Höhn., Sber. Akad. Wiss. Wien, Math. -naturw. Kl., Abt. 1 125(1–2): 96 (1916)

Type species: ***Cylindrosporella carpini*** (Lib.) Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 125(1–2): 96 (1916)

Depazea Fr., Observ. mycol. (Havniae) 2: 365 (1818)

Type species: ***Depazea frondicola*** Fr., Observ. mycol. (Havniae) 2: 365 (1818)

Diplacella Syd., Annls mycol. 28(1/2): 101 (1930)

Type species: ***Diplacella paulliniae*** (Gonz. Frag. & Cif.) Syd., Annls mycol. 28(1/2): 101 (1930)

Ditopella De Not., Sfer. Ital.: 42 (1863)

Type species: ***Ditopella fusispora*** De Not., Sfer. Ital.: 48 (1863)

Ditopellopsis J. Reid & C. Booth, Can. J. Bot. 45(9): 1479 (1967)

Type species: ***Ditopellopsis clethrae*** J. Reid & C. Booth, Can. J. Bot. 45(9): 1479 (1967)

Gloeosporidina Petr., Annls mycol. 19(3–4): 214 (1921)

Type species: ***Gloeosporidina moravica*** Petr., Annls mycol. 19(3–4): 214 (1921)

Gnomoniella Sacc., Michelia 2(no. 7): 312 (1881)

Type species: ***Gnomoniella tubiformis*** (Tode) Sacc. [as 'Gnomoniella tubaeformis'], (1882)

Gnomoniopsis Berl., Icon. fung. (Abellini) 1(3): 93 (1893)

Type species: ***Gnomoniopsis chamaemori*** (Fr.) Berl., Icon. fung. (Abellini) 1(3): 93 (1893)

Mamiania Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 210 (1863)

Type species: ***Mamiania fimbriata*** (Pers.) Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 211 (1863)

Millerburtonia Cif., Mycopath. Mycol. appl. 6(1): 26 (1951)

Type species: ***Millerburtonia oyedaeae*** Cif., Mycopath. Mycol. appl. 6(1): 27 (1951)

Occultocarpon L.C. Mejía & Zhu L. Yang, in Mejía et al., Fungal Divers 52(1): 101 (2012)

Type species: ***Occultocarpon ailaoshanense*** L.C. Mejía & Zhu L. Yang, in Mejía et al. Fungal Divers 52(1): 101 (2012)

Ophiognomonia (Sacc.) Sacc., Syll. fung. (Abellini) 14(1): 613 (1899)

Type species: ***Ophiognomonia melanostyla*** (DC.) Sacc., Icon. fung. (Abellini) 2: 146 (1899)

Phragmoporthe Petr., Annls mycol. 32(5/6): 354 (1934)

Type species: ***Phragmoporthe ploettneriana*** (Henn.) Petr., Annls mycol. 32(5/6): 354 (1934)

Phylloporthe Syd., Annls mycol. 23(3/6): 348 (1925)

Type species: ***Phylloporthe evernoniae*** Syd., Annls mycol. 23(3/6): 349 (1925)

Plagiostoma Fuckel, Jb. nassau. Ver. Naturk. 23–24: 118 (1870) [1869–70]

Type species: ***Plagiostoma euphorbiae*** (Fuckel) Fuckel, Jb. nassau. Ver. Naturk. 23–24: 118 (1870) [1869–70]

Pleuroceras Riess, Hedwigia 1(6): 25 (1854)

Type species: ***Pleuroceras ciliatum*** Riess, Hedwigia 1(6): 25 (1854)

Skottsbergiella Petr., in Skottsberg, Nat. Hist. Juan Fernandez Easter Isl. 2: 481 (1927)

Type species: ***Skottsbergiella diaporthoides*** Petr., in Skottsberg, Nat. Hist. Juan Fernandez Easter Isl. 2: 481 (1927)

Sirococcus Preuss, Linnaea 26: 716 (1855)

Type species: ***Sirococcuss trobilinus*** Preuss, Linnaea 26: 716 (1853)

Spataporthe Bronson et al., Int. J. Pl. Sci. 174(3): 278–292 (2013)

Type species: ***Spataporthe taylorii*** Bronson et al., Int. J. Pl. Sci. 174(3): 278–292 (2013)

Uniseta Ciccar., Nuovo G. bot. ital. 54: 711 (1948)

Type species: ***Uniseta flagellifera*** (Ellis & Everh.) Ciccar., Nuovo G. bot. ital. 54: 15 (1947)

Xenotypa Petr., Sydowia 9(1–6): 499 (1955)

Type species: ***Xenotypa aterrima*** (Fr.) Petr., Sydowia 9(1–6): 499 (1955)

Zythia Fr., Summa veg. Scand., Section Post. (Stockholm): 407 (1849)

Type species: ***Zythia resinae*** (Ehrenb.) P. Karst., Meddn Soc. Fauna Flora fenn. 16: 104 (1890) [1889]

Key to genera of *Gnomoniaceae*

1. Sexual morph known 2
2. Sexual morph not known; asexual morph common in nature……………………................……….........………. 29
3. Life mode parasitic……...............………....... ***Millerburtonia***
2. Life mode saprobic, or endophytic……………....…..…. 3
3. Pseudostromata / stromata absent; perithecia immersed in host tissues………………….......................… 4
4. Pseudostromata / stromata present; perithecia immersed in stromatic tissues……...................………........................20
4. Pseudostromata / stromata present; perithecia immersed in stromatic tissues…………...………...………...………... 5
4. Perithecia aggregated; necks parallel to substrate and not fused . . . . ***Cryptosporella***
5. Infected lesions distinct and colourful 6
5. Infected lesions indistinct……...……………................... 7
6. Infected leaves with dark purple to brown pigmentation……….. ***Apioplagiostoma***
6. Infected leaves with tan to grey pigmentation…..… ***Zythia***
7. Ascomata forming under clypeus…..........… ***Clypeoporthe***
7. Ascomata do not form under clypeus…......................…… 8
8. Ascospores slightly isthmoid with a median septum, often readily separating as part spores…...............… ***Pleuroceras***
8. Ascospores non-isthmoid, not separating into part spores…......…..............................……..…..………. 9
9. Appendages generally present…...............................… 10
9. Appendages generally absent………............................ 11
10. Perithecia mostly epiphyllous…………… 14
10. Perithecia mostly hypophyllous….…...................... 15
11. Ascospores with mucilaginous sheath……….. ***Diplacella***
11. Ascospores without mucilaginous sheath…..............… 12
12. Perithecia occurring on both sides of the leaf……...........………..…....................... ***Gnomoniella***
12. Perithecia occurring on only upper or lower side of leaf……....………………..……...............................… 13
13. Asci inoperculate without conspicuous apical ring………............................….......***Spataporthe***
13. Asci with characteristic apical ring………...............… 16
14. Appendages ovoid to sabulate……. ***Ambarignomonia***
14. Appendages cuneiform with diffuse ends or ovoid, subulate acicular………......................................…. ***Gnomonia***
15. Ascospores fusiform; arranged irregularly fasciculate or, obliquely in one longitudinal row….....…. ***Apiognomonia***
15. Ascospores oval to filiform; arranged mostly unevenly parallel, also irregularly multi-seriate or obliquely uniseriate, occasionally parallel…........................…. ***Ophiognomonia***
16. Necks present…...…..…. 17
16. Necks absent……...............................… ***Gloeosporidina***
17. Necks lateral …………………......…......… ***Gnomoniopsis***
17. Necks central ………………….......................................… 18
18. Ectostromatic disc present; dark brown to black……………………………....……….. ***Ditopella***
18. Ectostromatic disc absent……….........................……. 19
19. Ascospores not apiosporous…......……....… Plagiostoma
19. Ascospores apiosporous…............................... ***Mamiania***
20. Stromata plectenchymatous ……................ ***Phylloporthe***
20. Stromata pseudoparenchymatous…............................... 21
21. Ectostromatic disc present; rectangular, hexagonal to irregularly-shaped..……….......................… ***Ditopellopsis***
21. Ectostromatic disc absent………………….................. 22
22. Mycelial clumps at the base of perithecia …… ……………………..........................… ***Occultocarpon***
22. Mycelial clumps not at the base of perithecia ...……… 23
23. Cytoplasm of ascospores granular and divided into two parts with wide vacuous space forming diplastic polarity…………………………………........….... ***Bagcheea***
23. Cytoplasm of ascospores not divided into two parts…..24
24. Ascospores unicellular……..…..…..……………..….…. 25
24. Ascospores multi-cellular..…..…..…..…..…..…..…..… 26
25. Ascospores elongate allantoid to cylindrical……..…..…..…..…..…..…..…..…......….. ***Xenotypa***
25. Ascospores oval to short allantoid…........… ***Amphiporthe***

26. Ascospores not constricted at the septa……..... 27
26. Ascospores slightly constricted at the septa……..... 28
27. Ascospores 1-septate……..... ***Skottsbergiella***
27. Ascospores 3-septate……..... ***Phragmoporthe***
28. Ascospores not apiosporous; ……..... ***Alnecium***
28. Ascospores apiosporous; ……..... ***Anisomyces***
29. Conidia hyaline……..... 30
29. Conidia brown……..... ***Uniseta***
30. Conidiomata pycnidia……..... 31
30. Conidiomata acervuli……..... 32
31. Conidia released as chains ……..... ***Depazea***
31. Conidia release one at a time ……..... ***Asteroma***
32. Conidia spindle-shaped, 1-septate…..... ***Sirococcus***
32. Conidia filiform to fusiform, unicellular…….. ***Cylindrosporella***

Gondwanamycetaceae Réblová et al., Stud. Mycol. 68(1): 188 (2011)

Facesoffungi number: FoF 01282

Pathogenic on plants or *parasitic* on beetles. **Sexual morph**: *Ascomata* perithecial, black, necks relatively long, tapered towards the apex, terminating in ostiolar hyphae. *Peridium* fragile, thin-walled, interascal tissue absent. *Asci* 8 to multi-spored, evanescent. *Ascospores* hyaline, aseptate, fusiform to lunate or falcate, with or without a gelatinous sheath. **Asexual morph**: Hyphomycetous. *Conidiophores* monoverticillate or penicillate, brown. *Conidiogenous cells* phialidic. *Conidia* aseptate, slimy.

Type: ***Gondwanamyces*** G.J. Marais & M.J. Wingf.

Notes: The family *Gondwanamycetaceae*, a strongly supported monophyletic sister clade to *Ceratocystidaceae*, was introduced for the genus *Gondwanamyces* and its asexual morph *Custingophora* by Réblová et al. (2011). Studies of Viljoen et al. (1999) and Kolařík and Hulcr (2008) also documented the phylogenetic relationship of the asexual genera *Knoxdaviesia* and *Custingophora* to the sexual morphs of this family. The morphological characters of this clade include the apparent absence of interascal filaments in the ascomatal centrum and hyaline, allantoid ascospores, with a hyaline sheath, giving the spore a falcate to lunate appearance. Sexual morphs of this family have been reported from infructescences of *Protea* (Wingfield et al. 1988; Marais et al. 1998) and from sapwood associated with *Scolytidae* (bark beetles) (Bright and Torres 2006; Kolařík and Hulcr 2008), which produce dark, globose ascomata with a long, filiform neck, evanescent asci, and hyaline, fusiform ascospores, with or without a gelatinous sheath. Distinctive morphological characters of asexual morphs of *Gondwanamyces* includes, conidiophores that are erect, darkly pigmented, and paler towards the apex, which are either monoverticillate, sometimes with a terminal vesicle or divergently penicillate, with whorls of phialides producing hyaline conidia. The conidiogenous loci are located at the base of the shallow collarette (Kolařík and Hulcr 2008). Réblová et al. (2011) placed this family in the order *Microascales* based on analysis of SSU and a combined dataset of LSU, SSU and RPB2 sequence data and this was followed by Maharachchikumbura et al. (2015).

Gondwanamyces G.J. Marais & M.J. Wingf., Mycologia 90(1): 139 (1998)

Facesoffungi numbers: FoF 02228; Figs 60, 61

Pathogenic on various *Protea* species, occurring in the infructescences and *parasitic* on bark beetles. **Sexual morph**: *Ascomata* globose to subglobose, black, with long neck, tapered towards the apex, terminating in short and divergent, 5–11 ostiolar hyphae. *Asci* evanescent, hyaline. *Ascospores* hyaline, aseptate, fusiform, with or without a sheath, sometimes gelatinous sheath giving a lunate to falcate appearance to the ascospores. **Asexual morph**: *Conidiophores* macronematous, mononematous, olivaceous-brown, septate, arising from well-developed rhizoids; stipe erect, simple, inflated at the apex. *Conidiogenous cells* (phialides) produced terminally on conidiophores, discrete, ovoid, olivaceous-brown, producing conidia at the apex and leaving minute collarettes. *Conidia* holoblastic, hyaline, one-celled, smooth-walled, cylindrical to allantoid, rounded at the apex and truncate at the base, produced in mucoid masses at the apex of conidiophores.

Type species: ***Gondwanamyces proteae*** Wingf. et al., in Marais et al., Mycologia **90**(1): 139 (1998)

Notes: Based on RFPL analyses, cycloheximide sensitivity, cell wall saccharides and morphology of asexual morphs, the genus *Gondwanamyces*, was introduced to accommodate *Ceratocystiopsis proteae* M.J. Wingf. et al. and *Ophiostoma capense* M.J. Wingf. & P.S. van Wyk. These fungi were described as having asexual morphs in the genus *Knoxdaviesia* (Wingfield et al. 1988; Wingfield and van Wyk 1993), which was synonymized under *Custingophora* by Kolařík and Hulcr (2008). *Gondwanamyces* species are characterized by ascomata, that are similar to those of species of *Ceratocystis* and *Ophiostoma*, with globose ascomatal bases and long necks, bearing ascospores in slimy masses (Marais et al. 1998). Phylogenetic studies of Marais et al. (1998) and Zhang et al. (2006) have shown that these fungi reside in the order *Microascales* and are closely related to, but distinct, from species of *Ceratocystis*. *Gondwanamyces* was first observed in infructescences of *Protea* spp. infested by insects (Wingfield et al. 1988; Marais et al. 1998), whereas, some recently described species of *Gondwanamyces* are associated with *Scolytidae* (bark beetles) (Bright and Torres 2006; Kolařík and Hulcr 2008). The genera *Gondwanamyces and Custingophora* are currently placed in the family *Gondwanamycetaceae* (Réblová et al. 2011; Maharachchikumbura et al. 2015).

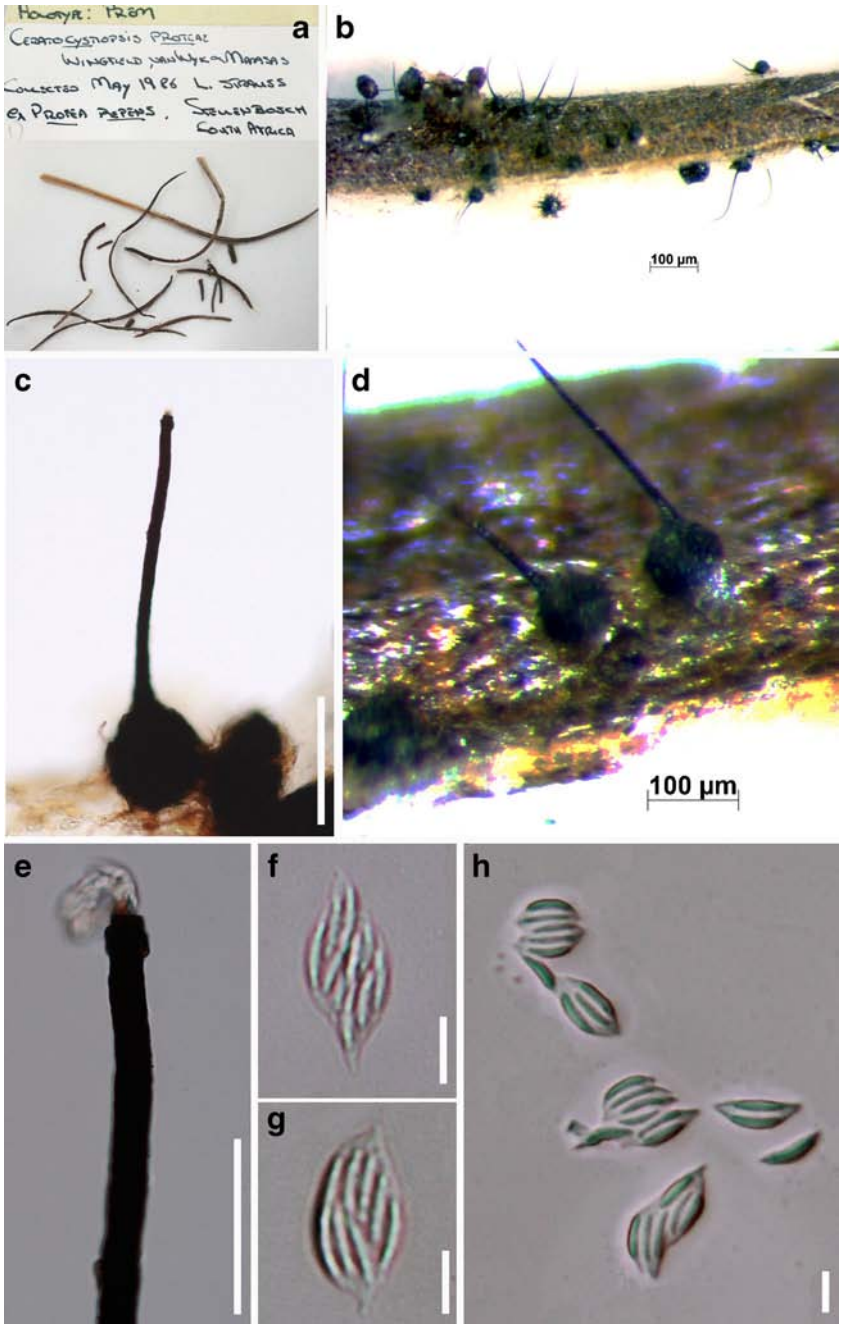

Fig. 60 ***Gondwanamyces proteae*** (Material examined: SOUTH AFRICA, Cape Province, Stellenbosch, from flower within inflorescence, infested by insects, L.J. Strauss, 7 October 1985, PREM 48924, **holotype**) **a** Herbarium specimen **b-d** Ascomata on host e Long neck of ascomata **f**, **g** Asci **h** Ascospores. Scale bars: **b**, **c**, **d** = 100 µm. **e** = 50 µm, **f**–**h** = 5 µm

Other genus included

Custingophora Stolk et al., Persoonia 5(2): 195 (1968)

Type species: ***Custingophora olivacea*** Stolk et al., in Stolk & Hennebert, Persoonia 5(2): 197 (1968)

Key to genera of *Gondwanamycetaceae*

1. Sexual morph with globose ascomatal bases and long necks, bearing fusiform ascospores in slimy masses ***Gondwanamyces***

1. Asexual morph with monoverticillate or penicillate conidiophores, bearing cylindrical to allantoid conidia in mucoid masses ***Custingophora***

Graphiaceae Z.W. de Beer, Seifert & M. J. Wingf., CBS fungal biodiversity series 12: 1–19 (2013)

Facesoffungi number: FoF 01099

Saprobic on wood; sometimes causing wounds on trees bark or beetles. **Sexual morph**: Undetermined. **Asexual morph**: Hyphomycetous. *Conidiomata* macronematous, synnematous, determinate, with dematiaceous, compact, stipes flared at the fertile tip; hyphae of stipe pigmented,

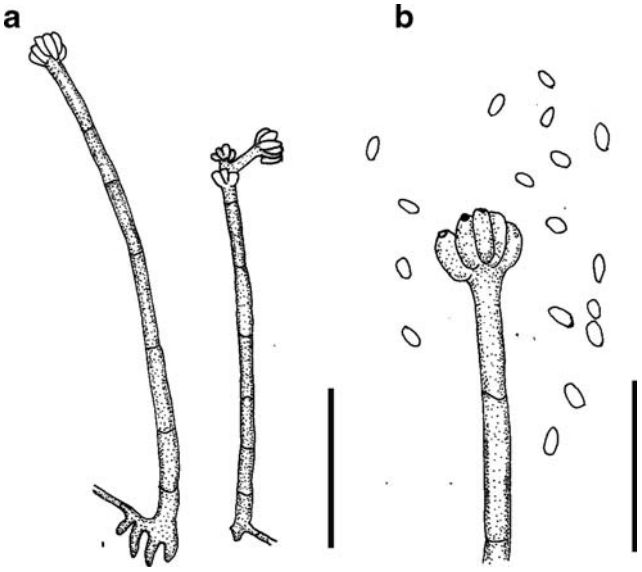

Fig. 61 ***Knoxdaviesia proteae*** **a** Conidiophores **b** Conidiogenous cells and conidia (re-drawn from Wingfield et al. <CitationRef CitationID="CR687>1988**). Scale bars; b = 10 μm, a = 50 μm**

simple, septate, branched. *Conidiophores* penicillately branched, with branching in two or three levels, forming metulae at the tip. *Conidiogenous cells* in whorls of two to six, phialidic, with percurrent, annellidic extensions; conidiogenesis enteroblastic. *Conidia* produced in a transparent, slimy droplet, aseptate, cylindrical to obovoid, sometimes slightly curved with age, truncate at base, often with a distinct basal frill, hyaline. Rarely synanamorphic with obovoid, pigmented conidia.

Type: ***Graphium*** Corda

Notes: Based on the phylogenetic distance between *Graphium* and other families of *Microascales*, the family *Graphiaceae* was introduced by de Beer et al. (2013). *Graphiaceae* is monophyletic (Lackner et al. 2014) and comprises a single genus *Graphium*, which is a synnematous hyphomycete described by Corda (1837), with *G. penicillioides* as the type species. Maharachchikumbura et al. (2015) also placed *Graphium* species under the family *Graphiaceae*, in the order *Microascales*.

Graphium Corda, Icon. fung. (Prague) 1: 18 (1837)

Facesoffungi numbers: FoF 02143; Fig. 62

Saprobic on sapwood; sometimes causing wounds on trees, or from bark or ambrosia beetles. **Sexual morph**: Undetermined. **Asexual morph**: Hyphomycetous. *Colonies* scattered, black, upright, with abundant, mostly single, sometimes in pairs or triplets, erect synnemata, sometimes with aerial mycelium on host surface, with cylindrical, dark brown to black stipes and divergent light brown to grey capitula, surrounded by watery conidial masses, at first colourless, then white, but quickly becoming olive brown to almost black. *Conidiophores* branched, generally biverticillate, with whorls of two to six, with swollen apex. *Conidiogenous cells* in several whorls, cylindrical to subulate, straight or sometimes slightly curved, phialidic, sometimes with percurrent proliferations. *Conidia* cylindrical to ovoid, with rounded apices and subtruncate to truncate bases, aseptate, hyaline, smooth-walled.

Type species: ***Graphium penicillioides*** Corda, Icon. fung. (Prague) 1: 18 (1837)

Notes: Corda (1837) introduced *Graphium* with *G. penicillioides* as the type species. It is a hyphomycetous genus, including species with dark synnemata, terminating in a slimy head of aseptate conidia. Synnematous species with dry conidia were also introduced to this genus by Saccardo (1886). Later, more than 120 synnematous fungal species were added (Seifert and Okada 1993; Index Fungorum 2016). Goidanich (1935) re-described *Graphium* more or less in its classical concept, and many of the synnematous asexual morphs of *Ophiostoma* were classified under *Graphium* by Hedgcock (1906) and Seifert and Okada (1993). Okada et al. (2000) designated an epitype for *G. penicillioides*, representing *Graphium sensu stricto* and the eleven *Graphium* species related to *Ophiostoma* were transferred to *Pestum* (Okada et al. 1998, 2000; Harrington et al. 2001). Based on available SSU and ITS sequences, Cruywagen et al. (2010) included eight described and seven undescribed species together with *G. penicillioides* in *Graphium sensu stricto*. These asexual morphs were isolated from stained sapwood, wounds on trees, or from bark or ambrosia beetles (Mouton et al. 1994; Okada et al. 1998, 2000; Jacobs et al. 2003; Geldenhuis et al. 2004; Hulcr et al. 2007; Massoumi Alamouti et al. 2007; Cruywagen et al. 2010; Paciura et al. 2010). De Beer et al. (2013) provided a description of *Graphium sensu stricto* based on *G. penicillioides* and the seven species that comprised a monophyletic lineage. Separation of *Graphium sensu stricto* from *Microascus* and its allied genera was supported by multi-gene analyses (Zhang et al. 2006; Spatafora et al. 2006; Schoch et al. 2009). De Beer et al. (2013) also confirmed that the distinctive *Graphium* lineage was distinct from *Microascus* and introduced the new family, *Graphiaceae*.

Halosphaeriaceae E. Müll. & Arx, ex Kohlm., Can. J. Bot. 50: 1951 (1972)

Facesoffungi number: FoF 01294

Saprobic on algae, immersed or submersed on phanerogams, wood, bark, leaves, and other cellulosic plant remains, grains of sand, or in calcareous shell fragments, rarely parasitic or symbiotic, found in marine and freshwater habitats (oceans and estuaries). **Sexual morph**: *Ascomata* subglobose, cylindrical or pyriform, hyaline or dark; sometimes subiculate, rarely stromatic; superficial or immersed. *Ostioles* papillate to long cylindrical; ostiolar canal with periphyses or pseudoparenchyma; rarely without ostioles. *Peridium* soft, subcarbonaceous or carbonaceous, composed of flattened, thick- or thin-walled cells. Centre of immature ascomata

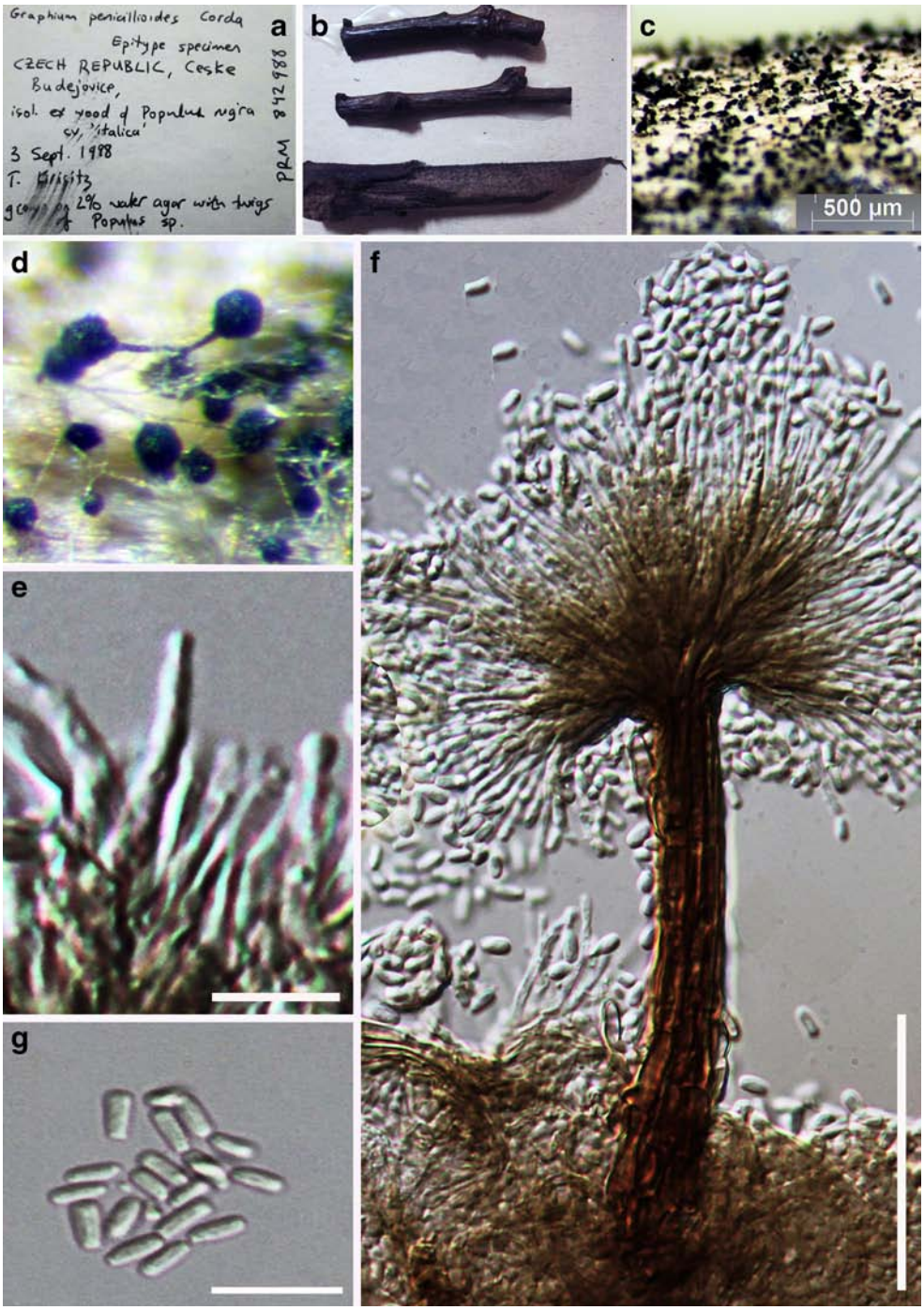

Fig. 62 ***Graphium penicillioides*** (Material examined: CZECH REPUBLIC, České Budějovice, isolated from wood core of *Populus nigra* L. (*Salicaceae*), 3 September 1998, T. Kirisits, PRM 842988, **epitype**) **a**, **b** Herbarium material c Colony on the surface of the substrate **d** Synnema on the host surface **e** Synnema after spore dispersal **f** Conidiogenous cells **g** Polyblastic conidia. Scale bars: **c**, **d** = 500 µm, **e** = 20 µm, **f**, **g** = 10 µm

consisting of polygonal, thin-walled, pseudoparenchymatic cells, sometimes with pits, at maturation separating to form catenophyses or compressed by the asci and dissolving. *Paraphyses* absent. *Asci* fusiform, clavate or rarely subglobose, with or without apical structures, thin-walled, 1-layered, persistent or swelling and deliquescing at or before ascospore maturity. Hymenial layer at base of venter, flat or convex. Mature ascospores filling the venter of the ascoma, released singly through the ostiole or rarely within the ascus, which swells after dispersal. *Ascospores* overlapping 2–3 seriate, hyaline or light brown, 1- multi-celled, mostly with characteristic ornamentations, appendages or gelatinous sheaths, or both. **Asexual morph**: Varied types. Conidiophores present or lacking, septate or lacking septa, hyaline to pale brown, conidiogenous cells monoblastic, terminal, conidia apical, helicoid; or conidiophores pleurogenous on the mycelium, conidiogenous cells holoblastic, terminal, sympodial or irregular, denticulate with schizolytic secession, conidia aleuriospores C to U-shaped, rarely sigmoid, solitary, septate, hyaline, or conidiophores

monoblastic, ellipsoidal cylindrical or clavate, septate, hyaline to pale brown, conidia unicellular, thick-walled, pale brown to dark brown, catenulate, or conidiogenous cells monoblastic to polyblastic, conidia terminal, clavate, 1–4 septate, thick-walled pale brown to dark brown, or conidia terminal, hyaline, branched, septate, with main axis give rise to 2–3 side branches, typically tetraradiate.

Type: ***Halosphaeria*** Linder

Notes: The family *Halosphaeriaceae*, which is the most diverse group of marine ascomycetes, was introduced by Müller and von Arx (1962) and Eriksson (1984) with *Halosphaeria* as the type genus (Barghoorn and Linder 1944). Members of the *Halosphaeriaceae* are amongst the most intensively studied of marine ascomycetes at the morphological, ultrastructural and molecular level, with 161 species in 62 genera species (Pang 2002; Jones et al. 2009a, 2015; Maharachchikumbura et al. 2015). Morphological characters unique to the family *Halosphaeriaceae* include: perithecial ascomata, necks (usually with periphyses), presence of catenophyses that easily deliquesce, unitunicate, thin-walled asci that deliquesce early, asci with or lacking an apical ring and appendaged ascospores (Jones 1995). Based on scanning and transmission electron microscopic studies of ascospore appendage morphology and ontogeny, a number of genera were found to be polyphyletic and new genera introduced to accommodate them, e.g. *Ondiniella*, and *Marinospora*, while others were reinstated, e.g. *Antennospora*, *Arenariomyces* and *Halosphaeriopsis* (Jones et al. 1983, 1984; Jones 1995). Subsequent molecular studies have supported these changes. The family *Halosphaeriaceae* was shown to be polyphyletic and the genera *Kohlmeyeriella*, *Lulworthia* and *Lindra* referred to a new family *Lulworthiaceae* (Campbell et al. 2003; Pang et al. 2003; Koch et al. 2007). Hibbett et al. (2007) and Schoch et al. (2007) referred *Halosphaeriaceae* to the order *Microascales*, while others continued to include it in the order *Halosphaeriales* (Zhang et al. 2006; Jones et al. 2009a). Maharachchikumbura et al. (2015) and Jones et al. (2015) accept the placement of the *Halosphaeriaceae* as one of the families in *Microascales*. However, the higher level classification of this family remains controversial.

Halosphaeria Linder, Farlowia 1: 412 (1944)

Facesoffungi numbers: FoF 02142; Figs 63, 64, 65

Saprobic on wood in marine environments. **Sexual morph**: *Ascomata* globose, subglobose, obpyriform, ellipsoidal, immersed to superficial, ostiolate, papillate, coriaceous, pale brown to black, necks variable in length, periphysate, centrum breaking up into deliquescing catenophyses. *Asci* 8-spored, unitunicate, thin-walled, clavate, pedicellate, lacking an apical ring, deliquescing early. *Ascospores* biseriate, hyaline, broad-ellipsoidal, 1-septate, not constricted at the septa, with 3–4 spoon-shaped equatorial appendages and one at each end of the spore. **Asexual morph**: Undetermined.

Type species: ***Halosphaeria appendiculata*** Linder, Farlowia 1: 412 (1944)

Notes: The genus *Halosphaeria* is monotypic with *H. appendiculata* Linder as the type species. Other species assigned to the genus by Kohlmeyer (1972) have been transferred to other genera as the result of ultrastructural and molecular studies: *Antennospora*, *Halosphaeriopsis*, *Lautisporopsis*, *Okeanomyces*, *Ondinella*, and *Remispora* (Jones et al. 2009a, 2015).

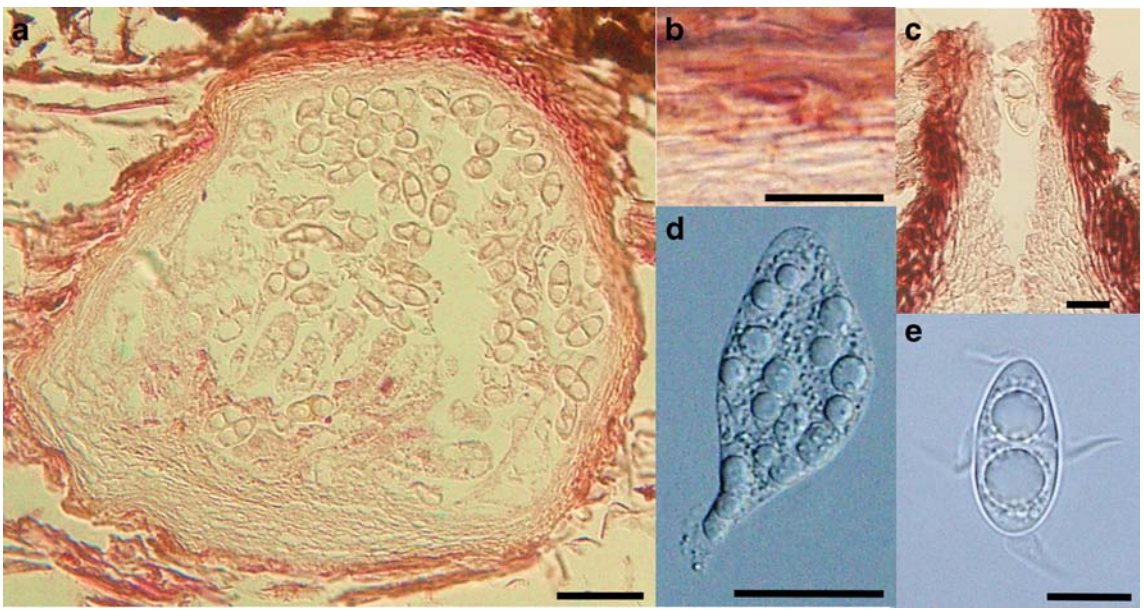

Fig. 63 ***Halosphaeria appendiculata*** (Material examined: TAIWAN, New Taipei City, Tungpeichiao, rocky shore, on drift wood, 13 April 2012, K. L. Pang) **a** Immersed ascoma **b** Peridium composed of a few layers of elongated cells with large lumina **c** Spore passing through ostiole **d** Clavate ascus **e** Ellipsoidal ascospore with spoon-shaped appendages at polar and equatorial positions Scale bar: **a**, **d** = 30 μm, **b–c**, **e** = 10 μm

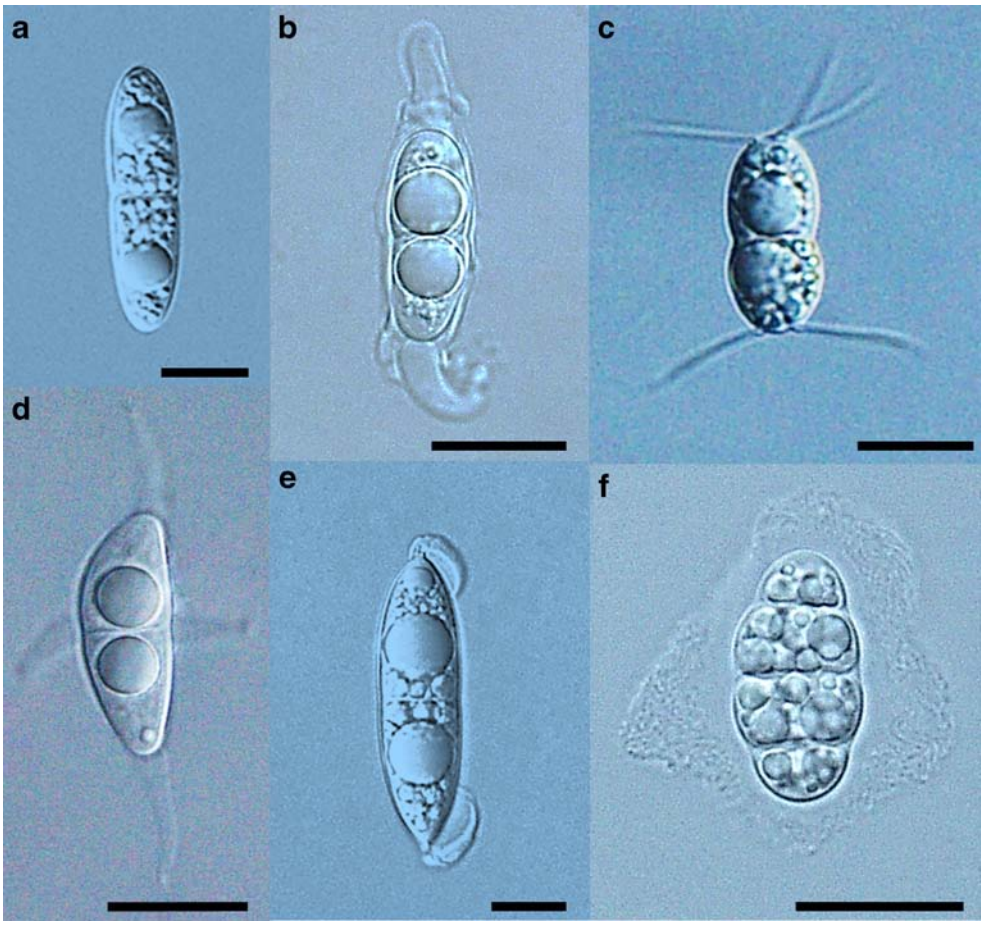

Fig. 64 ***Halosphaeriaceae*** **selected genera a** *Aniptodera longispora* (Material examined: MALAYSIA, Tioman island, Mangrove, on dead mangrove wood, 12 July 2010, K. L. Pang) **b** *Ceriosporopsis halima* (Material examined: TAIWAN, Keelung, National Taiwan Ocean University, rocky shore, on drift wood, 2 March 2012, K. L. Pang) **c** *Arenariomyces trifurcatus* (Material examined: TAIWAN, New Taipei City, Hemei, rocky shore, on drift wood, 22 February 2011, K. L. Pang) **d** *Marinospora calyptrata* (Material examined: GREAT BRITAIN, Langstone Harbour, Rocky shore, on drift wood, 10 August 2010, K. L. Pang) **e** *Cucullosporella mangrovei* (Material examined: MALAYSIA, Tioman island, Mangrove, on dead mangrove wood, 12 July 2010, K. L. Pang) **f** *Appendichordella amicta*. Scale bars: **a–f** = 15 μm

Other genera included

Alisea J. Dupont & E.B.G. Jones, Mycol. Res. 113(12): 1358 (2009)

Type species: ***Alisea longicolla*** J. Dupont & E.B.G. Jones, Mycol. Res. 113(12): 1358 (2009)

Aniptodera Shearer & M.A. Mill., Mycologia 69(5): 893 (1977)

Type species: ***Aniptodera chesapeakensis*** Shearer & M.A. Mill., Mycologia 69(5): 894 (1977)

Anisostagma K.R.L. Petersen & Jørg. Koch, Mycol. Res. 100: 209 (1996)

Type species: ***Anisostagma rotundatum*** K.R.L. Petersen & Jørg. Koch, Mycol. Res. 100(2): 211 (1996)

Antennospora Meyers, Mycologia 49: 501 (1957)

Type species: ***Antennospora quadricornuta*** (Cribb & J.W. Cribb) T.W. Johnson, J. Elisha Mitchell Scient. Soc. 74: 46 (1958)

Appendichordella R.G. Johnson et al., Can. J. Bot. 65(5): 941 (1987)

Type species: ***Appendichordella amicta*** (Kohlm.) R.G. Johnson et al., Can. J. Bot. 65(5): 941 (1987)

Arenariomyces Höhnk, Veröff. Inst. Meeresf. Bremerhaven 3: 28 (1954)

Type species: ***Arenariomyces trifurcatus*** Höhnk, Veröff. Inst. Meeresf. Bremerhaven 3: 30 (1954)

Ascosacculus J. Campbell, J.L. Anderson & Shearer, Mycologia 95 (3): 545 (2003)

Type species: ***Ascosacculus aquaticus*** (K.D. Hyde) J. Campb. et al., Mycologia 95 (3): 545 (2003)

Bathyascus Kohlm., Revue Mycol. 41(2): 190 (1977)

Type species: ***Bathyascus vermisporus*** Kohlm., Revue Mycol., Paris 41(2): 191 (1977)

Carbosphaerella I. Schmidt, Feddes Repert. 80(2–3): 108 (1969)

Type species: ***Carbosphaerella pleosporoides*** I. Schmidt, Feddes Repert. 80: 108 (1969)

Ceriosporopsis Linder, Farlowia 1: 408 (1944)

Type species: ***Ceriosporopsis halima*** Linder, Farlowia 1(3): 409 (1944)

Chadefaudia Feldm.-Maz., Revue Générale de Botanique 64: 150 (1957)

Type species: ***Chadefaudia marina*** Feldm.-Maz., Rev. gén. Bot. 64: 150 (1957)

Corallicola Volkm.-Kohlm. & Kohlm., Mycotaxon 44(2): 418 (1992)

Type species: ***Corallicola nana*** Volkm.-Kohlm. & Kohlm., Mycotaxon 44(2): 418 (1992)

Corollospora Werderm., Notizbl. Bot. Gart. Berlin-Dahlem: 248 (1922)

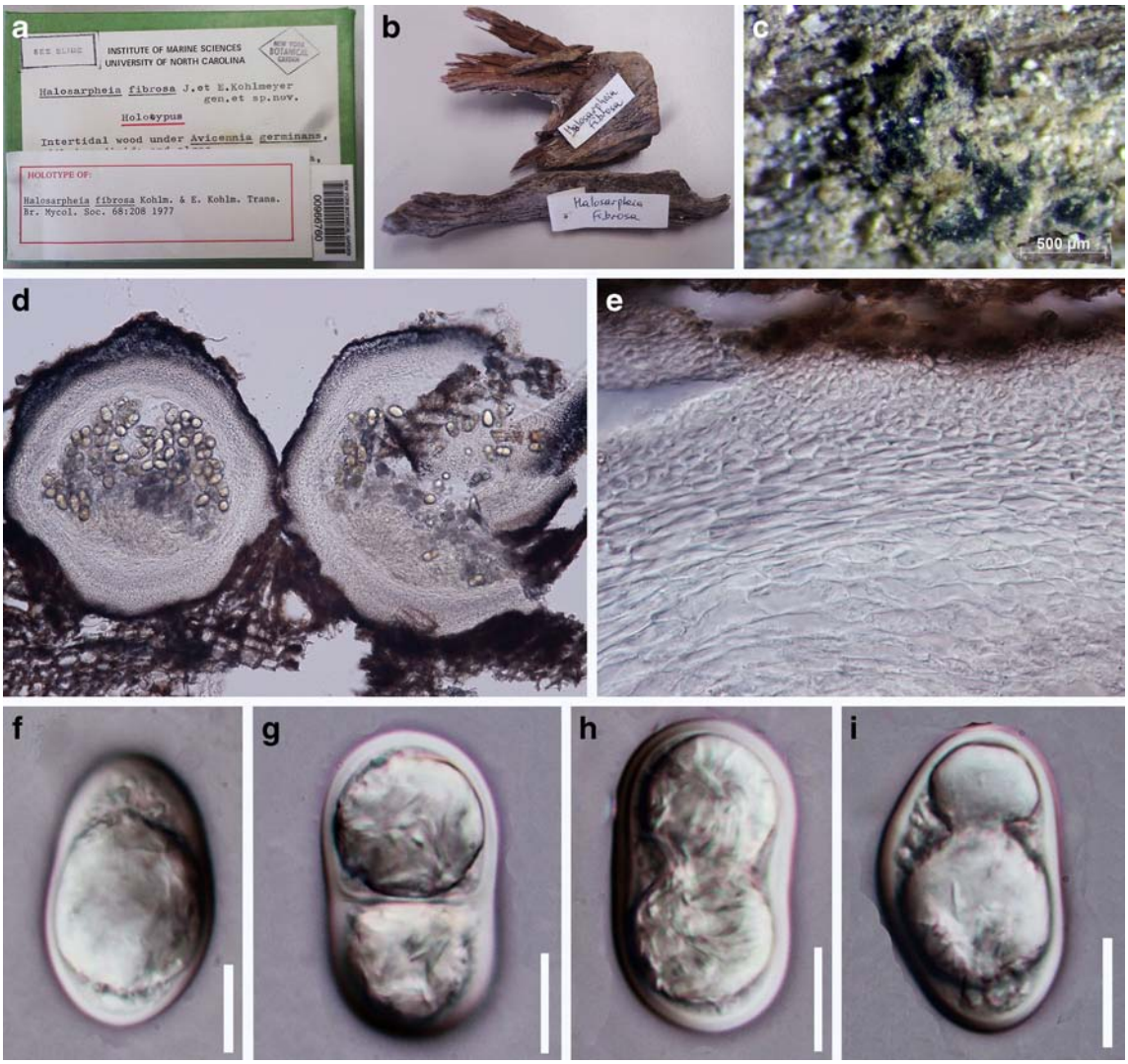

Fig. 65 ***Halosarpheia fibrosa*** (Material examined: BERMUDA, St. George Island, Coot Pond, intertidal wood of *Avicennia germinans*, with teredinids and algae, 14 May 1976, J. J. Kohlmeyer, NY 00966760, **holotype**) **a**, **b** Herbarium material of *Halosarpheia fibrosa* **c** Ascomata on host surface d Section through ascomata **e** Peridium **f-i** Ascospores. Scale bars: **c** = 500 μm, **d**, **e** = 100 μm. **f–i** = 20 μm

Type species: ***Corollospora maritima*** Werderm., Notizbl. Königl. bot. Gart. Museum Berlin 8: 248 (1922)

Cucullosporella K.D. Hyde & E.B.G. Jones, Mycotaxon 37: 200 (1990)

Type species: ***Cucullosporella mangrovei*** (K.D. Hyde & E.B.G. Jones) K.D. Hyde & E.B.G. Jones, Mycotaxon 37: 200 (1990)

Ebullia K.L. Pang, Mycoscience 56: 40 (2015)

Type species: ***Ebullia octonae*** (Kohlm.) K.L. Pang, Mycoscience 56: 40 (2015)

Fluviatispora K.D. Hyde, Mycol. Res. 98: 720 (1994)

Type species: ***Fluviatispora tunicata*** K.D. Hyde, Mycol. Res. 98: 722 (1994)

Gesasha Abdel-Wahab & Nagahama, Nova Hedwigia 92(3–4): 501 (2011)

Type species: ***Gesasha mangrovei*** Abdel-Wahab & Nagah., Nova Hedwigia 92(3–4): 507 (2011)

Haiyanga K.L. Pang & E.B.G. Jones, Raffles Bull. Zool., Suppl. 19: 8 (2008)

Type species: ***Haiyanga salina*** (Meyers) K.L. Pang & E.B.G. Jones, Raffles Bull. Zool., Suppl. 19: 8 (2008)

Haligena Kohlm., Nova Hedwigia 3: 87 (1961)

Type species: ***Haligena elaterophora*** Kohlm., Nova Hedwigia 3: 87 (1961)

Halosarpheia *sensu stricto* Kohlm. & E. Kohlm., Trans. Br. Mycol. Soc. 68(2): 208 (1977)

Type species: ***Halosarpheia fibrosa*** Kohlm. & E. Kohlm., Trans. Br. Mycol. Soc. 68(2): 208 (1977)

Halosphaeriopsis T.W. Johnson, J. Elisha Mitchell Scient. Soc. 74: 44 (1958)

Type species: ***Halosphaeriopsis mediosetigera*** (Cribb & J.W. Cribb) T.W. Johnson, J. Elisha Mitchell Scient. Soc. 74: 44 (1958)

Havispora K.L. Pang & Vrijmoed, Mycologia 100(2): 293 (2008)

Type species: ***Havispora longyearbyenensis*** K.L. Pang & Vrijmoed, Mycologia 100(2): 293 (2008)

Iwilsoniella E.B.G. Jones, Syst. Ascomyc. 10(1): 8 (1991)

Type species: ***Iwilsoniella rotunda*** E.B.G. Jones, Syst. Ascomyc., 10(1): 8 (1991)

Kitesporella Jheng & K.L. Pang, Bot. Mar. 55: 462 (2012)

Type species: ***Kitesporella keelungensis*** J.S. Jheng & K.L. Pang, Bot. Mar. 55(5): 462 (2012)

Kochiella Sakay. et al., Fungal Divers. 46: 96 (2011)

Type species: ***Kochiella crispa*** (Kohlm.) Sakay. et al. Jones, Fungal Divers. 46: 96 (2011)

Lautisporopsis E.B.G. Jones et al., Mycotaxon 67: 1 (1998)

Type species: ***Lautisporopsis circumvestita*** (Kohlm.) E.B.G. Jones et al., Can. J. Bot. 72(10): 1558 (1994)

Lignincola Höhnk, Veröff. Inst. Meeresf. Bremerhaven 3: 216 (1955)

Type species: ***Lignincola laevis*** Höhnk, Veröff. Inst. Meeresf. Bremerhaven 3: 216 (1955)

Limacospora Jørg. Koch & E.B.G. Jones, Can. J. Bot. 73(7): 1011 (1995)

Type species: ***Limacospora sundica*** (Jørg. Koch & E.B.G. Jones) Jørg. Koch & E.B.G. Jones, Can. J. Bot. 73(7): 1013 (1995)

Luttrellia Shearer, Mycologia 70(3): 692 (1978)

Type species: ***Luttrellia estuarina*** Shearer, Mycologia 70(3): 693 (1978)

Magnisphaera J. Campbell et al., Mycologia 95(3): 546 (2003)

Type species: ***Magnisphaera spartinae*** (E.B.G. Jones) J. Campb. et al., Mycologia 95(3): 547 (2003)

Marinospora A.R. Caval., Nova Hedwigia 11: 548 (1966)

Type species: ***Marinospora calyptrata*** (Kohlm.) A.R. Caval., Nova Hedwigia 11: 548 (1966)

Moana Kohlm. & Volkm.-Kohlm., Mycol. Res. 92 (4): 418 (1989)

Type species: ***Moana turbinulata*** Kohlm. & Volkm.-Kohlm., Mycol. Res. 92(4): 418 (1989)

Morakotiella Sakay., Mycologia 97(4): 806 (2005)

Type species: ***Morakotiella salina*** (C.A. Farrant & E.B.G. Jones) Sakay., Mycologia 97(4): 806 (2005)

Nais Kohlm., Nova Hedwigia 4: 409 (1962)

Type species: ***Naïs inornata*** Kohlm., Nova Hedwigia 4: 409 (1962)

Natantispora J. Campbell et al., Mycologia 95(3): 543 (2003)

Type species: ***Natantispora retorquens*** (Shearer & J.L. Crane) J. Campbell et al., Mycologia 95(3): 543 (2003)

Nautosphaeria E.B.G. Jones, Trans. Br. Mycol. Soc. 47(1): 97 (1964)

Type species: ***Nautosphaeria cristaminuta*** E.B.G. Jones, Trans. Br. Mycol. Soc. 47(1): 97 (1964)

Neptunella K.L. Pang & E.B.G. Jones, Mycol. Progr. 2(1): 35 (2003)

Type species: ***Neptunella longirostris*** (Cribb & J.W. Cribb) K.L. Pang & E.B.G. Jones, Mycol. Progr. 2(1): 35 (2003)

Nereiospora E.B.G. Jones et al., J. Linn. Soc. Bot. 87(2): 204 (1983)

Type species: ***Nereiospora comata*** (Kohlm.) E.B.G. Jones et al., J. Linn. Soc. Bot. 87(2): 206 (1983)

Nimbospora J. Koch, Nordic J. Bot. 2(2): 166 (1982)

Type species: ***Nimbospora effusa*** Jørg. Koch, Nordic Journal of Botany 2 (2): 166 (1982)

Nohea Kohlm. & Volkm.-Kohlm., Syst. Ascomyc. 10: 121 (1991)

Type species: ***Nohea umiumi*** Kohlm. & Volkm.-Kohlm., Syst. Ascomyc. 10: 122 (1991)

Oceanitis Kohlm., Revue Mycol. 41(2): 193 (1977)

Type species: ***Oceanitis scuticella*** Kohlm., Revue de Mycologie 41 (2): 194 (1977)

Ocostaspora E.B.G. Jones et al., Bot. Mar. 26: 353 (1983)

Type species: ***Ocostaspora apilongissima*** E.B.G. Jones et al., Bot. Mar. 26(7): 354 (1983)

Okeanomyces K.L. Pang & E.B.G. Jones, J. Linn. Soc. Bot. 146(2): 228 (2004)

Type species: ***Okeanomyces cucullatus*** (Kohlm.) K.L. Pang & E.B.G. Jones, J. Linn. Soc. Bot. 146(2): 228 (2004)

Ondiniella E.B.G. Jones et al., Bot. Mar. 27: 136 (1984)

Type species: ***Ondiniella torquata*** (Kohlm.) E.B.G. Jones et al., Bot. Mar. 27(3): 136 (1984)

Ophiodeira Kohlm. & Volkm.-Kohlm., Can. J. Bot. 66 (10): 2062 (1988)

Type species: ***Ophiodeira monosemeia*** Kohlm. & Volkm.-Kohlm., Can. J. Bot. 66(10): 2062 (1988)

Phaeonectriella R.A. Eaton & E.B.G. Jones, Nova Hedwigia 19(3–4): 779 (1971) [1970]

Type species: ***Phaeonectriella lignicola*** R.A. Eaton & E.B.G. Jones, Nova Hedwigia 19(3–4): 779 (1971) [1970]

Praelongicaulis E.B.G. Jones et al., gen. nov. Fungal Divers. 73: 54 (2015)

Type species: ***Praelongicaulis kandeliae*** (Abdel-Wahab & E.B.G. Jones) E.B.G. Jones et al., Fungal Divers. 73: 54 (2015)

Panorbis J. Campb. et al., Mycologia 95(3): 544 (2003)

Type species: ***Panorbis viscosus*** (I. Schmidt) J. Campb. et al., Mycologia 95(3): 544 (2003)

Pileomyces K.L. Pang & Jheng, Bot. Stud. 53: 536 (2012)

Type species: ***Pileomyces formosanus*** K.L. Pang & J.S. Jheng, Bot. Stud. 53: 536 (2012)

Pseudolignincola Chatmala & E.B.G. Jones, Nova Hedwigia 83(1–2): 225 (2006)

Type species: ***Pseudolignincola siamensis*** Chatmala & E.B.G. Jones, in Jones, Chatmala & Pang, Nova Hedwigia 83(1–2): 226 (2006)

Remispora Linder, Farlowia 1(3): 409 (1944)

Type species: ***Remispora maritima*** Linder, Farlowia 1: 410 (1944)

Saagaromyces K.L. Pang & E.B.G. Jones, Mycol. Progr. 2(1): 35 (2003)

Type species: ***Saagaromyces ratnagiriensis*** (S.D. Patil & Borse) K.L. Pang & E.B.G. Jones, Mycological Progress 2 (1): 35 (2003)

Sablicola E.B.G. Jones et al., Can. J. Bot. 82(4): 486 (2004)

Type species: ***Sablecola chinensis*** E.B.G. Jones et al., Can. J. Bot. 82(4): 486 (2004)

Thalassogena Kohlm. & Volkm.-Kohlm., Syst. Ascomyc. 6: 223 (1987)

Type species: ***Thalassogena sphaerica*** Kohlm. & Volkm.-Kohlm., Syst. Ascomyc. 6(2): 225 (1987)

Thalespora Chatmala & E.B.G. Jones, Nova Hedwigia 83(1–2): 228 (2006)

Type species: ***Thalespora appendiculata*** Chatmala & E.B.G. Jones, in Jones, et al., Nova Hedwigia 83(1–2): 229 (2006)

Tinhaudeus K.L. Pang et al., Fungal Divers. 75:160 (2015)

Type species: ***Tinhaudeus formosanus*** K.L. Pang et al., Fungal Divers. 75:164 (2015)

Tirispora E.B.G. Jones & Vrijmoed, Can. J. Bot. 72(9): 1373 (1994)

Type species: ***Tirispora unicaudata*** E.B.G. Jones & Vrijmoed, Can. J. Bot. 72(9): 1373 (1994)

Toriella Sakay., et al., Fungal Divers. 46(1): 99 (2011)

Type species: ***Toriella tubulifera*** (Kohlm.) Sakay. et al., Fungal Divers. 46(1): 100 (2011)

Trailia G.K. Sutherl., Trans. Br. Mycol. Soc. 5: 149 (1915)

Type species: ***Trailia ascophylli*** G.K. Sutherl., Trans. Br. Mycol. Soc. 5(1): 149 (1915)

Trichomaris Hibbits et al., Can. J. Bot. 59(11): 2123 (1981)

Type species: ***Trichomaris invadens*** Hibbits et al., Can. J. Bot. 59(11): 2123 (1981)

Tubakiella Sakay., et al., Fungal Divers. 46: 97 (2011)

Type species: ***Tubakiella galerita*** (Tubaki) Sakay. et al., Fungal Divers. 46: 99 (2011)

Tunicatispora K.D. Hyde, Aust. Syst. Bot. 3: 712 (1990)

Type species: ***Tunicatispora australiensis*** K.D. Hyde, Aust. Syst. Bot. 3(4): 712 (1990)

Key to genera of *Halosphaeriaceae*

1. Ascospores aseptate 2
1. Ascospores septate 9
2. Ascospores appendaged 3
2. Ascospores lacking appendages 4
3. Ascospores with polar and 4 groups of equatorial hair-like appendages . . . . . ***Nautosphaeria***
3. Ascospores with a single, uncoiling polar appendage……..... ***Moana***
3. Ascospores with a prominent sheath …… ***Fluviatispora***
4. Ascospores longer than 50 μm, filiform, range 50–300 × 4–15 μm . . . . . ***Bathyascus***
4. Ascospores shorter than 50 μm, spherical, ellipsoidal or rhomboid 5
5. Ascospores ellipsoidal or spherical to round. 6
5. Ascospores rhomboid. . . . . ***Kitesporella***
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13. Ascus tip lacking thimble-shaped apical thickening…..……. ***Alisea***
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14. Ascospores with a faint sheath . . . . . ***Neptunella***
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16. Ascospores with a hamate polar appendage 17
16. Ascospores with an ephemeral drop of polar mucilage, becoming 2-4-septate on germination…***Okeanomyces***
17. Ascomata formed beneath a stroma, ascospores 6–21× 6–8 μm . . . . . ***Ophiodeira***
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18. Ascospores ellipsoidal, 25–36 × 8–12 μm. 19
18. Ascospores filiform, 60–80 × 4–6 μm ascomata thick-walled . . . . . ***Oceanitis***
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27. Ascospores with a sheath and polar and lateral or sub-polar appendages 28
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28. Ascospores with polar hair-like and lateral sheath-like appendage . . . . . ***Nimbospora***
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29. Exosporium folds to form an annulus-like equatorial appendage, polar appendages form inside and end chamber consist of two electron-dense layers.. ***Toriella***
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32. Ascospore appendages ephemeral . . . . . ***Gesasha***
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34. Ascospores wing-like or radiating appendages ..... ***Remispora***
34. Ascospores ellipsoidal without radiating appendages ..... ***Kochiella***
35. Appendages initially wrapped around the ascospore wall, separating in water to form long filaments that are spoon-shaped at the place of attachment . . . . . ***Morakotiella***
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36. Ascospore appendages with a spade-like tip ..... ***Arenariomyces***
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45. Appendages lacking cup-like fragments at their tips . . 47
46. Equatorial appendages two pairs, radiating, at the central septum . . . . . ***Marinospora***
46. Equatorial appendages one pair not radiating ..... ***Toriella***
47. Exosporic sheath highly fibrillar (mucilaginous), appendage slug-like. . . . . ***Limacospora***
47. Exosporic sheath compact, not fibrillar, appendages not slug-like 48
48. Ascospores thick walled at apices. . . . . ***Tubakiella***
48. Ascospores wall evenly distributed. 49
49. Apical appendages swells in water, equatorial appendages subulate, evenly distributed around the septum. . . . . ***Ebullia***
49. Apical appendages tubular, 3–4 lateral appendages subcylindrical with small caps on their tips ..... ***Ceriosporopsis***
50. Ascospores with no appendages 47
50. Ascospores with appendages 49
51. Ascospores filamentous, broad at one end, tapering at the other. . . . . ***Trailia***
51. Ascospores not tapering at one end 48
52. Ascospores 5-septate (rarely 9), asci with 4 ascospores . . . . . ***Luttrellia***
52. Ascospores 3-septate, asci with 8 ascospores ..... ***Pseudolignincola***
53. Ascospores hyaline or brown with polar and equatorial appendages. 50
53. Ascospores hyaline, with only polar appendages 52
53. Ascospores with sheath, lacking polar and equatorial appendages 58
54. Appendages hair-like tufts, one polar and four equatorial 51
54. Polar appendages spine-like, equatorial appendages formed by fragmentation of an exosporic sheath ***Corollospora***

55. Catenophyses present, ascospores hyaline, appendages string-like, lacking an equatorial pad ……..…***Havispora***
55. Catenophyses lacking, ascospores with hyaline end cells and brown central cells, equatorial pad present . . . . . ***Nereiospora***
56. Ascospores with a single polar appendage 53
56. Ascospores with bipolar appendages 54
57. Appendage an ephemeral drop of mucilage ..... ***Okeanomyces***
57. Tetra radiate appendages formed after release from the ascoma. . . . . ***Thalespora***
58. Ascospores appendages hamate, unfurling in water 55
58. Ascospore appendages not hamate 57
59. Ascospores narrower than 7 μm. . . . . ***Oceanitis***
59. Ascospores wider than 7 μm 56
60. Ascospores verrucose, wider than 40 μm .. ***Magnisphaera***
60. Ascospores not verrucose, narrower than 40 μm ***Halosarpheia sensu lato***
61. Ascospores appendages sub-polar, spine-like ***Arenariomyces***
61. Ascospores appendages broad strap-like. . . ***Haligena***
61. Ascospores appendages round . . . . . ***Trichomaris***
62. Ascospores 12–20 μm wide, central cells dark, appendages a fragmenting sheath net-like ..... ***Carbosphaerella***
62. Ascospores hyaline, 7–11 μm wide ... ***Appendichordella***

Harknessiaceae Crous, in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 28: 55 (2012)

Facesoffungi number: FoF 01387

Saprobic or *pathogenic*, associated with leaf spots. **Sexual morph**: *Ascomata* perithecial, solitary or aggregated, immersed, globose, coriaceous, brown, papillate. *Papilla* emergent to depressed, wall comprising 3–5 layers of brown-walled cells of *textura angularis. Hamathecium* comprising hyaline, septate paraphyses. *Asci* 8-spored, unitunicate, cylindrical to clavate, short pedicellate, with J-, apical ring. *Ascospores* uniseriate to biseriate, hyaline, ellipsoid to fusoid, aseptate, thick-walled, guttulate, smooth-walled. **Asexual morph**: Coelomycetous. *Conidiomata* eustromatic, pycnidial, scattered or aggregated, immersed, globose, coriaceous, with single or several locules, dark brown to black. *Peridium* comprising thin-walled, almost hyaline to brown cells of *textura angularis. Ostiole* wide, central, surrounded by brown cells. *Conidiophores* lining the inner cavity or reduced to basal layer sometimes reduced to conidiogenous cells, sometimes septate, branched. *Conidiogenous cells* holoblastic, discrete, lageniform, subcylindrical to cylindrical, hyaline to pale yellow, smooth, producing macroconidia and sometimes microconidia from same conidiogenous cell, proliferating Sympodially, one or several times. *Macroconidia* with a basal appendage, hyaline when young, brown at maturity, unicellular, although basal appendage separated by a septum thick-walled, smooth-walled, with or without light and dark longitudinal bands, sometimes longitudinally striate, guttulate, basal appendage cellular, cylindrical to subcylindrical, hyaline, thin-walled, devoid of contents, apical appendage present or absent, if present elongate. *Microconidia* hyaline, oval to ellipsoid, aseptate, smooth-walled.

Type: ***Harknessia*** Cooke

Notes: The family *Harknessiaceae* is typified by *H. eucalypti* Cooke and has distinct morphological characters with a wuestneia-like sexual morph. LSU analysis places the family in *Diaporthales* (Crous et al. 2012). Crous et al. (2012) introduced six novel species of *Harknessia* on *Eucalyptus* and a multi-gene analysis (ITS, CAL and TUB) was provided for these species. Most members in the family are associated with leaf spots and they are suspected to be pathogens. However, many species have been isolated from asymptomatic plant tissues and are assumed to be saprobes.

Harknessia Cooke, in Cooke & Harkness, Grevillea 9(no. 51): 85 (1881)

Facesoffungi numbers: FoF 02144; Figs 66, 67

Saprobic or *pathogenic*, mostly on leaf tissues. **Sexual morph**: *Ascomata* perithecial, single or aggregated, immersed brown. *Neck* emergent to depressed, wall of 3–5 layers of brown cells of *textura angularis. Paraphyses* hyaline, septate, dispersed between asci. *Asci* 8-spored, unitunicate, cylindrical to clavate, short pedicellate, with J- apical ring. *Ascospores* uni- to biseriate, hyaline, ellipsoid to fusoid, aseptate, thick-walled, guttulate, smooth-walled. **Asexual morph**: Coelomycetous, appearing as nearly circular, black distinct spots. *Conidiomata* erumpent, scattered, pycnidial, unilocular, globose to subglobose, brown. *Peridium* comprising 3–4 layers of brown-walled cells of *textura angularis. Conidiophores* short, cylindrical, almost globose, branched, hyaline, mixed with peridium cells. *Conidiogenesis cells* hyaline to brown, holoblastic, bottle-shaped, cylindrical. *Conidia* hyaline when young, brown at maturity, globose to ovoid, with a truncate apiculate apex and an obtuse to blunt base, smooth-walled, with longitudinal striations along the length of some conidia. *Basal appendages* hyaline, tubular, smooth, thin-walled, often collapsing.

Type species: ***Harknessia eucalypti*** Cooke, Grevillea 9(no. 51): 85 (1881)

Notes: *Harknessia* species are found in a large variety of ecosystems and are commonly associated with leaf spots, leaves with tip dieback or leaf scorch and stem cankers (Crous et al. 1989; Wijayawardene et al. 2016). Some species have been isolated from leaf and twig litter (Marincowitz et al. 2008). However, whether *Harknessia* species are important pathogens or saprobes is not resolved. *Harknessia* species with hyaline conidia and apical appendages were placed in *Mastigosporella* by von Höhnel (1915), and species with brown conidia with apical and basal appendages were moved to *Apoharknessia* (Lee et al. 2004), while species with very thick conidial walls and longitudinal slits were included in *Dwiroopa* (Farr and Rossman 2003). However, there is molecular support to place *Harknessia* in a distinct lineage in the family *Harknessiaceae*.

Helminthosphaeriaceae Samuels et al., Mycologia 89(1): 144 (1997)

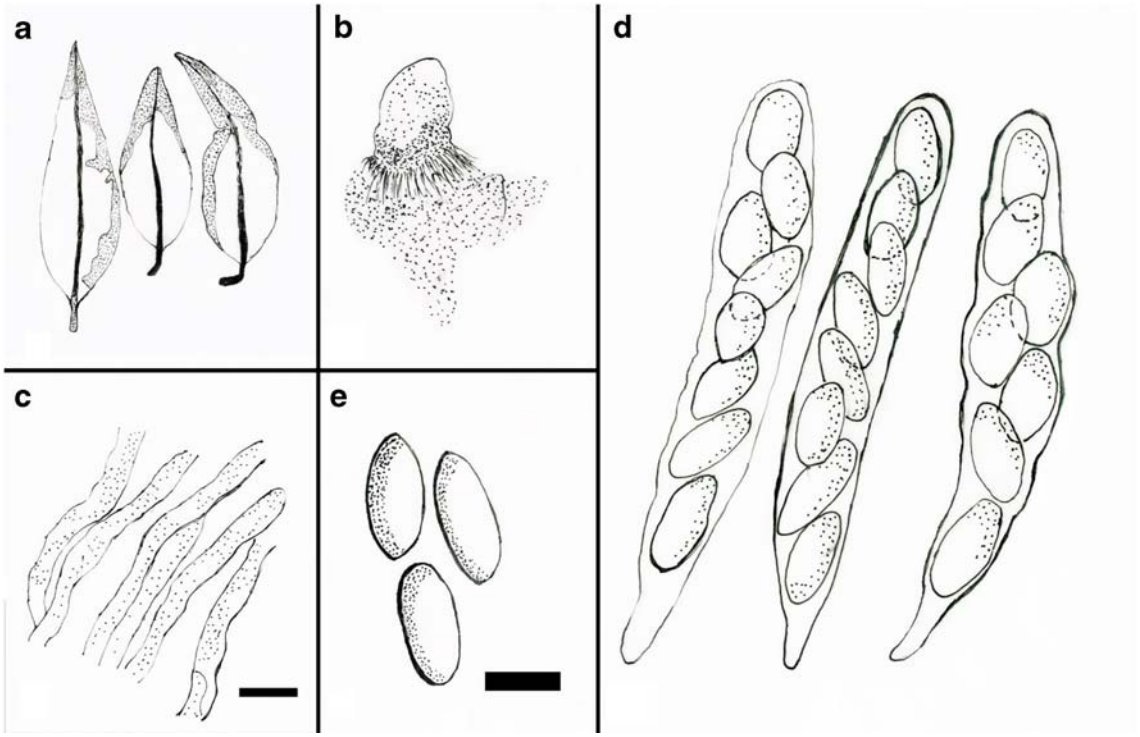


Fig. 66 **Sexual morph of *Harknessia eucalyptorum*** (CPC 12697). **a** Leaf spot symptoms on *Eucalyptus* sp. **b** Ascomata with short neck **c** Paraphyses **d** asci **e** Ascospores. Scale bars = 10 μm (redrawn from Crous et al. 2012)

Facesoffungi number: FoF 01142

Saprobic or *parasitic* on wood, stems or decorticated branch in terrestrial habitats, some fungicolous. **Sexual morph**: *Ascomata* perithecial, gregarious or scattered, dark brown to black, solitary, superficial or immersed, ovoid, globose to subglobose, carbonaceous or membranaceous, rough, tuberculate, smooth or with setae, papillate or ostiole indistinct or absent, the apex collapsing when dry, hyaline periphyses lining the ostiole or absent. *Peridium* thick (30–60 μm), composed of two layers, outer layer comprising brown cells of *textura angularis* or *prismatica*, carbonaceous or membranaceous; inner layer comprising of hyaline cells of *textura prismatica*, thin, membranaceous. *Hamathecium* with numerous, septate, persistent or deliquescing, swollen, filiform or cylindrical pseudoparaphyses. *Asci* 8-spored, unitunicate, thin or thick-walled, cylindrical to clavate, pedicellate, apex truncate, not amyloid, apical ring refractive or indistinct. *Ascospores* 2-seriate, hyaline or brown or becoming dark colored in part, allantoid, clavate, cylindrical to ellipsoid, 0–3-septate, smooth-walled, with or without guttules. **Asexual morph**: Hyphomycetous. *Conidiophores* macronematous, mononematous, scattered or gregarious, brown, straight, septate, unbranched, smooth-walled. *Conidiogenous cells* monoblastic, terminal, integrated, percurrent. *Conidia* solitary, acrogenous, brown, septate, obclavate, fusiform to cylindrical, straight, subtruncate to obtuse at the apex, truncate or swollen at the base, eguttulate or guttulate.

Type: ***Helminthosphaeria*** Fuckel

Notes: The family *Helminthosphaeriaceae* was introduced by Samuels et al. (1997b) based on black, setose ascomata and cylindrical asci with brown to hyaline ascospores and only included *Helminthosphaeria* (Fuckel 1870). *Tengiomyces* was added to the family by Réblová (1999a) based on morphological data. *Echinosphaeria*, *Hilberina*, *Ruzenia* and *Synaptospora* were included based on analysis of LSU sequence data and morphological characters (Miller and Huhndorf 2004; Miller et al. 2014). *Endophragmiella* was accepted as the asexual morph of *Echinosphaeria*. The family *Helminthosphaeriaceae* forms a well-supported clade in the order *Chaetosphaeriales*, with *Chaetosphaeriaceae* as a sister clade (Maharachchikumbura et al. 2015). Currently seven genera are accepted in the family based on morphological and phylogenic analyses of LSU, SSU, TEF and RPB2 sequence data (Maharachchikumbura et al. 2015).

Helminthosphaeria Fuckel, Jb. nassau. Ver. Naturk. 23–24: 166 (1870) [1869–70]

Facesoffungi number: FoF 01143, Fig. 68

Saprobic on wood or decorticated branch in terrestrial habitats, some fungicolous. **Sexual morph**: *Ascomata* perithecial, gregarious or scattered, dark brown to black, solitary, superficial or immersed, globose to subglobose, carbonaceous or membranaceous, rough, smooth or with setae, with or without ostioles, hyaline periphyses lining ostiole or absent, the apex collapsing when dry. *Peridium* thick (30–60 μm), composed of two layers, outer layer comprising of brown cells of *textura angularis*, carbonaceous or membranaceous; inner layer

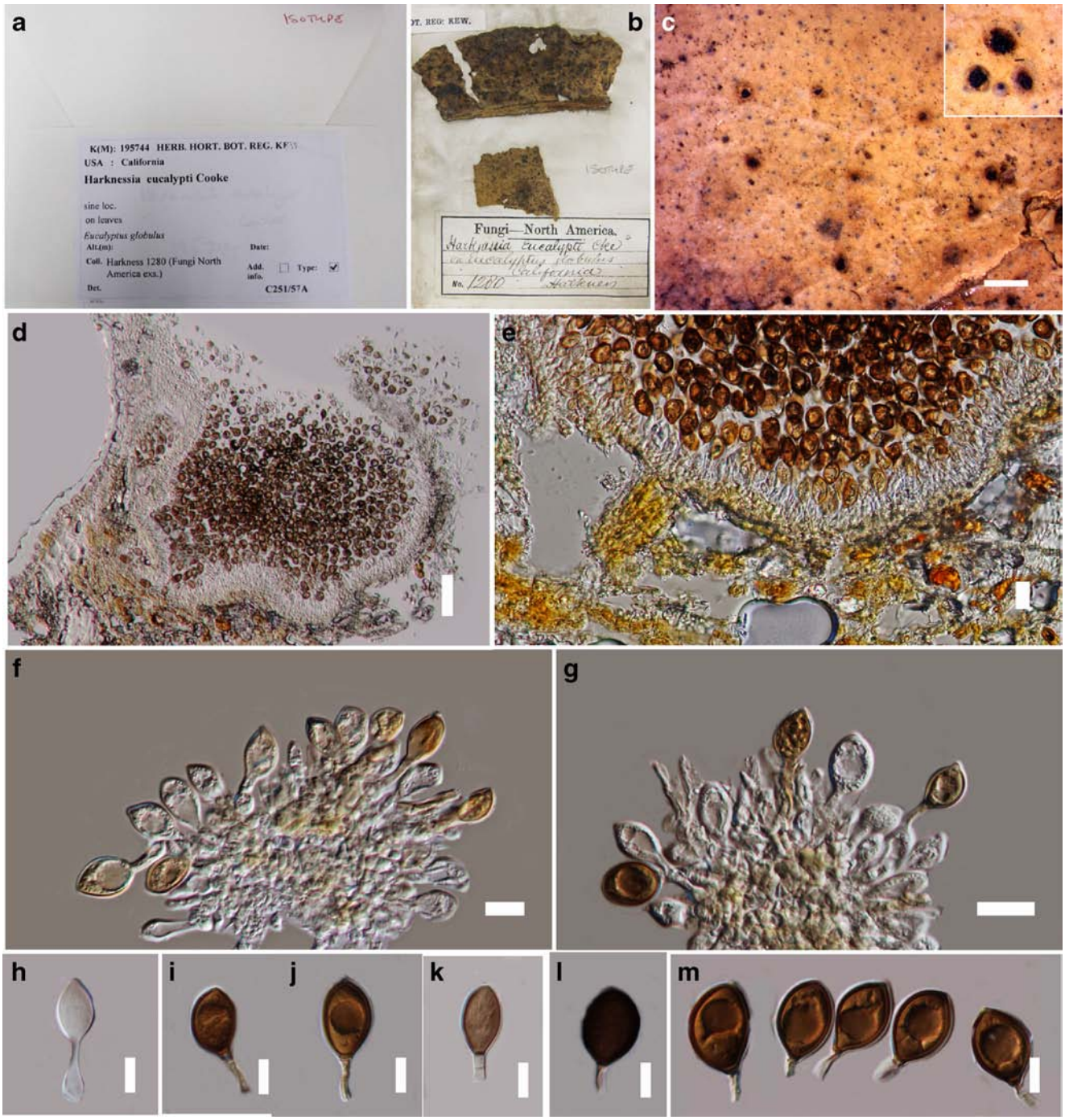


Fig. 67 ***Harknessia eucalypti*** (Material examined: USA, California, on leaves of *Eucalyptus globulus* Labill. (*Myrtaceae*), Harkness 1280, **isotype** K (M) 195744). **a**, **b** Herbarium packet and specimen **c** Conidiomata on host substrate **d** Cross section of conidioma **e** Peridium **f**, **g** Conidia attached to conidiophores **h–m** Conidia. Scale bars: **d** = 100 μm, **e–g** = 20 μm, **h–m** = 10 μm

comprising hyaline cells of *textura prismatica*, thin, membranaceous. *Hamathecium* with numerous, septate, unbranched or branched, swollen, filiform or cylindrical paraphyses. *Asci* 8-spored, unitunicate, cylindrical to clavate, pedicellate, apex truncate, not amyloid, apical ring refractive or indistinct,. *Ascospores* 2-seriate, hyaline or brown or greyish, clavate to ellipsoid, 0–3-septate, smooth-walled, with or without guttules. **Asexual morph**: Hyphomycetous. *Conidiophores* mononematous, scattered to gregarious, brown, straight, septate, branched, smooth-walled. *Conidiogenous cells* integrated, intercalary or percurrent. *Conidia* solitary, hyaline to brown or multi-coloured, aseptate to multi-septate, obclavate to cylindrical, eguttulate or guttulate.

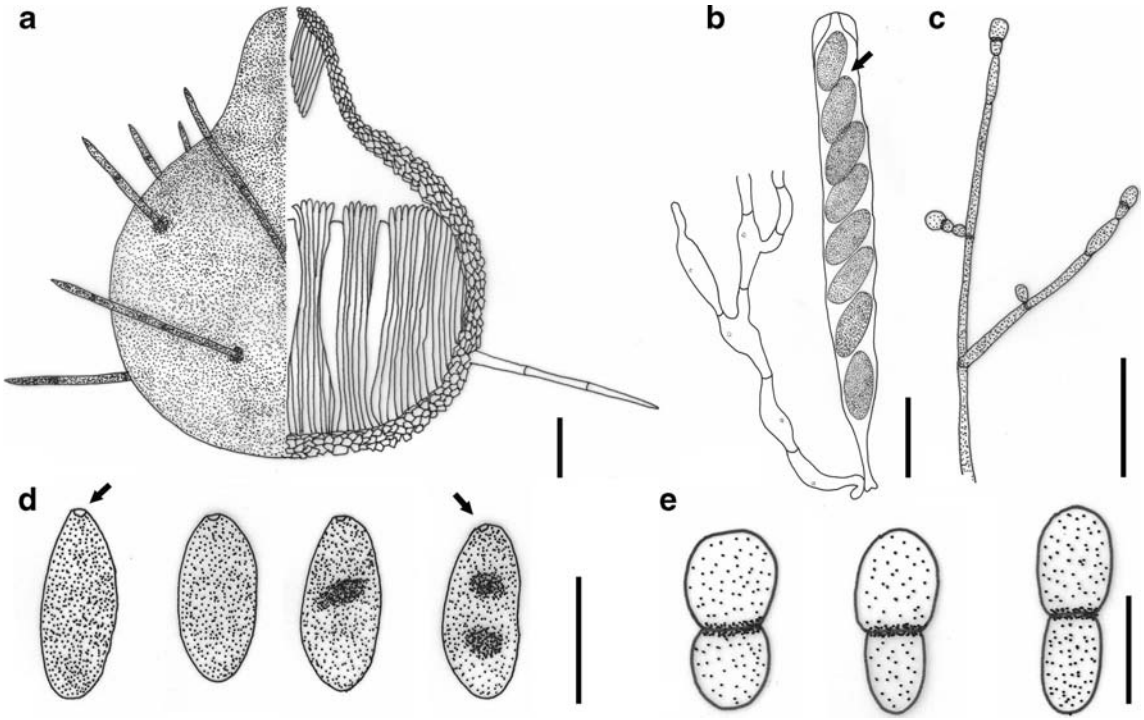


Fig. 68 ***Helminthosphaeria clavariarum*** (from Samuels et al. 1997b) **a** Ascoma with setae and vertical section of ascoma **b** Asci and pseudoparaphyses **c** Conidiophore and conidia (asexual morph *Diplococcium* sp.) **d** Ascospores (pores in ascospores are indicted by arrowhead) **e** Conidia (asexual morph *Diplococcium* sp.). Scale bars: **a**, **c** = 50 μm, **b** = 20 μm, **d–e** = 10 μm

Type species: ***Helminthosphaeria clavariarum*** (Desm.) Fuckel, Jb. nassau. Ver. Naturk. 23–24: 166 (1870) [1869–70]

Notes: The genus *Helminthosphaeria* was introduced by Fuckel (1870), with *H. clavariarum* as the type species. This genus was included in *Melanosporaceae*, in the order *Sordariales* based on its 1-septate ascospores with apical pores (Parguey-Leduc 1960). Lundqvist (1972) excluded *Helminthosphaeria* from *Melanosporaceae* and thought that it should be used as a subfamily or family due to its distinct filamentous pseudoparaphyses and asci lacking sheaths. Barr (1990) reevaluated the family *Sordariaceae* and included *Helminthosphaeria*. Eriksson and Hawksworth (1993) placed *Helminthosphaeria* in the order *Sordariales*. Samuels et al. (1997b) monographed the genus, including the asexual morph *Diplococcium*, and introduced the family *Helminthosphaeriaceae*. The sexual morph is characterized by a fungicolous or lignicolous habit, superficial or immersed ascomata, cylindrical asci and hyaline to brown ascospores, and an asexual morph characterized by smooth or verrucose, septate conidia (Samuels et al. 1997b; Goh and Hyde 1998; Hernández-Restrepo et al. 2012).

Other genera included

Echinosphaeria A.N. Mill. & Huhndorf, Mycol. Res. 108(1): 29 (2004)

Type species: ***Echinosphaeria canescens*** (Pers.) A.N. Mill. & Huhndorf, Mycol. Res. 108(1): 31 (2004)

Endophragmiella B. Sutton, Mycol. Pap. 132: 58 (1973)

Type species: ***Endophragmiella pallescens*** B. Sutton, Mycol. Pap. 132: 62 (1973)

Hilberina Huhndorf & A.N. Mill., Mycol. Res. 108(1): 31 (2004)

Type species: ***Hilberina caudata*** (Fuckel) Huhndorf & A.N. Mill., in Miller & Huhndorf, Mycol. Res. 108(1): 31 (2004)

Ruzenia O. Hilber, The Genus *Lasiosphaeria* and Allied Taxa (Kelheim): 7 (2002)

Type species: ***Ruzenia spermoides*** (Hoffm.) O. Hilber, in Hilber & Hilber, The Genus *Lasiosphaeria* and Allied Taxa (Kelheim): 7 (2002) = *Sphaeria spermoides* Hoffm., Veg. Crypt. 2: 12 (1790)

Synaptospora Cain, Beih. Sydowia 1: 4 (1957) [1956]

Type species: ***Synaptospora petrakii*** Cain, Beih. Sydowia 1: 5 (1957)

Tengiomyces Réblová, Mycotaxon 70: 408 (1999)

Type species: ***Tengiomyces indicus*** (Varghese & V.G. Rao) Réblová, Mycotaxon 70: 408 (1999)

Key to genera of *Helminthosphaeriaceae*

1. Hyphomycete with acrogenous, cylindrical hyaline conidia ***Endophragmiella***

1. Ascomycete 2
2. Ascospores hyaline at maturity ***Ruzenia***
2. Ascospores brown or greyish-brown or versicolor at maturity 3
3. Ascospores versicolored ***Tengiomyces***
3. Ascospores concolourous 4
4. Ascospores curved 5
4. Ascospores straight 6
5. Ascospores L-shape ***Hilberina***
5. Ascospores allantoid ***Echinosphaeria***
6. Ascospores clavate to cylindrical, greyish-brown, not contracted at the septa ***Helminthosphaeria***
6. Ascospores oval to ellipsoid, brown, constricted at the septa.. ***Synaptospora***

Hispidicarpomycetaceae Nakagiri, Mycologia 85(4): 649 (1993)

Facesoffungi number: FoF 01098

Parasitic on marine alga. **Sexual morph**: *Ascomata* superficial, solitary to gregarious, ostiolate, apapillate. *Peridium* composed of three-layers: outer layer with thick-walled, short hyphal projections, brown to dark brown, middle layer of light brown to dark brown, thick-walled hyphal, flattened cells of *textura epidermoidea*, and an inner layer of pale brown, thin-walled, flattened cells of *textura epidermoidea*, lining the whole ascomatal venter. *Paraphyses* septate branched. *Asci* 8-spored, unitunicate, thin-walled, clavate to pyriform, deliquescing early and lacking an apical ring. *Ascospores* hyaline, ellipsoid to elliptic-fusiform, unicellular, lacking appendages or a sheath, overlapping. **Reproductive state**: of brown hyphae, *Spermodochia* composed of a mass spermatiospores. *Spermatiospores*, verticillate, asymmetrical penicilliate-like, brown at the base, paler and hyaline towards the apex. *Stipes* septate, branched, brown at the base. *Spermatia* cylindrical, unicellular, hyaline. *Trichogynes* septate, cylindrical, brown.

Type: ***Hispidicarpomyces*** Nakagiri

Notes: The family *Hispidicarpomycetaceae* was introduced to accommodate a marine ascomycete, *Hispidicarpomyces galaxauricola* Nakagiri inhabiting the alga *Galaxaura falcata* (Rhodophyta), which was found along the Japanese coast by Nakagiri (1993). This fungus produces trichogynes and spermatiophores composed of spermodochia which resemble *Spathulospora* species, another ascomycete parasitic on a red alga (*Ballia* spp.), but differs from the latter genus in possessing hyphoid thalli, in spermodochia formation, and ascomata structure (Nakagiri 1993). The genera *Spathulospora*, *Retrostium* (*Spathulosporaceae*) and *Hispidicarpomyces* (*Hispidicarpomycetaceae*) were referred to the order *Spathulosporales* by Nakagiri (1993). However, molecular data placed the genus *Spathulospora* (*S. adelpha* and *S. antartica*) in the order *Lulworthiales* (Inderbitzin et al. 2004), although the type species (*S. phyophila*) has not been sequenced. Consequently, the affinity of *Spathulospora* within the *Lulworthiales* raises the question as to the phylogenetic position of *Hispidicarpomycetaceae*. Maharachchikumbura et al. (2015) also accepted the taxonomic placement of the family *Hispidicarpomycetaceae* within the order *Spathulosporales*. Further collections, isolation and sequencing are necessary to resolve the taxonomic position of these families.

Hispidicarpomyces Nakagiri, Mycologia 85(4): 639 (1993)

Facesoffungi number: FoF 02110, Fig. 69

Parasitic on the red alga *Galaxaura falcata*. **Sexual morph**: *Ascomata* hemisphaerical, erumpent, solitary to gregarious, ostiolate, epapillate, black. *Peridium* composed of several cell layers with short hyphal projections at the outer surface. *Paraphyses* present. *Asci* in a hymenium lining whole ascocarp venter, 8-spored, unitunicate, thin-walled, clavate to pyriform, early deliquescing. *Ascospores* hyaline, ellipsoidal to fusiform, unicellular, lacking appendages or a sheath. **Reproductive state**: *Spermodochia* composed of penicilliate-like spermatiophores (antheridia), brown to dark brown. *Spermatia* cylindrical, one-celled, hyaline. *Trichogynes* cylindrical, septate, simple, with thin-walled and hyaline apical cell.

Type species: ***Hispidicarpomyces galaxauricola*** Nakagiri, Mycologia 85(4): 639 (1993)

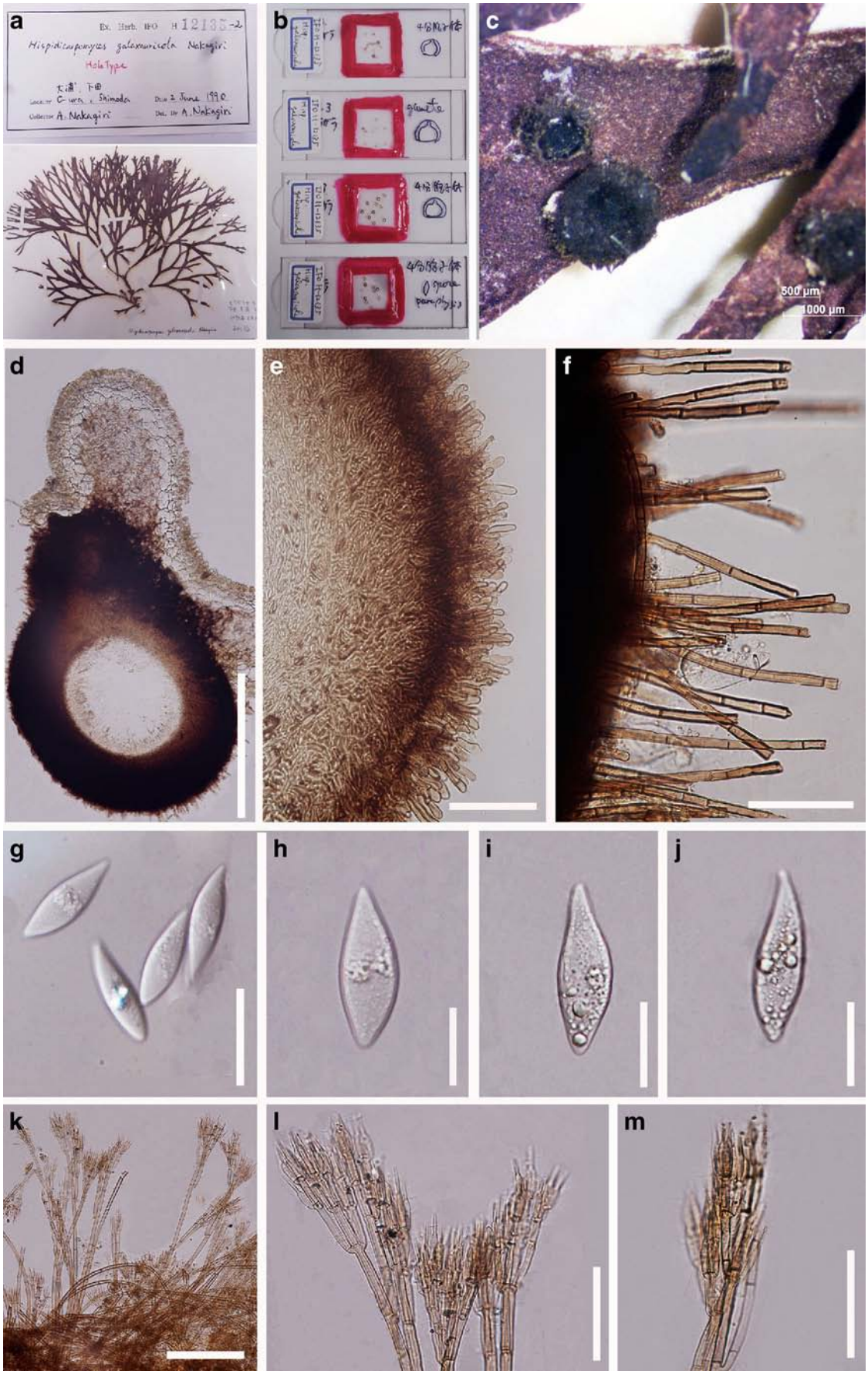
Notes: A monotypic marine genus introduced by Nakagiri (1993) in the family *Hispidicarpomycetaceae* that needs further taxon sampling to determine its phylogenetic position within Ascomycota (Jones et al. 2009b, 2015). Nakagiri (1993) described similar morphological features of *Hispidicarpomyces* and *Spathulospora*, such as production of trichogynes and spermatiophores in a spermodochium. However, *Hispidicarpomyces* species possess different morphological features to *Spathulospora*, including a hyphoid thallus, spermodochia formation, alternate development of spermodochium within the ascocarp, a peridium with a hispid surface, a hymenium extending along the entire inside of the ascocarp venter, the hamathecium (paraphyses), ascospores without appendages and the host alga.

Hypocreaceae De Not. [as 'Hypocreacei'], G. bot. ital. 2(1): 48 (1844)

= *Trichodermataceae* Fr. [as 'Trichodermacei'], Syst. orb. veg. (Lundae) 1: 144 (1825)

Facesoffungi number: FoF 01904

Fig. 69 ***Hispidicarpomyces galaxauricola*** (Material examined: JAPAN, O-ura, Shimoda, 2 June 1990, IFO H-12135, *Galaxaura falcata* Kjellman (*Chaetangiaceae*, Rhodophyta) **holotype**) **a** Herbarium material of *H. galaxauricola* **b** Slides of *H. galaxauricola* **c** Ascomata on host surface **d** Section through ascoma **e** Peridium **f** Short hyphal projections arising from outer layer of peridium **g-j** Ascospores **k–l** Branching spermatiophores **m** Penicilliate phialides of spermatiophores. Scale bars: **c** = 500 μm, **d** = 50 μm, **e**, **f**, **k** = 20 μm, **l–m** = 10 μm, **g–j** = 5 μm


a
Ex. Herb. IFO H 12135-2
Hispidicarpomyces galeanuricola Nakagiri
Holotype
Collector A. Nakagiri
Det. by A. Nakagiri
b
c
500 µm
1000 µm
d
e
f
g
h
i
j
k
l
m

Biotrophic, *hemibiotrophic*, *saprobic* or *hypersaprobic* on various plants, other fungi, and myxomycetes, terrestrial and aquatic habitats. **Sexual morph**: *Stromatic tissue* present or lacking, when present soft and fleshy, pallid or brightly pigmented to light brownish, immersed erumpent, effuse, tuberculate or pulvinate, occasionally stipitate, then fertile region clavate, or subiculum of interwoven pallid or brightly pigmented hyphae. *Ascomata* solitary or often arranged in groups, immersed in or erumpent to superficial on substrate, pallid, brightly pigmented, or shades of light brown or blue to violet (appearing black), rarely brown, globose, ovoid, obpyriform or spheroid, collabent at times, apex papillate, with periphysate ostiole, surface glabrous or warted or bearing hyaline or pallid hyphal appendages or rarely thick-walled setae. *Peridium* externally composed of pseudoparenchymatous cells, sometimes with thick, sclerotial walls, internally composed of compressed rows of cells, pallid to brightly pigmented or brown, blue or violet. *Paraphyses* apical (periphysoids), usually deliquescent, occasionally visible at maturity, as cellular remnants among asci or as remnants apical fringe. *Asci* basal to peripheral, mostly 8-spored, occasionally polysporous or less than eight, cylindric, oblong or inflated, apical ring often lacking, when present shallow, refractive, non-amyloid. *Ascospores* uniseriate, biseriate or in fascicle, hyaline, yellowish, pinkish to greenish or occasionally brown, 1-celled or one to several septate, occasionally with longitudinal septa, disarticulating into part-spores at times or budding to form conidia within ascus, ellipsoid, fusoid, allantoid, elongate or globose, with smooth, verruculose or longitudinally striate cell wall. **Asexual morph**: Hyphomycetous, grouped on sporodochia or synnemata, rarely coelomycetous, conidiogenous cells enteroblastic phialidic, thick-walled structures present at times.

Type: ***Hypocrea*** Fr. (= ***Trichoderma*** Pers.)

Notes: The family *Hypocreaceae* was recognized within *Hypocreales* and divided into six subfamilies by Lindau (1897). Seaver (1909a, b, 1910a, b, 1911) divided the order *Hypocreales* into two families (*Nectriaceae* and *Hypocreaceae*) depending on their perithecial and stromatic characters. Petch (1938) also accepted *Nectriaceae* and *Hypocreaceae* as distinct families within the *Hypocreales*, while Munk (1957) and Dennis (1960) placed them in the *Sphaeriales*. Later, Miller (1949), Bessy (1950), Luttrell (1951), Dingley (1951a, b, 1952a, b, 1953, 1954)), von Arx and Müller (1954), Müller and von Arx (1962), Gäumann (1964), Rogerson (1970) and Barr (1990) placed *Nectriaceae* under *Hypocreaceae* as one family. However, Kreisel (1969) accepted *Hypocreaceae* and *Nectriaceae* in the order *Hypocreales*, along with another five families based on their bright coloured, fleshy ascomata, presence of apical paraphyses and production of phialides on free conidiophores. Rossman et al. (1999) believed that *Nectriaceae* and *Hypocreaceae* could be two separate families within the *Hypocreales*. In their work they included 12 genera in *Hypocreaceae*, including *Hypocrea* and *Hypomyces* as two major genera encompassing the majority of species. Currently, Maharachchikumbura et al. (2015) accepted 18 genera in the family.

Trichoderma Pers., Neues Mag. Bot. 1: 92 (1794)

Facesoffungi number: FoF 02111, Figs 70, 71

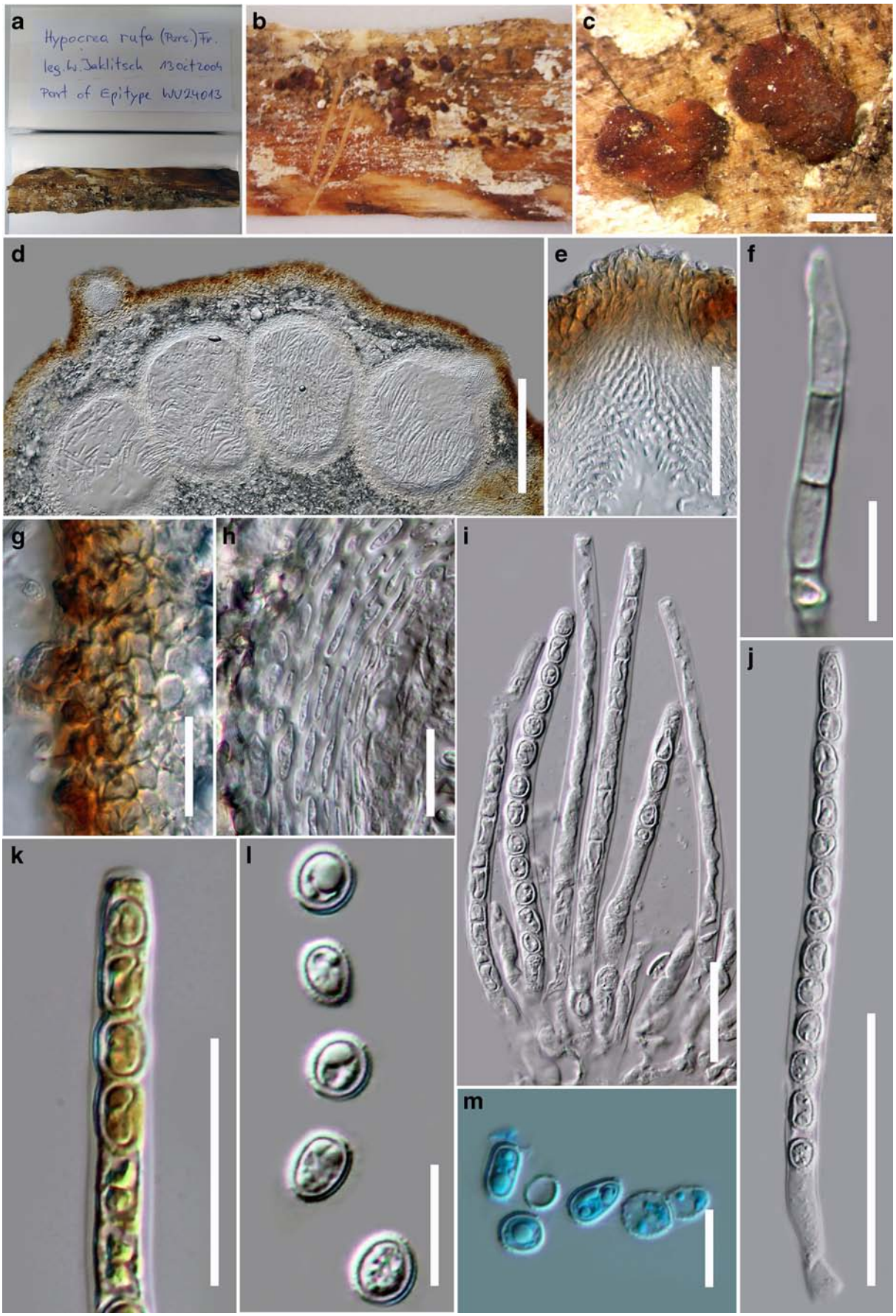
Biotrophic, *hemibiotrophic*, *saprobic* or *hypersaprobic* on various plants, on other members of the fungi including members of *Basidiomycota*, or on perennial bracket fungi in varying stages of decay, and less commonly on herbaceous substrates. **Sexual morph**: *Stromata* discrete to effused, composed of pseudoparenchyma cells or highly compacted hyphae, with ascomatal elevations conspicuous or not, stromatal surface variously wrinkled, tuberculate or creased, margins of stromata free from or adherent to the substrate, hyaline, white, yellow, reddish-brown, dark brown to black. *Ascomata* immersed in the stroma, ascomatal wall and stromatal tissues KOH+ or KOH−. *Asci* unitunicate, 8-spored, cylindrical. *Ascospores* 1-septate, disarticulating early in development into two equal or unequal, subglobose, globose, ovoid, oblong or wedge-shaped part ascospores, hyaline or green, typically spinulose or warted, rarely smooth. **Asexual morph**: Hyphomycetous. *Conidiophores* are mostly formed in pustules, conspicuously curved to sinuous or conspicuously curved, without or with weakly developed or well developed main axis, branched, branching irregular, verticillate or sometimes tree-like, hyaline, smooth, septate. *Phialides* solitary or forming in whorls, sometimes percurrently proliferating, straight, cylindrical or somewhat swollen at or below the middle, curved to sinuous or straight, hyaline, smooth. *Conidia* unicellular, ovoid, ellipsoidal, oblong, globose to subglobose, green, rarely hyaline, guttulate, smooth, verruculose, spinulose or warted. *Chlamydospores* globose to subglobose and terminal at the ends of hyphae or intercalary within hyphal cells.

Type species: ***Trichoderma viride*** Pers., Neues Mag. Bot. 1: 92 (1794)

≡ *Hypocrea rufa* (Pers.) Fr., Summa veg. Scand., Section Post. (Stockholm): 383 (1849)

Notes: *Hypocrea* was described by Fries in 1825, based on *Sphaeria rufa* Pers., a species with hyaline ascospores. Currently, the type species of the genus is represented by *Hypocrea rufa* (Pers.) Fr. The genus *Hypocrea* is characterized by typically hyaline or green, eight, 1-septate ascospores, that disarticulate at the septum when they are young, producing 16 part-spores in each ascus. *Hypocrea* (with sexual morph) and *Trichoderma* (with asexual morph) are linked and Rossman

Fig. 70 ***Trichoderma viride*** (Material examined: CZECH REPUBLIC, South Bohemia, Frymburk, on partly decorticated logs of *Pinus sylvestris* L. (*Pinaceae*), leg. W. Jaklitsch, W.J. 2753, 3 October 2004. WU 24013, **epitype**) **a** Herbarium label **b**, **c** Stromata on host substrate **d** Transverse section through stromata with perithecia **e** Ostiolar opening in transverse section **f** Hair on surface of stroma **g** Outer layer of stromata **h** Peridium. **i**, **j** Asci **k** Ascus in Melzer's reagent **l** Ascospores **m** Ascospores in cotton blue. Scale bars: **c** = 1 mm, **d** = 200 μm, **e** = 50 μm, **f** = 10 μm, **g**–**i** = 20 μm, **j** = 50 μm, **k** = 20 μm, **l**, **m** = 10 μm


a
Hypocrea rufa (Pers.) Fr.
leg. W. Jaklitsch 13 Oct 2004
Part of Epitype WU24013
b
c
d
e
f
g
h
i
j
k
l
m

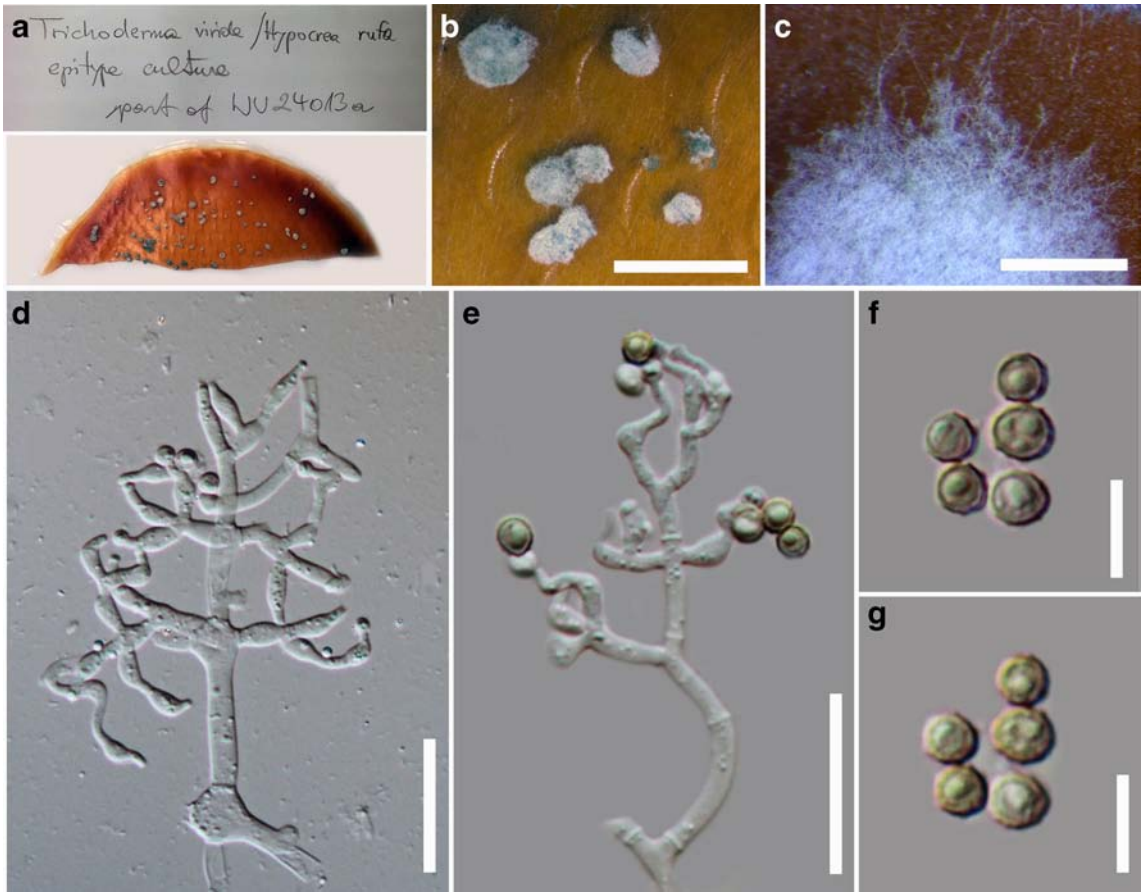


Fig. 71 ***Trichoderma viride*** (Material examined: Dry culture, WU 24013a, **epitype**) **a** Herbarium material and label **b**, **c** Sporulation on CMD **d**, **e** Conidiophores **f**, **g** Conidia. Scale bars: **b** = 2 mm, **c** = 500 μm, **d**, **e** = 20 μm, **f**, **g** = 10 μm

et al. (2013) proposed the use of *Trichoderma* over *Hypocrea*, and this was followed by Maharachchikumbura et al. (2015).

Other genera included

Aphysiostroma Barrasa et al., Can. J. Bot. 63(12): 2439 (1986) [1985]

Type species: ***Aphysiostroma stercorarium*** Barrasa et al., Can. J. Bot. 63(12): 2441 (1986) [1985]

Arachnocrea Z. Moravec, Bull. trimest. Soc. mycol. Fr. 72: 161 (1956)

Type species: ***Arachnocrea stipata*** (Lib. ex Fuckel) Z. Moravec, Bull. trimest. Soc. mycol. Fr. 72: 161 (1956)

Dialhypocrea Speg., Boln Acad. nac. Cienc. Córdoba 23(3−4): 475 (1919) [1918]

Type species: ***Dialhypocrea puiggariana*** Speg., Boln Acad. nac. Cienc. Córdoba 23(3−4): 475 [no. 320, reprint page 113] (1919) [1918]

Escovopsis J.J. Muchovej & Della Lucia, Mycotaxon 37: 192 (1990)

Type species: ***Escovopsis weberi*** J.J. Muchovej & Della Lucia [as 'weberii'], Mycotaxon 37: 192 (1990)

Escovopsioides H.C. Evans & J.O. Augustin, PLoS ONE 7(12): e51392, 6 (2012)

Type species: ***Escovopsioides nivea*** H.C. Evans & J.O. Augustin, PLoS ONE 7(12): e51392, 6 (2012)

Hypocreopsis P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 251 (1873)

Type species: ***Hypocreopsis riccioidea*** (Bolton) P. Karst., Bidr. Känn. Finl. Nat. Folk 19: 221 (1871)

Hypomyces (Fr.) Tul. & C. Tul., Annls Sci. Nat., Bot., sér. 4 13: 11 (1860)

Type species: ***Hypomyces lactifluorum*** (Schwein.) Tul. & C. Tul., Annls Sci. Nat., Bot., sér. 4 13: 11 (1860)

Lichenobarya Etayo et al., in Lawrey et al., Bryologist 118: 88 (2015)

Type species: ***Lichenobarya usneae*** (Etayo) Etayo et al., in Lawrey et al., Bryologist 118: 88 (2015)

Mycogone Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 18 (1809)

Type species: ***Mycogone rosea*** Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 18 (1809)

Protocrea Petch, J. Bot., Lond. 75: 219 (1937)

Type species: ***Protocrea farinosa*** (Berk. & Broome) Petch, J. Bot., Lond. 75: 219 (1937)

Pseudohypocrea Yoshim. Doi, Bull. natn. Sci. Mus., Tokyo, N.S. 15: 655 (1972)

Type species: ***Pseudohypocrea citrinella*** (Ellis) Yoshim. Doi, Bull. natn. Sci. Mus., Tokyo 15(4): 655 (1972)

Rogersonia Samuels & Lodge, Sydowia 48(2): 250 (1996)

Type species: ***Rogersonia striolata*** Samuels & Lodge, Sydowia 48(2): 251 (1996)

Sepedonium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 18 (1809)

Type species: ***Sepedonium mycophilum*** (Pers.) Nees, Syst. Pilze (Würzburg): 44 (1816) [1816–17]

Sibirina G.R.W. Arnold, Nova Hedwigia 19(1–2): 299 (1970) [1969]

Type species: ***Sibirina fungicola*** G.R.W. Arnold, Nova Hedwigia 18(1−2): 300 (1970) [1969]

Sphaerostilbella (Henn.) Sacc. & D. Sacc., Syll. fung. (Abellini) 17: 778 (1905)

= ***Gliocladium*** Corda, Icon. fung. (Prague) 4: 30 (1840)

Type species: ***Sphaerostilbella lutea*** (Henn.) Sacc. & D. Sacc., Syll. fung. (Abellini) 17: 778 (1905)

Sporophagomyces K. Põldmaa & Samuels, in Põldmaa et al., Can. J. Bot. 77(12): 1765 (1999)

Type species: ***Sporophagomyces chrysostomus*** (Berk. & Broome) K. Põldmaa & Samuels, in K. Põldmaa et al., Can. J. Bot. 77(12): 1765 (1999)

Stephanoma Wallr., Fl. crypt. Germ. (Norimbergae) 2: 269 (1833)

Type species: ***Stephanoma strigosum*** Wallr., Fl. crypt. Germ. (Norimbergae) 2: 269 (1833)

Key to the genera of *Hypocreaceae* with sexual morph

1. Coprophilous, asexual morph verticillium-like ***Aphysiostroma***

1. Fungicolous or lignicolous rarely on herbaceous substrates, asexual morph *Acremonium*-, *Gliocladium*-, *Stilbella*-, *Trichoderma*- or verticillium-like 2

2. Ascospores transversely seriate, aseptate ***Rogersonia***

2. Ascospores smooth, spinulose, longitudinally seriate, or ornamented but not transversely seriate. uniseptate or rarely multi-septate or aseptate 3

3. Ascospores 0−1-septate, rarely 3-septate, not disarticulating within the ascus 4

3. Ascospores 1-septate, disarticulating while in the ascus 5

4. Ascospores fusiform to naviculate or lanceolate, smooth-walled, sometimes finely verrucose, mature ascospores disarticulating into part ascospores after discharge……. ***Sporophagomyces***

4. Ascospores ellipsoid, lanceolate or fusiform, smooth, spinulose to tuberculate …..…….…….…….…….....6

5. Stromata thin, arachnoid to loosely arranged, cottony, white to pink, ascospores hyaline to green…….....…..7

5. Stromata discrete or effused, pulvinate, hyaline, white, pale yellow to yellow orange, reddish brown, dark brown to black, ascospores hyaline or green…….....…….....…8

6. Part ascospores irregularly globose, septum sub-median, disarticulating into dimorphic part ascospores, asexual morph verticillium-like…..…..... ***Arachnocrea***

6. Part ascospores conical, septum median, disarticulating into monomorphic-part ascospores, asexual morph gliocladium-like…….....……...… ***Protocrea***

7. Stromata pale yellow to yellow orange, ascospores hyaline…….…….....… 9

7. Stromata hyaline, white, reddish brown, dark brown to black, ascospores hyaline or green…… ***Trichoderma***

8. Stromata prosenchymatous, ascospores smooth, part ascospores conical to lemon-shaped, monomorphic …… ***Pseudohypocrea***

8. Stromata pseudoparenchymatous, ascospores spinulose, part ascospores dimorphic……. ***Dialhypocrea***

9. Ascospores typically fusiform, apiculate, often coarsely warted, rarely smooth or spinulose, ascomata typically partly or completely immersed in densely cottony or highly compacted subiculum, hyaline or in shades of yellow, orange tan or green…… ***Hypomyces***

9. Ascospores ellipsoid to naviculate, non-apiculate, ascomata immersed or superficial on stomata, purple, reddish brown to grey or in shades of yellow…..…. 10

10. Ascomata immersed in the well-developed stroma, reddish brown to grey…***Hypocreopsis***

10. Ascomata superficial on stromata, dark red to purple, or in shades of yellow…….. ***Sphaerostilbella***

Key to the genera of *Hypocreaceae* with asexual morph

1. In leaf-cutting ant nests, conidiophore branched, vesiculate……...…..2

1. On diverse fungi, soil, litter and wood, conidiophores simple, branched, trichodermoid, penicillate or verticillate…….....….3

2. Form lageniform phialides on terminal and intercalary globose vesicles, hyaline smooth-walled conidia in long chains…..…….. ***Escovopsioides***

2. Form lageniform to subulate terminal and intercalary globose, clavate to cylindrical vesicles, conidia hyaline at first becoming pigmented with an ornamented or mucilaginous brown outer coat or sheath, arrange in short basipetal chains…….....….....***Escovopsis***

3. Produce phragmo conidia (primarily three-septate), resting spores lacking……..... ***Sporophagomyces***

3. Produce amero, didymo, phragmo or stauro conidia, resting spores present……..……..…..……. 4
4. Conidiomata postulate or absent, with trichodermoid branching conidiophore, conidia green or hyaline ……..…… ***Trichoderma***
4. Conidiomata absent, conidiophore unbranched, sparingly branched or penicillately or verticillately branched, conidia hyaline or pigmented…..…….....**5**
5. Conidiogenous cell terminal and intercalary in conidiophore, produce stauro-conidia.....***Stephanoma***
5. Conidiogenous cell phialidic, produce amero, didymo, phragmo or stauro conidia……..……6
6. Produce two types of conidiophores and conidia…….…….…....…….7
6. Produce only one type of conidiophores and conidia…….…….....…….8
7. Conidiophores unbranched, sparingly branched or verticillate, produce hyaline or pigmented amero conidia…….…….. ***Sepedonium***
7. Conidiophores monoblastic, branched or verticillate, produce hyaline amero conidia……..…..…. ***Mycogone***
8. Conidiophores densely verticillate, conidia arranged as singles (one conidium on each conidiogenous cell) ….…….…….…....…… ***Sibirina***
8. Conidiophores branched, penicillate or verticillate, conidia arrange as singles or in basipetal chains……

Cladobotryum

Hyponectriaceae Petr., Annls mycol. 21(3/4): 305 (1923)

Facesoffungi number: FoF 01775

Saprobic or *pathogenic* on dead plant matter, in terrestrial and aquatic habitats. **Sexual morph**: Appearing as black, shiny spots on host surface or small black lines arising from cracks in bark. *Pseudostromata* present or lacking, if present, superficial, forming clypeus over the ascomata. *Ascomata* solitary or aggregated, immersed, erumpent or rarely somewhat superficial, globose to ovoid, upright or horizontal, brown to black. *Papilla* short, ostiolate, with or without periphyses. *Peridium* comprising two layers, outer layer of brown cells of *textura angularis*, inner layer of hyaline, cells of *textura angularis*, in some genera cells are of *textura globosa*. *Hamathecium* of sparse, septate, paraphyses, tapering towards the apex, often deliquescing at maturity. *Asci* 8-spored, unitunicate, oblong, cylindrical or ellipsoidal, short pedicellate, with a J+, or J-, apical ring. *Ascospores* overlapping biseriate, or fasciculate, hyaline, yellow to light brown, fusoid, isthmoid, elongate filiform, obovoid, or oblong, asymmetric or symmetric, unicellular or septate, smooth-walled or verruculose, with or without a mucilaginous sheath. **Asexual morph**: Undetermined.

Type: ***Hyponectria*** Sacc.

Notes: *Hyponectriaceae* was introduced by Petrak (1923) to accommodate both *Hyponectria* and *Anisostomula*. Seventeen genera were included in the family by Hawksworth et al. (1995). However, Hyde et al. (1998) excluded most of the genera from the family, while *Palmomyces* and *Charonectria* were added (Hyde et al. 1998; Rossman et al. 1999). *Hyponectriaceae* comprises the genera *Apiothyrium*, *Arecomyces*, *Arwidssonia*, *Cesatiella*, *Chamaeascus*, *Charonectria*, *Discosphaerina*, *Exarmidium*, *Frondicola*, *Hyponectria*, *Micronectria*, *Papilionovela*, *Pellucida*, *Physalospora*, *Phragmitensis*, *Rachidicola* and *Xenothecium* (Sivanesan and Shivas 2002; Maharachchikumbura et al. 2015). This is a problematic family and it is not clear if it belongs in *Xylariales*. The type species *Hyponectria buxi* needs recollecting and sequencing as the sequence data in GenBank may be problematic (Jaklitsch and Voglmayr 2012). The family is almost certainly polyphyletic and has been used as a "waste bin" for genera that cannot be assigned to other families (Jaklitsch et al. 2016). Consequently, other genera in this family should also be recollected and sequenced to establish their phylogenetic affinities. In this paper we include 17 genera that are listed in Maharachchikumbura et al. (2015), but do not provide a key to genera and most genera are probably wrongly placed. *Pseudomassaria* is placed in *Pseudomassariaceae*.

Hyponectria Sacc., Michelia 1(no. 2): 250 (1878)

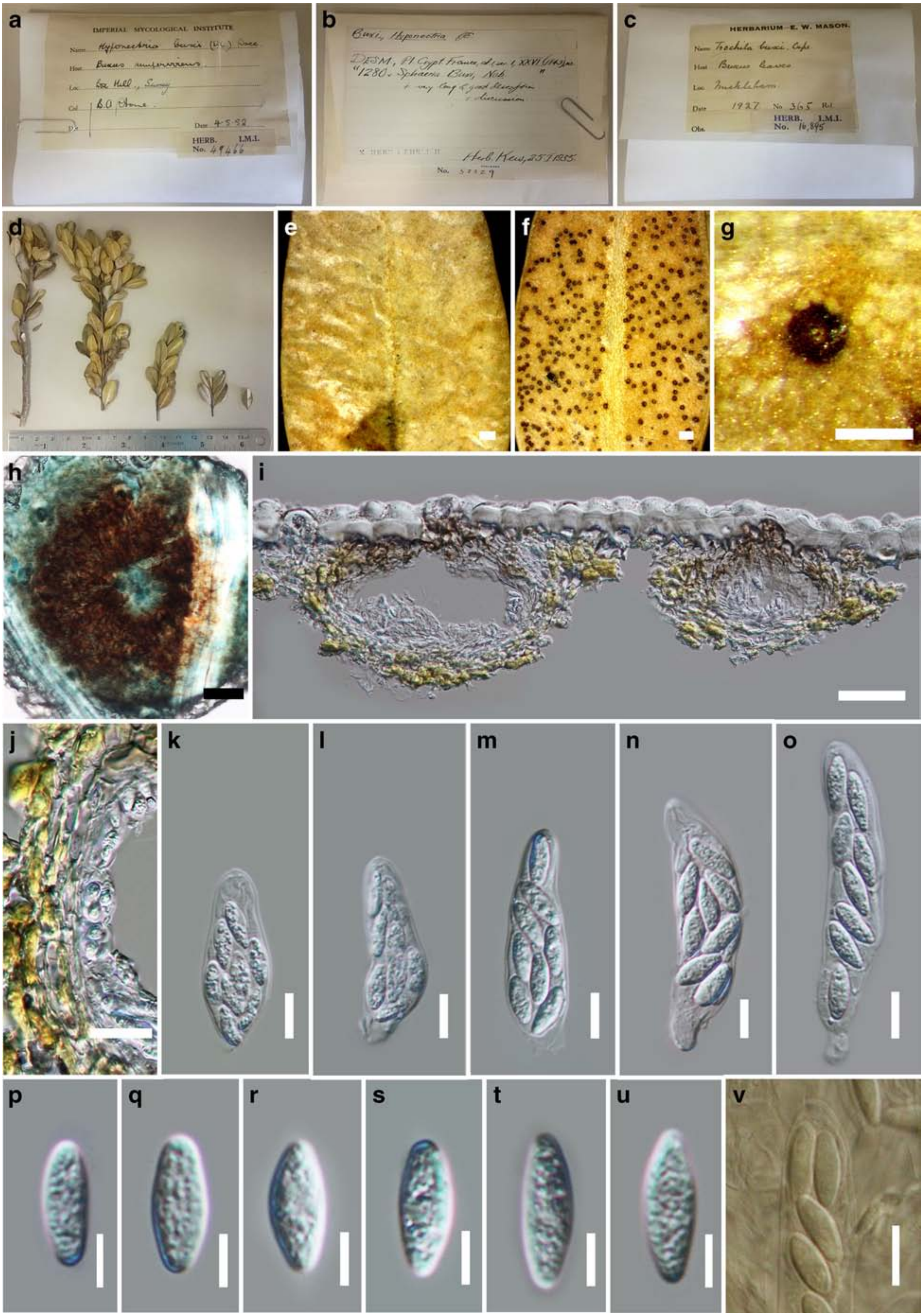
Facesoffungi number: FoF 02112; Fig. 72

Pathogenic or *saprobic* on leaves of *Buxus* sp. **Sexual morph**: *Ascomata* immersed, depressed globose, visible as orange to brown dots on the host surface, coriaceous, ostiolate, solitary or mostly gregarious. *Ostiole* aperiphysate. *Peridium* one stratum of 2 layers of cells of *textura angularis* with thickened, brown walls cells around the ostiole. *Paraphyses* not observed. *Asci* 8-spored, unitunicate, cylindric-clavate to clavate, short pedicellate, with an indistinct, J-, apical ring. *Ascospores* overlapping biseriate or obliquely uniseriate, hyaline, ellipsoidal or oblong, straight or inequilateral, 1-celled, contents minutely guttulate, lacking a sheath. **Asexual morph**: Undetermined.

Type species: ***Hyponectria buxi*** (DC.) Sacc., Michelia 1(no. 2): 250 (1878)

Notes: *Hyponectria* is typified by *Hyponectria buxi*, which was introduced by Saccardo (1878). *Hyponectria buxi* needs to be recollected and sequenced as the sequence data in GenBank may be inaccurate. The other genera in this family should also be recollected and sequenced to establish affinities.

Fig. 72 ***Hyponectria buxi*** (Material examined: UK, Surrey, Mickleham, on leaves of *Buxus* sp., 1927, E.W. Mason no. 365 (IMI 16895, IMI52229 and IMI49466). **a-c** Package of herbarium material **d** Herbarium specimen **e** Ascomata on the upper leaf surface **f** Ascomata on the lower leaf surface **g** Close up of ascoma **h** Close up of ascomata under microscope **i** Section of ascoma **j** Cells of peridium **k–o** Asci **p–u** Ascospores **v** J- reaction of apical ring in Melzer's reagent. Scale bars: **e–f** = 500 μm **g** = 200 μm, **h-i** = 50 μm, **j** = 20 μm, **k–o** = 10 μm, **p–u** = 5 μm and **v** = 10 μm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Herb. Kew, 25.7.1885.
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No. 16,845

Other genera included

Apiothyrium Petr., Sydowia 1(1–3): 1 (1947)
Type species: ***Apiothyrium arcticum*** Petr., Sydowia 1(1–3): 1 (1947)
Arecomyces K.D. Hyde, Sydowia 48(2): 227 (1996)
Type species: ***Arecomyces frondicola*** K.D. Hyde, Sydowia 48(2): 232 (1996)
Arwidssonia B. Erikss., Svensk bot. Tidskr. 68: 199 (1974)
Type species: ***Arwidssonia empetri*** (Rehm) B. Erikss., Svensk bot. Tidskr. 68: 200 (1974)
Cesatiella Sacc., Michelia 1(no. 2): 250 (1878)
Type species: ***Cesatiella australis*** Sacc. & Speg., Michelia 1(no. 2): 250 (1878)
Chamaeascus L. Holm et al., Blyttia 51(3–4): 121 (1993)
Type species: ***Chamaeascus arcticus*** L. Holm et al., Blyttia 51(3–4): 121 (1993)
Charonectria Sacc., Michelia 2(no. 6): 72 (1880)
Type species: ***Charonectria consolationis*** Sacc., Michelia 2(no. 6): 72 (1880)
Discosphaerina Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 126(4–5): 353 (1917)
Type species: ***Discosphaerina discophora*** Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 126(4–5): 353 (1917)
Exarmidium P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 29, 222 (1873)
Type species: ***Exarmidium hysteriiforme*** P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 222 (1873)
Frondicola K. D. Hyde., J. Linn. Soc., Bot. 110(2): 100 (1992)
Type species: ***Frondicola tunitricuspis*** K.D Hyde., Bot. J. Linn. Soc. 110: 95–110, 1992
Micronectria Speg., Anal. Soc. cient. argent. 19(1): 45 (1885)
Type species: ***Micronectria guaranitica*** Speg., Anal. Soc. cient. argent. 19(1): 45 (1885)
Papilionovela Aptroot, Mycol. Res. 101(3): 266 (1997)
Type species: ***Papilionovela albothallina*** Aptroot, Mycol. Res. 101(3): 266 (1997)
Pellucida Dulym. et al., Mycol. Res. 105(2): 250 (2001)
Type species: ***Pellucida pendulina*** Dulym. et al., in Dulymamode et al., Mycol. Res. 105(2): 250 (2001)
Physalospora Niessl, Verh. nat. Ver. Brünn 14: 170 (1876)
Type species: ***Physalospora alpestris*** Niessl, Verh. nat. Ver. Brünn 14: 170 (1876)
Phragmitensis M.K.M. Wong et al., Bot. Mar. 41(4): 379 (1998)
Type species: ***Phragmitensis marina*** M.K.M. Wong et al., Bot. Mar. 41(4): 379 (1998)
Rachidicola K.D. Hyde & J. Fröhl., in Hyde, Sydowia 47(2): 217 (1995)
Type species: ***Rachidicola palmae*** K.D. Hyde & J. Fröhl., in Hyde, Sydowia 47(2): 218 (1995)
Xenothecium Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 589 (1919)
Type species: ***Xenothecium jodophilum*** Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 589 (1919)

Key to genera of *Hyponectriaceae*

1. Ascospore unicellular……..…… 2
1. Ascospore multicellular…… 7
2. A mucilaginous sheath…….. 3
2. Lacking a mucilaginous sheath…… 4
3. Ellipsoidal, Cylindrical, J-, immersed under a clypeus or pseudostroma ..…..……..…… ***Arecomyces***
3. Cymbiform, Clavate, lacking an apical apparatus, immersed, pseudostroma, globose to subglobose…… ***Phragmitensis***
4. Oblong…….....…… 5
4. Baciliform to lunate, clavate to ellipsoidal, lacking apical apparatus immersed, non papillate, darker around the pore....…….……..…..... ***Chamaeascus***
5. Oblong or ellipsoidal……..…..…… 6
5. Oblong to fusiform, clavate, lacking ostiole and paraphyses……...… ***Discosphaerina***
6. Cylindric-clavated to clavate, J-, immersed, globose, Ostiole aperiphyses, paraphyses……...… ***Hyponectria***
6. Cylindric-clavated to clavate, J+ or J-, immersed, globose or conical, clypeus……...… ***Physalospora***
7. 1-septate……...…… 8
7. More than 1 septate……...……..… 10
8. Apiosporous, lacking a J+……....…… 9
8. Oblong or ellipsoidal, J-, immersed, solitary, pallid clypeus…… ***Charonectria***
9. Ascospore with spine-like appendages, cylindric-clavate, with inconspicuous apical ring, immersed under a pseudostroma……...……..…….. ***Frondispora***
9. Ascomata lie horizontally between the cuticle and epidermis of the host, with a laterally placed ostiole……...……..… ***Apiothyrium***
10. 2-septate, hyaline, lacking a mucilaginous sheath, cylindric-clavated to clavate, J-, immersed under the clypeus…....……..... ***Rachidicola***
10. More than 2-septate……...… 11
11. 1–3- septate or multiseptate……. 12
11. (l-)3(−5)-septate, hyaline, cylindrical to slightly saccate, J+, immersed, opening by 3–5 lobes…… ***Arwidossonia***
12. 1–3- septate, long ellipsoid, ornamented with two colour, gelatinous wings, cylindrical, lacking an apical apparatus, apothecia erumpent, discoid with periphyses and paraphyses…….....… ***Papilionovela***
12. 3-septate or more than……..…… 13
13. 3-septae……....…… 14

13. Multiseptate……. 15
14. 3-septae, fusoid, hyaline, cylindrical, immersed, global, filiform paraphyses. . . . . ***Cesatiella***
14. 3-septage, ellipsoid to fusiform-oblong, hyaline-yellow, immersed in clusters under a clypeus, filiform paraphyses……..... ***Exarmidium***
15. Filiform, hyaline ascospore…….. 16
15. Oblong, hyaline ascospore, uniseriate, lacking a paraphyses……...…… ***Xenothecium***
16. Cylindrical asci, erumpent, globose, Ostiole with papilla, paraphyses……..…. ***Micronectria***
16. Filiform, hyaline ascospore……..……. ***Pellucida***

Iodosphaeriaceae O. Hilber, in Hilber & Hilber, The Genus *Lasiosphaeria* and Allied Taxa (Kelheim): 7 (2002)

Facesoffungi number: FoF 01905

Saprobic on plant hosts. **Sexual morph**: *Ascomata* superficial, solitary, black, and easily removed from the substrate, ascomata covered with dark brown, setae-like, hairs, comprising agglutinated mycelial strands, with a stellate arrangement, arising from cells at the perithecial surface. *Ostiole* pore-like, periphysate. *Peridium* outer region comprising angular, pigmented, brown cells, inner region comprising flattened, hyaline cells. *Paraphyses* hypha-like, septate, flexuose, numerous, slightly tapered towards the apex. *Asci* 8-spored, unitunicate, narrowly clavate, short pedicellate or apedicellate, apex rounded, with a J+, subapical ring. *Ascospores* biseriate, allantoid, unicellular, hyaline, smooth-walled, lacking sheaths or appendages. **Asexual morph**: Ceratosporium-like conidia have been observed on the surface of perithecia, but may not be related.

Type: ***Iodosphaeria*** Samuels et al., Mycotaxon 28(2): 486 (1987); Fig. 73

Type species: ***Iodosphaeria phyllophila*** (Mouton) Samuels et al., Mycotaxon 28(2): 486 (1987)

Notes: The family *Iodosphaeriaceae* was introduced by Hilber and Hilber (2002) to accommodate the genus *Iodosphaeria*. The genus was placed in the order *Amphisphaeriales*; as it has superficial ascomata covered with dark brown, setae-like hairs, comprising agglutinated mycelial strands, with a stellate arrangement (Hilber and Hilber 2002). Li et al. (2015b) introduced a new species, *Iodosphaeria tongrenensis* Li et al., bringing the total of species in the genus to nine. Li et al. (2015b) provided molecular data that showed this taxon clustered in *Xylariales* and in this study we confirm its distinctness as a family and placement in *Xylariomycetidae*. When Samuels et al. (1987) introduced the genus *Iodosphaeria* they deposited a specimen collected in New Zealand in PDD and this was used in this study to illustrate the family (Fig. 73).

Jobellisiaceae Réblová, Mycologia 100 (6): 899 (2009)

Facesoffungi number: FoF 01906

Saprobic on wood in terrestrial and freshwater habitats. **Sexual morph**: *Ascomata* perithecial, superficial or erumpent, basally immersed, globose to subglobose, lageniform to obpyriform, brown to black or externally with yellowish pigments, solitary to gregarious, papillate with long upright neck. *Peridium* 3-layered, comprising cells of *textura angularis* or *textura prismatica* or *textura intricata*, some with an orange, middle wall layer. *Hamathecium* with numerous, filamentous, septate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical to cylindric-clavate, short pedicellate, with a large, refractive, J-, apical ring, rarely with delicate ring like structures. *Ascospores* uniseriate to overlapping uniseriate, reddish brown to brown, to greenish brown, ellipsoidal to oblong-elliptical, to fusiform, 1-septate, with germ pores at one or both ends. **Asexual morph**: Undetermined.

Type: ***Jobellisia*** M.E. Barr; Fig. 74

Type species: ***Jobellisia luteola*** (Ellis & Everh.) M.E. Barr, Mycotaxon 46: 61 (1993)

Notes: The monotypic family *Jobellisiaceae* was introduced by Réblová (2008) based on LSU rDNA sequence data. This family is characterized by superficial or basally immersed, astromatic, brown or yellowish, pigmented ascomata, and ellipsoidal, 1-septate, reddish brown to brown ascospores, with darker pigment at the median septum, with germ pores at one or both ends. The genus is found in tropical and temperate zones of the northern hemisphere (Réblová 2008). According to the phylogenetic analysis of Réblová (2008), the closest relatives of *Jobellisia* and the family *Jobellisiaceae* were members of the orders *Diaporthales*, *Calosphaeriales* and *Togniniaceae*. In the phylogenetic analyses carried out by Maharachchikumbura et al. (2015), this family is raised to a new order *Jobellisiales* and is phylogenetically closer to *Togniniales* and *Calosphaeriales*.

The genus currently comprises nine species. *Jobellisia* was placed in *Clypeosphaeriaceae* by Barr (1994), and Huhndorf et al. (1999) suggested that this genus should be placed in *Diaporthales*. A new family *Jobellisiaceae* was introduced by Réblová (2008) to accommodate *Jobellisia*.

Juncigenaceae E.B.G. Jones et al., in Jones et al., Cryptog. Mycol. 35(2): 133 (2014)

Facesoffungi number: FoF 01665

Saprobic growing on substrates, such as intertidal wood, mangrove and herbaceous wood and roots, bark, leaves in marine habitats. **Sexual morph**: *Ascomata* perithecial, subglobose to pyriform, immersed to superficial, subcoriaceous to coriaceous, brown to dark-brown, ostiolate, periphysate, papillate. *Peridium* comprising several cell layers of ellipsoidal to subglobose cells forming *textura angularis*. *Hamathecium* comprising numerous, narrow, unbranched, persistent, paraphyses, connected to the apex and base of the ascomatal wall. *Asci* 8-spored, unitunicate, thin-walled, persistent, clavate, cylindrical to fusiform, with apical ring, short pedicellate. *Ascospores* uniseriate, hyaline, ellipsoidal, clavate to fusiform, 1–3-septate with or without equatorial and polar

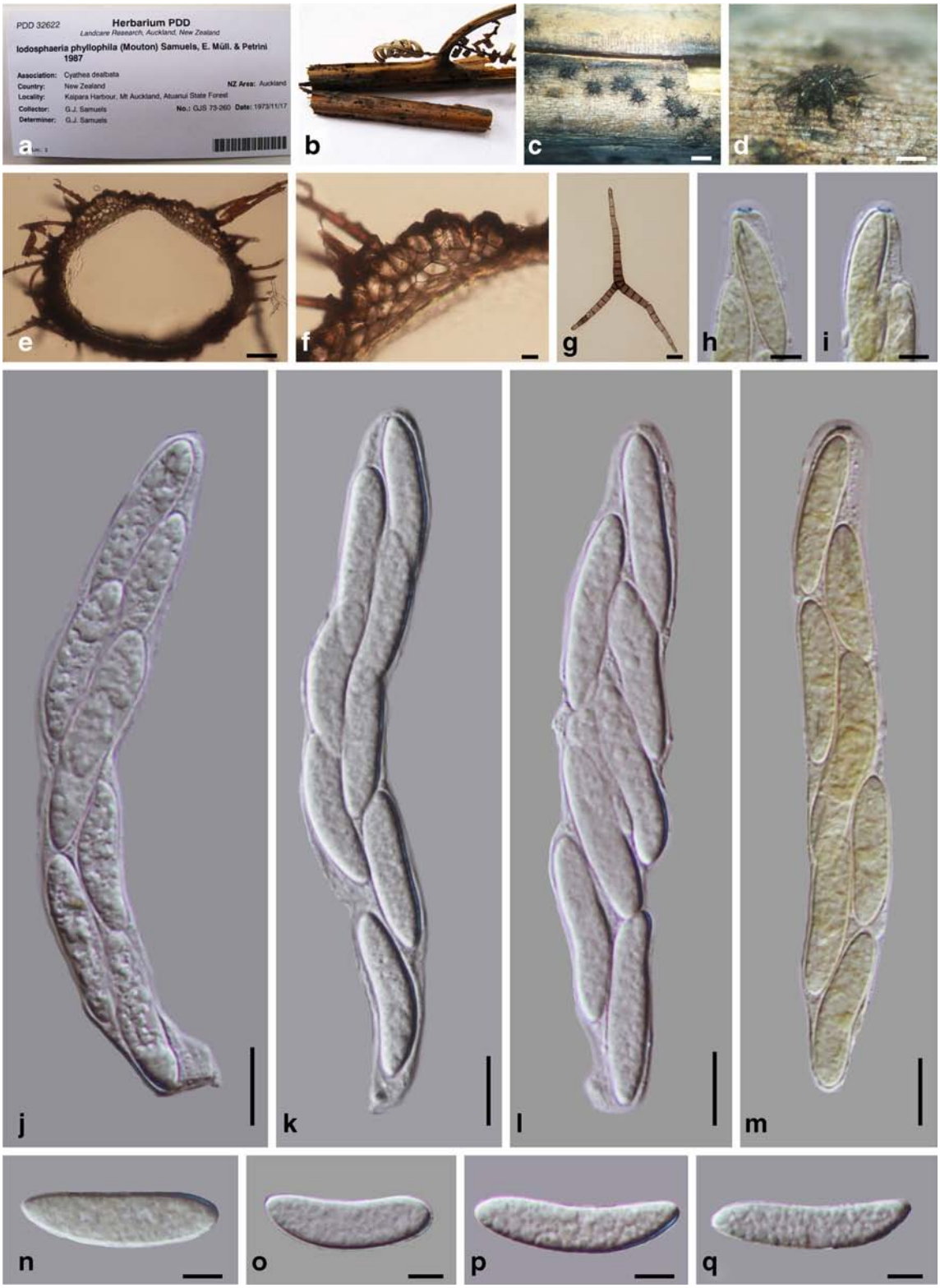


Fig. 73 ***Iodosphaeria phyllophila*** (Material examined: NEW ZEALAND: Kaipara Harbour, Mt Auckland, Atuanui State Forest; 17 November 1973, G.J. Samuels, GJS73-260, PDD 32622) **a**, **b** Herbarium package and material **c**, **d** Ascomata on the surface of host **e** Section of ascoma **f** Peridium **g** Ceratosporium-like conidium on the surface of the perithecia **h–i** Ascus apex with J+, subapical ring **j–m** Asci with ascospores (m stained in Melzer's reagent). n–q Ascospores. Scale bars: **c** = 1000 μm, **d** = 500 μm, **e** = 50 μm, **f**, **j–m** = 10 μm, **g** = 20 μm, **h**, **i**, **n–q** = 5 μm

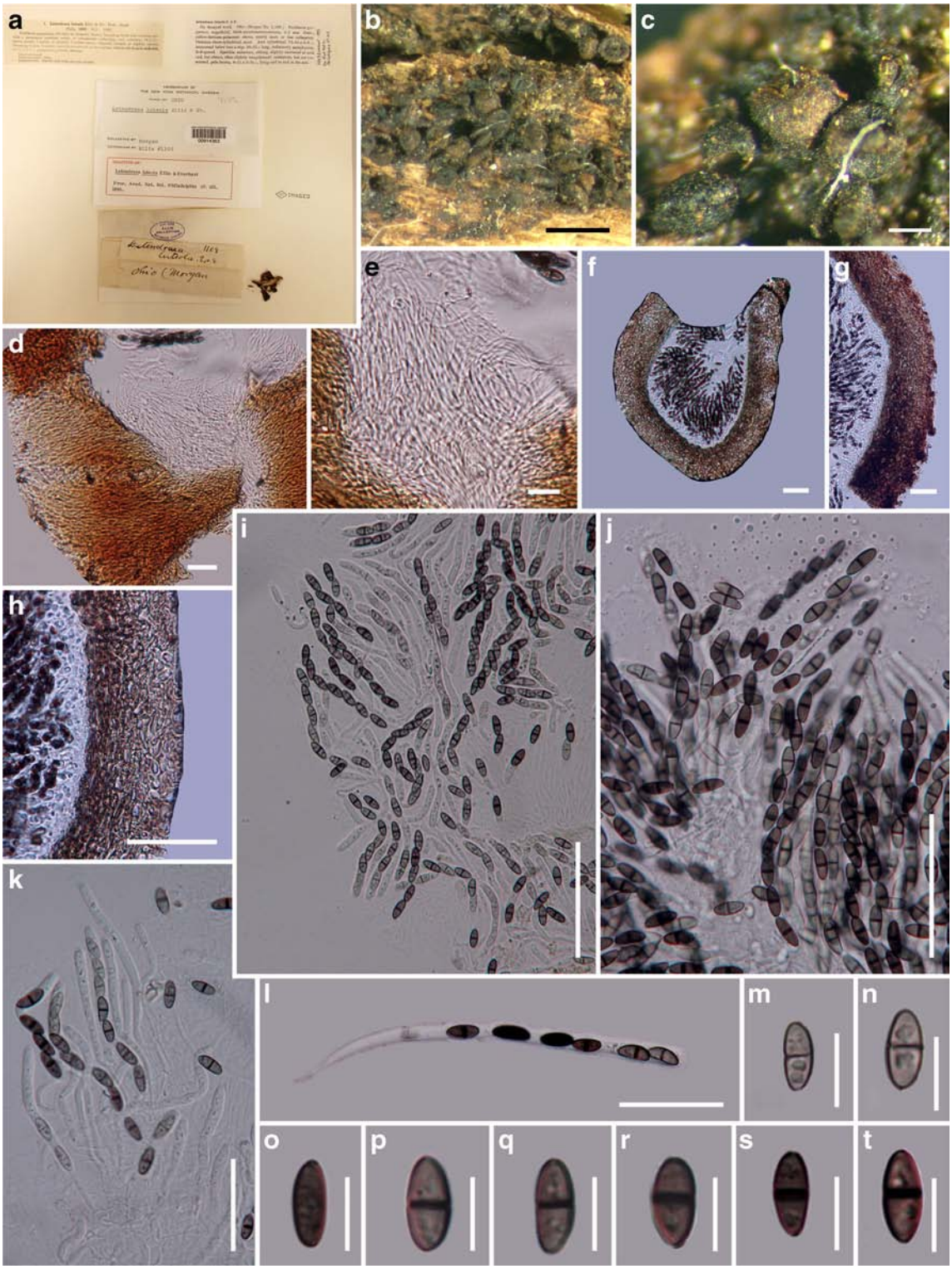


Fig. 74 ***Jobellisia luteola*** (Material examined: USA, Ohio, J.P. Morgan, 1109, NY 914363, **holotype**) **a** Herbarium label **b**, **c** Ascomata on substrate **d**, **e** Section through neck showing periphyses **f** Section through ascomata **g**, **h** Section through peridium showing wall layer i-k Squash mount of asci **l** Ascus. **m–t** Ascospores. Scale bars: **b** = 1 mm; **c** = 200 μm; **f**, **g**, **i**, **j**, **k** = 50 μm; **d** = 20 μm; **e**, **m–t** = 10 μm

appendages. **Asexual morph**: hyphomycetous. *Hyphae* septate, branched, hyaline to brown. *Conidiogenous cells* non-specialized, short, lateral, solitary, helicoid, septate, light to dark brown. *Conidia* brown, single, helicoid, septate, constricted at the septa.

Type: ***Juncigena*** Kohlm. et al.

Notes: The family *Juncigenaceae* was introduced by Jones et al. (2014) with *Juncigena* as the type genus and included the genera *Fulvocentrum*, *Marinokulati* and *Moheitospora*. They formed a monophyletic clade with high statistical support based on analysis of SSU and LSU sequence data. The family forms sister clades to the *Etheirophoraceae*, *Falcocladiacee* and *Torpedosporaceae* in the subclass *Hypocreomycetidae*. Jones et al. (2014) showed that the species *Swampomyces aegyptiacus* Abdel-Wahab, El-Shar. & E.B.G. Jones and *S. clavatispora* Abdel-Wahab, El-Shar. & E.B.G. Jones did not group in the genus *Swampomyces sensu stricto* and introduced the genus *Fulvocentrum* to accommodate them. Likewise, the marine ascomycete *Chaetosphaeria chaetosa* Kohlm. did not group in *Chaetosphaeria sensu stricto* (*Chaetosphaeriales*) and was transferred to a new genus *Marinokulati* (Jones et al. 2014). *Moheitospora ruticosae* Abdel-Wahab, Abdel-Aziz & Nagah., an asexual morph, groups in this family with high support. Jones et al. (2014) referred the *Juncigenaceae* to the subclass *Hypocreomycetidae*, order *incertae sedis* with the *Hypocreales* as a sister order and this was followed in Maharachchikumbura et al. (2015). Subsequently, Jones et al. (2015) introduced the order *Torpedosporales* to accommodate the three marine families: *Etheirophoraceae*, *Juncigenaceae* and *Torpedosporaceae*

Juncigena Kohlm. et al., Bot. Mar. 40(4): 291 (1997)

Facesoffungi number: FoF 02113; Figs 75, 76

Saprobic, a salt marsh fungus on the sedge *Juncus roemerianus*, which is obligate marine. **Sexual morph**: *Ascomata* solitary, subglobose to pyriform, coriaceous, fuscous, immersed, ostiolate, papillate. Ostiolar canal cylindrical, periphysate, hyaline. *Peridium* comprising several layers of ellipsoidal to subglobose cells, forming a *textura angularis*, darker to hyaline from outside to inside. *Hamathecium* composed of unbranched pseudoparaphyses attached to the top and bottom of the ascomatal cavity. *Asci* 8-spored, fusiform to cylindrical, short pedicellate, unitunicate, with a J-, apical ring. *Ascospores* uni or biseriate, hyaline, fusiform to ellipsoidal, 3-septate, constricted at the septa. **Asexual morph**: Saprobic on submerged bases of leaves in marine habitats. *Hyphae* hyaline to light brown, septate, branched; in pure culture producing conidia and multi-celled intercalary chlamydospores. *Conidiogenous cells* non-specialized, short, lateral, similar to vegetative hyphae; solitary, irregularly helicoid, light to dark brown, deeply constricted at the septa, increasing in diam. from base to apex. *Conidia* brown, single, helicoid, septate, constricted at the septa

Type species: ***Juncigena adarca*** Kohlm. et al., Bot. Mar. 40(4): 291 (1997)

Asexual morph. ***Cirrenalia adarca*** Kohlm. et al., Bot. Mar. 40(4): 292 (1997)

Notes: This genus was introduced by Kohlmeyer et al. (1997). Eriksson (1999) included *Juncigena* in the family *Magnaporthaceae*. Analysis of sequence data from protein coding and ribosomal nuclear loci (Schoch et al. 2007) has shown that *Juncigena adarca* clusters with *Swampomyces* sp. and is associated with *Coronophorales* with good support. However, Jones et al. (2009b) referred *Juncigena* to *Hypocreales incertae sedis* and Jones et al. (2014) transferred this genus in to a newly introduced family *Juncigenaceae*.

Other genera included

Fulvocentrum E.B.G. Jones & Abdel-Wahab, Cryptog. Mycol. 35(2): 131 (2014)

Type species: ***Fulvocentrum aegyptiaca*** (Abdel-Wahab et al.) E.B.G. Jones & Abdel-Wahab, in Jones et al., Cryptog. Mycol. 35(2): 131 (2014)

Marinokulati E.B.G. Jones & K.L. Pang, Cryptog. Mycol. 35(2): 132 (2014)

Type species: ***Marinokulati chaetosa*** (Kohlm.) E.B.G. Jones & K.L. Pang, Cryptog. Mycol. 35(2): 133 (2014)

Moheitospora Abdel-Wahab et al., Mycol. Progr. 9(4): 551 (2010)

Type species: ***Moheitospora fruticosae*** Abdel-Wahab et al., Mycol. Progr. 9(4): 551 (2010)

Key to genera of *Juncigenaceae*

1. Coelomycete with helicoid conidia . . . . . ***Moheitospora***
1. Ascomycete with fusiform to elongate ellipsoidal ascospores ……...……....2
2. Asci with an attenuate at the base, ascospores with polar and equatorial appendages . . . . . ***Marinokulati***
2. Asci with a short pedicel, ascospores lacking appendages. 3
3. Asci with an apical ring . . . . . ***Juncigena***
3. Asci with thickened apex . . . . . ***Fulvocentrum***

Kathistaceae Malloch & M. Blackw., Can. J. Bot. 68(8): 1719 (1990)

Facesoffungi number: FoF 01289

Saprobic on herbivore dung and insects. **Sexual morph**: *Ascomata* globose to subglobose, with a long neck composed of parallel hyphae, straight curved ostiolar setae, with spherical spore-bearing structures (sporidiomata), cylindrical unicellular extension present. *Peridium* thin walled, pseudoparenchymatous, forming cells of *textura angularis* in surface view and thick walled in cross section. *Hamathecium* lacking interascal filaments. *Asci* unitunicate, 8–spored, ellipsoidal to fusoid, thin-walled, evanescent at maturity, arranged in a basal fascicle. *Ascospores* clavate to falcate, hyaline or pale brown, 0–1 or transversely multi septate. **Asexual morph**: *Conidiomata* superficially similar to the ascomata, spherical, hyaline, without hyphal attachments, single wall layer thick at base, with or

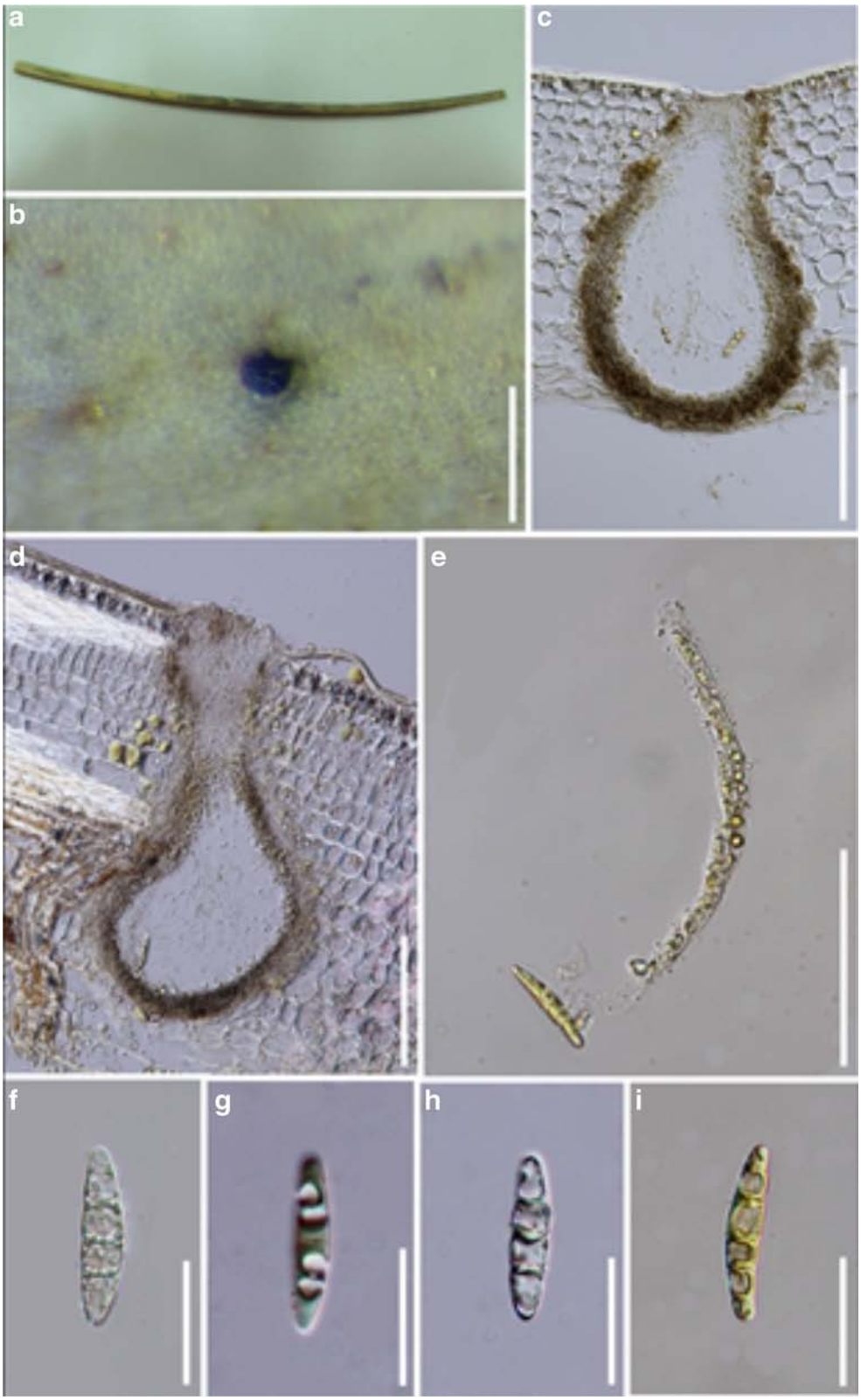


Fig. 75 ***Juncigena adarca*** (USA, North Carolina, Broad Creek (Atlantic Ocean), 34° 43′ 00″N, 76° 55′ 07″W (34.717, −76.919), on standing dead culms of *Juncus roemerianus* Scheele (*Juncaceae*), 9 October 1994J. Kohlmeyer (NY01276214, **holotype**) **a** Herbarium material **b** Ascoma **c**, **d** Ascoma in cross section **e** Asci and Ascospores **f–l** Ascospores. Note: Figure e and i are stained in Melzer's reagent. Scale bars: **b** = 200 μm, **c–d** = 100 μm, **e** = 50 μm, **f–l** = 20

without ostiole, when present ostiole comprising with long neck. *Conidiomatal wall* composed of flattened cells of *textura angularis*. *Conidiogenous cells* enteroblastic, phialidic, hyaline, and smooth. *Conidia* spherical or cylindrical, produced in the center of the conidiomata, hyaline, smooth, 0–1 or multi-septate, escaping in a continuous chain through the ostiolar neck.

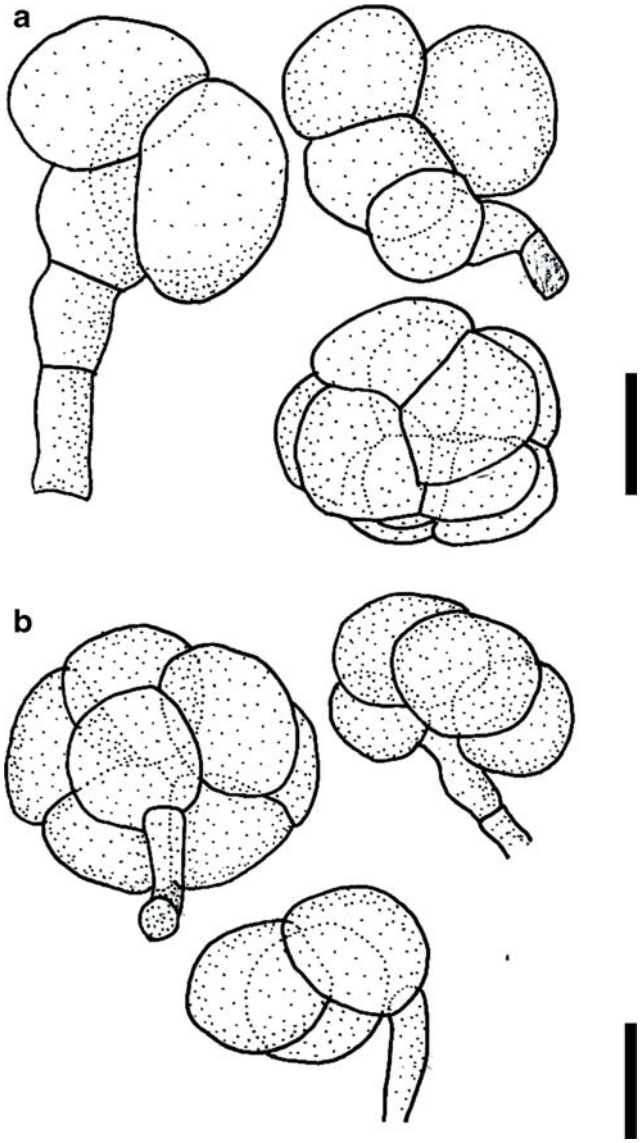


Fig. 76 ***Cirrenalia adarca*** (asexual morph of *Juncigena adarca*). **a** Conidia from decomposing insect larva in leaf of *Juncus roemerianus*. **b** Conidia from culture on seawater agar, isolate made from ascospores of *J. adarca* (redrawn from Kohlmeyer et al. 1997). Scale bars: **a**, **b** = 10 μm

Type: ***Kathistes*** Malloch & M. Blackw.

Notes: The monotypic family *Kathistaceae* was established invalidly by Malloch and Blackwell (1990), to accommodate the type species *Kathistes calyculata*, and two more species, *K. fimbriata* (Barrasa & G. Moreno) Malloch & Blackw., and *K. analemmoides* (Malloch & Blackw.). Malloch and Blackwell (1990) placed *Kathistaceae* in order *Ophiostomatales* based on the characters such as, ellipsoidal to spherical asci borne uniformly in the centrum. However, *Kathistes*, which was characterized with globose to subglobose ascomata, long necked perithecia with setose ostioles and ascospore germinating by repetition to produce budding yeast-like cells, morphologically does not appear to be closely related to other genera (Malloch and Blackwell 1990).

Maharachchikumbura et al. (2015) included three genera in the family *Kathistaceae*, including both sexual and asexual morphs. *Kathistes* is the only sexual genus in *Kathistaceae*, while *Mattirolella* and *Termitariopsis* are asexual genera.

Kathistes Malloch & M. Blackw., Can. J. Bot. 68(8): 1712 (1990)

Facesoffungi number: FoF 01290; Fig. 77

Saprobic on herbivore dung. **Sexual morph**: *Ascomata* subsphaerical to spherical, hyaline to pale brown, transparent, glabrous, thin-walled, with a long neck, with hyphal attachments extending into the substrate. *Ostiolar neck* long, dark reddish brown, composed of parallel hyphal elements, terminated by incurved setae to form a cuplike apex, often with a thickened collar-like area joined to the perithecium. *Peridium* one cell layer thick, comprising cells of *textura angularis* in surface view. *Hamathecium* lacking. *Asci* 8-spored, unitunicate, ellipsoidal to broadly clavate, short stipitate, tapered below, thin-walled, evanescent at maturity, arranged in a basal fascicle. *Ascospores* narrowly clavate to falcate, hyaline, smooth, initially unicellular, one septum at initially and more septa at maturity, without pores or slits, lacking gelatinous sheath, germinating by repetition of budding yeast-like cells. **Asexual morph**: *Conidiomata* superficially similar to the ascomata, spherical, hyaline, with a long neck, without hyphal attachments. *Peridium* comprising flattened cells of *textura angularis*, one cell layer thick. *Ostiolar neck* unicellular, dark reddish brown, arising from a single peridium cell, continuous into the hollow center of the conidiomata, open apically at maturity. *Conidia* spherical, produced in the center of the conidiomata, hyaline, smooth, escaping in a continuous chain through the ostiolar neck.

Type species: ***Kathistes calyculata*** Malloch & M. Blackw., Can. J. Bot. 68(8): 1712 (1990)

Notes: The genus *Kathistes* was introduced as the type genus in *Kathistaceae* by Malloch and Blackwell (1990), which was originally described with three species. The genus is characterized by long-necked perithecia with setose ostioles, basally arranged asci, with hyaline, transversely septate, ascospores without pores, slits, or sheaths. A budding yeast-like asexual morph is produced directly from the cells of the ascospores in culture.

In addition, preliminary data obtained from sequence data, show that *Kathistes* species are different from both *Pyxidiophoraceae* and *Ophiostomataceae*, hence a family *Kathistaceae* was introduced to accommodate *Kathistes* (Malloch and Blackwell 1990).

Other genera included

Mattirolella S. Colla, Boll. Lab. Zool. Portici 22: 44 (1929)

Type species: ***Mattirolella silvestrii*** S. Colla [as 'silverstrii'], Boll. Lab. Zool. Portici 22: 44 (1929)

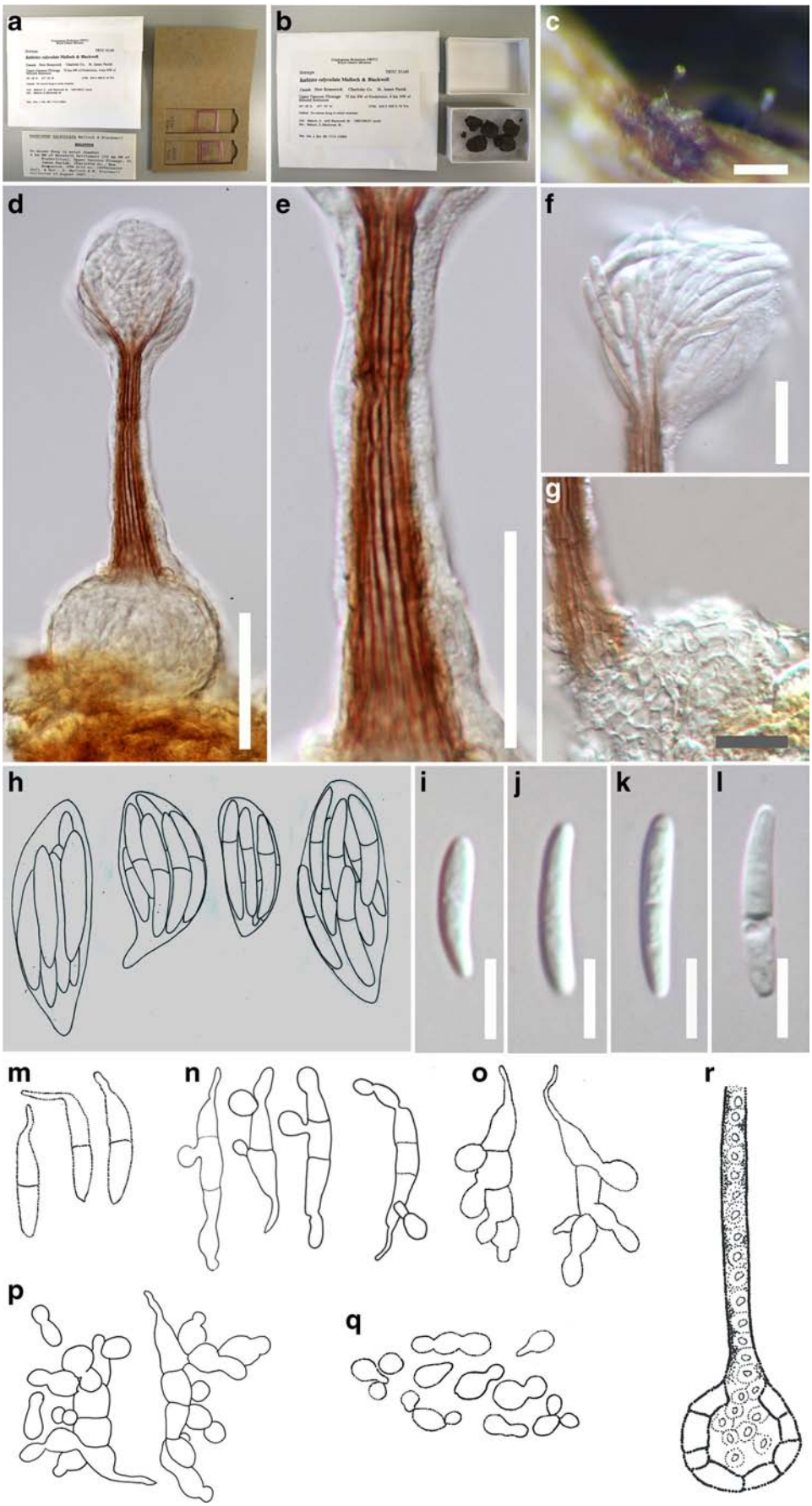


Fig. 77 ***Kathistes calyculata*** (Material examined: CANADA, New Brunswick, Charlotte Co., St. James Parish, Upper Canoose Flowage, on moose dung in moist chamber, 8 August 1987; D. Malloch and M. Blackwell, TRCT51145, **holotype**) **a**, **b** Material **c** Ascomata on substrate **d** Ascoma terminated by incurved setae to form a cup-like apex **e** Ascoma neck show substructure **f** Apex of ascoma neck **g** Peridium **h** Asci **i**, **j**, **k**, **l** Ascospores **m**, **n**, **o**, **p** Ascospores germinating **q** Yeast cells **r** Sporidiomata showing single-celled wall. Scale bars: **c** = 200 μm, **d** = 30 μm, **e** = 20 μm, **f and g**, = 10 μm, **i**, **j**, **k and l** = 5 μm (redrawn from Malloch and Blackwell 1990)

Termitariopsis M. Blackw et al., Mycotaxon 12(1): 98 (1980)

Type species: ***Termitariopsis cavernosa*** M. Blackw et al., Mycotaxon 12(1): 98 (1980)

Key to genera of *Kathistaceae*

1. Conidiomata hyaline, with a long neck . . . . . ***Kathistes***
   1. Conidiomata black, without neck 2
   2. Phialoconidia . . . . . ***Mattirolella***
   2. Macroconidia . . . . . ***Termitariopsis***

Koralionastetaceae Kohlm. & Volkm.-Kohlm., Mycologia 79(5): 764 (1987)

Facesoffungi number: FoF 01391

Saprobic on coralline covered rocks, sponges or on algae, found in marine habitats. **Sexual morph**: *Ascomata* black, subglobose, ovoid or ellipsoidal, superficial, ostiolate, papillate or epapillate, periphysate, subiculate, or without subiculum. *Hamathecium* composed of simple, septate paraphyses. *Asci* 8-spored, unitunicate, clavate to ellipsoidal or fusiform, pedicellate, deliquescent. *Ascospores* overlapping, hyaline, ellipsoidal to fusiform, multi-septate near the apices, or filiform and evenly multi-septate, thick or thin walled, germinating apically, lacking appendages. **Asexual morph**: *Spermatia* enteroblastic, subglobose.

Type: ***Koralionastes*** Kohlm. & Volkm.-Kohlm.

Notes: The family *Koralionastetaceae* was introduced by Kohlmeyer and Volkmann-Kohlmeyer (1987) to include a single genus *Koralionastes*, based on the thick-walled ascospores that germinate into hyphae bearing phialidic antheridia with enteroblastic spermatia. However, the ordinal and higher classification of the family *Koralionastetaceae* was unclear and *Koralionastes* was referred to Ascomycota genera *incertae sedis* (Eriksson 2006). A molecular study with SSU and LSU sequence data, with supporting morphological characteristics, enabled the assignment of the genera *Koralionastes* and *Pontogeneia* to the new order *Koralionastetales*, which is a sister group to the order *Lulworthiales* (Campbell et al. 2009). The orders *Lulworthiales* and *Koralionastetales* clustered together in a well-supported clade based on combined sequence data and a new subclass *Lulworthiomycetidae* was introduced by Maharachchikumbura et al. (2015).

Koralionastes Kohlm. & Volkm.-Kohlm., Mycologia 79(5): 765 (1987)

Facesoffungi number: FoF 02114; Fig. 78

Saprobic on coralline covered rocks, sponges or on algae, found in marine habitats. **Sexual morph**: *Ascomata* ellipsoidal, superficial, ostiolate, periphysate, papillate, black, subiculate, single. *Peridium* composed of several layers of pseudoparenchymatous cells, forming a *textura angularis*, more or less incrusted with melanin. *Paraphyses* simple, rarely branched, septate, filling immature ascomata, later surrounding the asci. *Asci* 8-spored, clavate to ellipsoidal, lacking an apical ring, with a short pedicel, dissolving at maturity, unitunicate, arising from an ascogenous tissue at the base of the locule. *Ascospores* overlapping, ellipsoidal to oval, with several cross septa, mostly septate near the apices, hyaline, thick-walled, lacking a sheath or appendages, germinating apically. **Asexual morph**: *Spermatia* enteroblastic, with basipetal succession, subglobose, wall cup shaped, hyaline, sticky.

Type species: ***Koralionastes ovalis*** Kohlm. & Volkm.-Kohlm., Mycologia 79(5): 765 (1987)

Notes: *Koralionastes* was introduced by Kohlmeyer and Volkmann-Kohlmeyer (1987) with three species, *Koralionastes angustus* Kohlm. & Volkm.-Kohlm., *K. ellipticus* Kohlm. & Volkm.-Kohlm. and *K. ovalis* Kohlm. & Volkm.-Kohlm. (the type species) encountered from corals and placed under a novel family *Koralionastetaceae*. Subsequently, two new species, *K. giganteus* Kohlm. & Volkm.-Kohlm. and *K. violaceus* Kohlm. & Volkm.-Kohlm. were introduced by Kohlmeyer and Volkmann-Kohlmeyer (1990). *Koralionastes* species are found on dead coralline covered rocks among crustose sponges and their ascospores have double walls and are ellipsoidal or fusiform (Campbell et al. 2009). The genera *Koralionastes* and *Pontogenia* differ from members of the *Lulworthiales* by the possession of paraphyses and periphyses, and lack apical mucous-containing chambers or gelatinous sheaths.

Other genus included

Pontogeneia Kohlm., Bot. Jb. 96(1–4): 201 (1975)

Facesoffungi number: FoF 02115; Fig. 79

Parasitic on marine algae (Phaeophyta). **Sexual morph**: Ascomata solitary to gregarious, subglobose or ovoid, superficial or semi immersed ostiolate, papillate or epapillate, coriaceous, black. *Paraphyses* distinct, thick, septate, or indistinct. *Asci* 8-spored, clavate or fusiform, unitunicate, thin walled, early deliquescing, attached in the lower part of the locule. *Ascospores* filiform, rearly ellipsoidal, hyaline, often curved, phragmosporous. **Asexual morph**: Undetermined.

Type species: ***Pontogeneia padinae*** Kohlm., Bot. Jb. 96(1–4): 201 (1975)

Notes: The genus *Pontogeneia* was introduced by Kohlmeyer (1975) for five perithecial ascomycetes parasitizing marine Phaeophyta. Two more species have since been added (Kohlmeyer and Kohlmeyer 1979; Kohlmeyer and Demoulin 1981). Later, *Pontogeneia microdictyi* Kohlm. & Volkm.-Kohlm was introduced to this genus by Campbell et al. (2009). All *Pontogeneia* species are associated with marine algae, belonging to the Chlorophyta or Phaeophyta

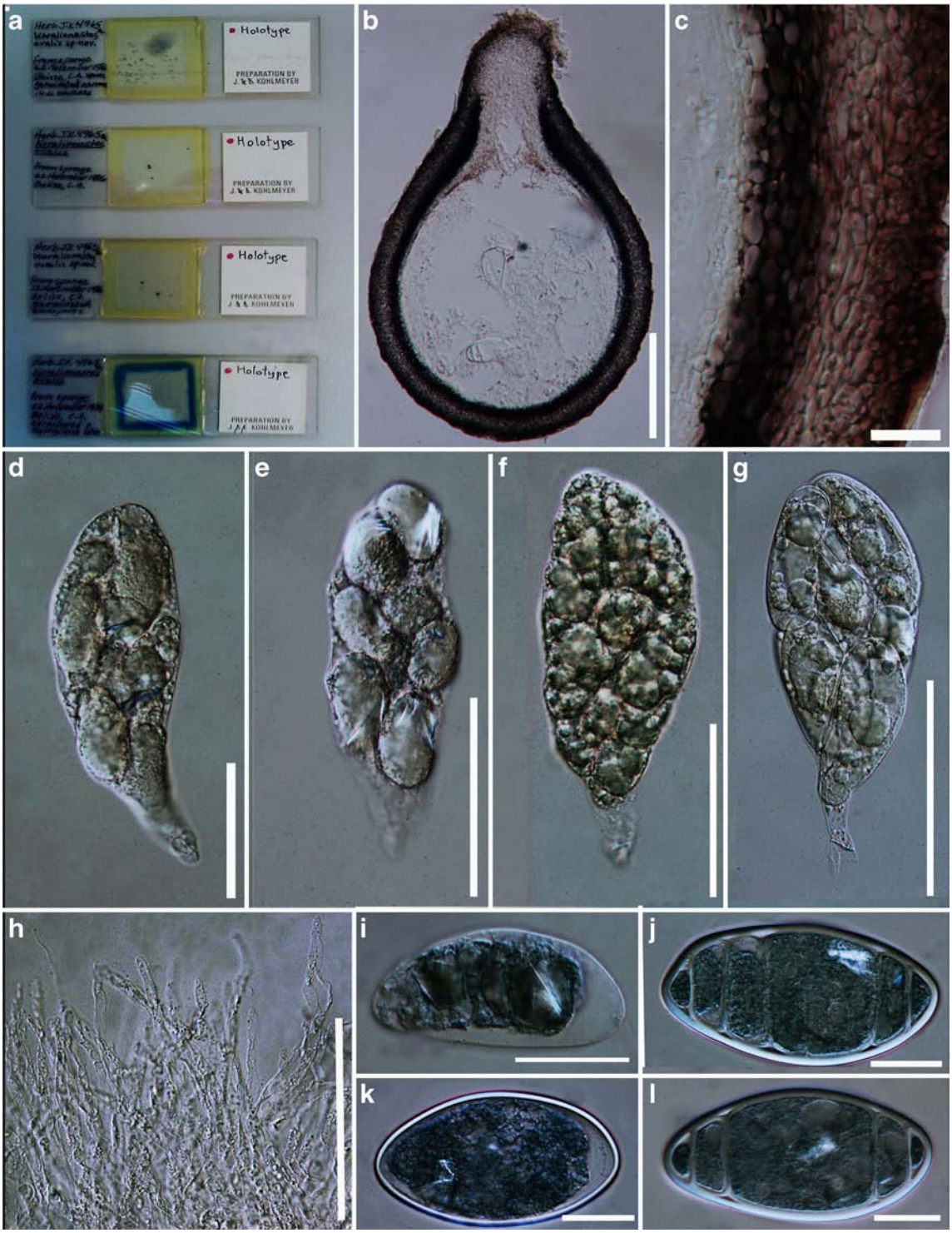
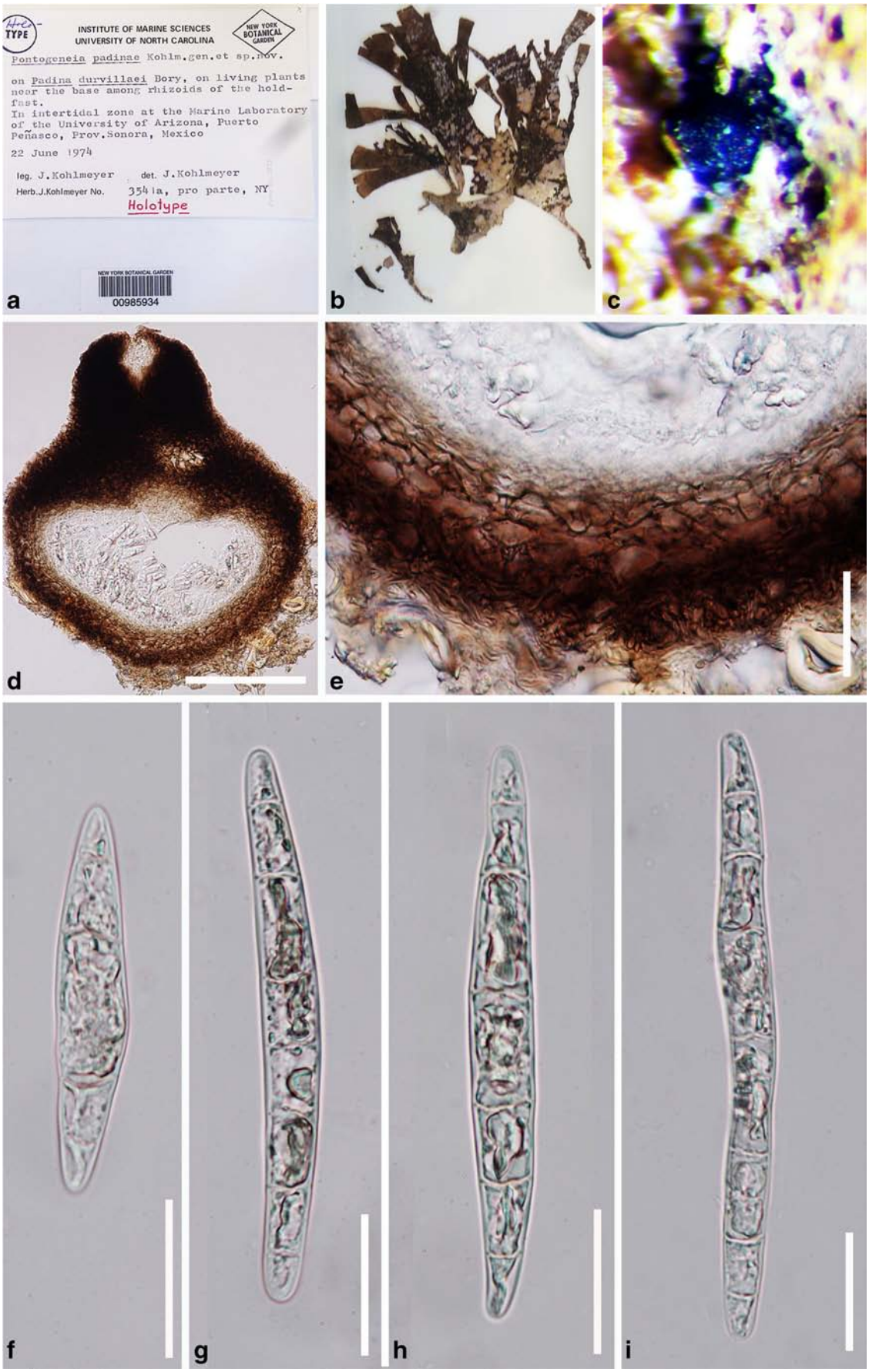


Fig. 78 ***Koralionastes ovalis*** (Material examined: BELIZE, back reef of South water Cay, sub tidal coral slab (0.2–0.5 m deep), November 1986, J. Kohlmeyer; NY 1317811, NY 1317823, NY 1317828, NY 1317838, slides from **holotype**) **a** Microslides of *Koralionastes ovalis* **b** Section through ascoma (NY 1317811) **c** Section through peridium **d–g** Asci (NY 1317828) **h** Paraphyses (NY 1317828) **i–l** Ascospores (NY 1317838). Scale bars: **b**, **c**, **h** = 100 μm, **d-g**, **i–l** = 50 μm

(Kohlmeyer and Kohlmeyer 1979; Kohlmeyer and Demoulin 1981). Based on the combined dataset of SSU and LSU rDNA sequences and morphological characters, the genera *Koralionastes* and *Pontogeneia* were assigned to the new order *Koralionastetales* (Campbell et al. 2009). Maharachchikumbura et al. (2015) and Jones et al. (2015) confirmed the placement of both *Koralionastes* and *Pontogeneia* under *Koralionastetaceae*, *Koralionastetales*.


TYPE
INSTITUTE OF MARINE SCIENCES
UNIVERSITY OF NORTH CAROLINA
NEW YORK BOTANICAL GARDEN
Pontogeneia padinae Kohlm.gen.et sp.nov.
on Padina durvillaei Bory, on living plants
near the base among rhizoids of the hold-
fast.
In intertidal zone at the Marine Laboratory
of the University of Arizona, Puerto
Peñasco, Prov.Sonora, Mexico
22 June 1974
leg. J.Kohlmeyer
det. J.Kohlmeyer
Herb.J.Kohlmeyer No.
354a, pro parte, NY
Holotype
NEW YORK BOTANICAL GARDEN
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◀ **Fig. 79** ***Pontogeneia padinae*** (Material examined: Intertidal zone at the Marine Laboratory of the University of Arizona, on living plants near the base among rhizoids of the holdfast, 22 June 1974, J. J. Kohlmeyer, NY 985934, **holotype**) **a**, **b** Herbarium material of *Pontogeneia padinae* **c** Ascomata on the base of algae d section through ascomata **e** Peridium **f–i** Ascospores. Scale bars: **d** = 100 μm, **e** = 20 μm, **f–i** = 10 μm

Key to the genera of *Koralionastetaceae*

1. On coral rock, associated with crustose sponges ..... ***Koralionastes***
1. On algae ..... ***Pontogeneia***

Lasiosphaeriaceae Nannf., Nova Acta R. Soc. Scient. upsal., Ser. 4 8(no. 2): 50 (1932)

Facesoffungi number: FoF 01145

Saprobic on wood, rotting vegetation, dung of herbivores, in freshwater, marine or terrestrial habitats, many coprophilous. **Sexual morph**: *Ascomata* perithecial or cleistothecial, gregarious or scattered, yellow, brown to black, solitary, superficial, erumpent or immersed, globose, subglobose to ovoid, carbonaceous, coriaceous or membranaceous, ornamented, tuberculate or smooth, with setae or hairs, papillate or papilla indistinct or absent, ostiolate, periphysate, the apex collapsing when dry. *Peridium* thick (10–100 μm), composed of two layers, outer layer comprising brown cells of *textura angularis* or *globulosa*, carbonaceous, coriaceous or membranaceous; inner layer comprising hyaline cells of *textura prismatica* or *porrecta*, thin, membranaceous. *Hamathecium* with numerous, hyaline, septate, filiform or cylindrical paraphyses. *Asci* 4- or 8-spored, unitunicate, thin or thick-walled, cylindrical to clavate, pedicellate, J-. *Ascospores* uni-seriate to irregularly biseriate, allantoid, clavate, cylindrical, ellipsoid to dumbbell-shaped, curved or not, 0–multi-septate, concolourous or versicolorous, hyaline, brown or black, divided, ornamented or smooth, with or without germ pore, appendages present or absent, with or without guttules. **Asexual morph**: Hyphomycetous. *Conidiophores* macronematous or mononematous, scattered or gregarious, brown, straight, septate, branched, smooth-walled. *Conidiogenous cells* enteroblastic or holoblastic, phialidic, hyaline to dark brown, subglobose to ampulliform, proliferating percurrently, with collarette. *Conidia* solitary, globose, subglobose to cylindrical, hyaline to brown, smooth, aseptate.

Type: ***Lasiosphaeria*** Ces. & De Not

Notes: The family *Lasiosphaeriaceae* was introduced by Nannfeldt (1932) based on black ascomata and cylindrical asci, with brown to hyaline ascospores, and is typified by *Lasiosphaeria* (Cesati and de Notaris 1863). This family is polyphyletic (Barr 1990) and this was confirmed by Huhndorf (2004a) based on analysis of LSU sequence data. *Lasiosphaeriaceae* is similar to *Nitschkiaceae* and *Tripterosporaceae* (Barr 1990), the former differs by having turbinate, ostiolate ascomata and septate ascospores (Munk 1957; Carroll and Munk 1964; Lundqvist 1972; Kruys et al. 2014). The family *Lasiosphaeriaceae* forms a sister clade to *Chaetomiaceae* with high support (Maharachchikumbura et al. 2015) and has 35 accepted genera. The family needs to be revised following a thorough molecular study.

Lasiosphaeria Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 229 (1863)

Facesoffungi number: FoF 01146, Fig. 80

Saprobic on wood, rotting vegetation, dung of herbivores, in fresh water or terrestrial habitats, many coprophilous. **Sexual morph**: *Ascomata* perithecial, gregarious or scattered, brown to black, solitary, superficial or sub-immersed, globose, subglobose to ovoid, carbonaceous, coriaceous or membranaceous, ornamented or smooth, with variously coloured tomentum below neck, papillate or indistinct, sitting on brown, septate subiculum, ostiolate and periphysate. *Peridium* thick (30–80 μm), composed of two layers, outer layer comprising brown cells of *textura angularis*, carbonaceous or coriaceous; inner layer comprising hyaline cells of *textura prismatica*, thin, membranaceous. *Hamathecium*, with numerous, hyaline, septate, filiform paraphyses. *Asci* 8-spored, unitunicate, thin walled, cylindrical to clavate, pedicellate, J-. *Ascospores* uni to biseriate, hyaline, yellowish to brown, allantoid, cylindrical to ellipsoid, curved or not, smooth, gelatinous appendages present or absent, with or without guttules, one end swollen or not. **Asexual morph**: Undetermined.

Type species: ***Lasiosphaeria ovina*** (Pers.) Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 229 (1863)

Notes: The genus *Lasiosphaeria* was introduced by Cesati and De Notaris (1863), to accommodate the type species *L. ovina*. This genus was included in *Lasiosphaeriaceae*, under the *Sordariales* based on its brown ascospores with pores (Barr 1990). It is characterized by tuberculate ascomata, covered with variously coloured tomenta, carbonaceous ascomata, numerous paraphyses, clavate asci and diverse-shaped ascospores.

Other genera included

Angulimaya Subram. & Lodha, Antonie van Leeuwenhoek 30: 329 (1964)

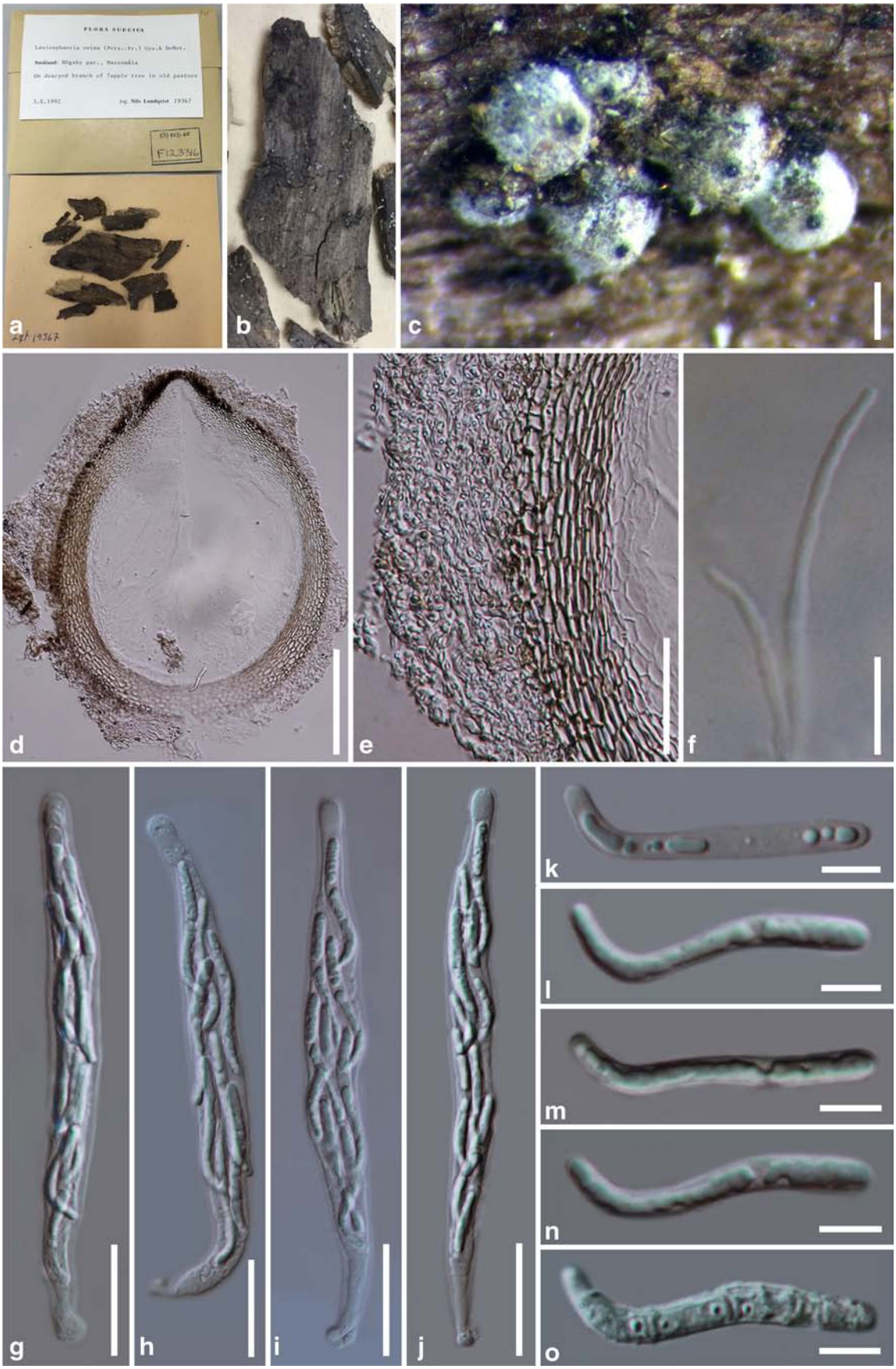
Type species: ***Angulimaya sundara*** Subram. & Lodha, Antonie van Leeuwenhoek 30: 329 (1964)

Anopodium N. Lundq., Bot. Notiser 117: 356 (1964)

Type species: ***Anopodium ampullaceum*** N. Lundq., Bot. Notiser 117: 356 (1964)

Apiosordaria Arx & W. Gams, Nova Hedwigia 13: 201 (1967)

Type species: ***Apiosordaria verruculosa*** (C.N. Jensen) Arx & W. Gams, Nova Hedwigia 13: 201 (1967)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◀ **Fig. 80** ***Lasiosphaeria ovina*** (Material examined: SWEDEN, Småland, Högsby par., Massemåla, on decayed branch of apple tree in old pasture, N. Lundqvist, 3 October 1992, S F-123316)**. a** Material label **b** Specimens **c** Ascomata **d** Ascoma cross section **e** Peridium. **f** Paraphyses **g-j** Asci **k-o** Ascospores Notes: Figs f-o soaked in 3 % KOH. Scale bars: **c** = 200 μm, **d** = 100 μm, **e**, **g-j** = 20 μm, **f**, **k–o** = 5 μm

Apodospora Cain & J.H. Mirza, Can. J. Bot. 48(5): 891 (1970)

Type species: ***Apodospora simulans*** Cain & J.H. Mirza, Can. J. Bot. 48(5): 891 (1970)

Apodus Malloch & Cain, Can. J. Bot. 49(6): 872 (1971)

Type species: ***Apodus deciduus*** Malloch & Cain, Can. J. Bot. 49(6): 872 (1971)

Arniella Jeng & J.C. Krug, Mycologia 69(1): 73 (1977)

Type species: ***Arniella echoura*** Jeng & J.C. Krug, Mycologia 69(1): 74 (1977)

Arnium Nitschke ex G. Winter, Bot. Ztg. 31: 450 (1873)

Type species: ***Arnium lanuginosum*** Nitschke [as 'lanuginosa'], Bot. Ztg. 31: 450 (1873)

Bellojisia Réblová, Mycologia 100(6): 897 (2008)

Type species: ***Bellojisia rhynchostoma*** (Höhn.) Réblová, Mycologia 100(6): 897 (2008)

Biconiosporella Schaumann, Veröff. Inst. Meeresf. Bremerhaven 14(1): 24 (1972)

Type species: ***Biconiosporella corniculata*** Schaumann, Veröff. Inst. Meeresf. Bremerhaven 14(1): 24 (1972)

Bombardia (Fr.) P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 20 (1873)

Type species: ***Bombardia fasciculata*** Fr., Bidr. Känn. Finl. Nat. Folk 23: 20 (1873)

Bombardioidea C. Moreau ex N. Lundq., Symb. bot. upsal. 20(no. 1): 274 (1972)

Type species: ***Bombardioidea bombardioides*** (Auersw.) Moreau, Encyclop. Mycol. 25(1): 317 (1954)

Camptosphaeria Fuckel, Jb. nassau. Ver. Naturk. 23–24: 140 (1870) [1869–70]

Type species: ***Camptosphaeria sulphurea*** Fuckel, Jb. nassau. Ver. Naturk. 23–24: 140 (1870) [1869–70]

Cercophora Fuckel, Jb. nassau. Ver. Naturk. 23–24: 244 (1870) [1869–70]

Type species: ***Cercophora mirabilis*** Fuckel, Jb. nassau. Ver. Naturk. 23–24: 245 (1870) [1869–70]

Cladorrhinum Sacc. & Marchal, in Marchal, Bull. Soc. R. Bot. Belg. 24(1): 64 (1885)

Type species: ***Cladorrhinum foecundissimum*** Sacc. & Marchal, in Marchal, Bull. Soc. R. Bot. Belg. 24(1): 64 (1885)

Diffractella Guarro et al., Syst. Ascom. 10: 107 (1991)

Type species: ***Diffractella curvata*** (Fuckel) Guarro et al., Syst. Ascom., Reprint of Volumes 1–4 (1982–1985) 10(2): 108 (1991)

Emblemospora Jeng & J.C. Krug, Can. J. Bot. 54(16): 1971 (1976)

Type species: ***Emblemospora monotrema*** Jeng & J.C. Krug, Can. J. Bot. 54(16): 1972 (1976)

Eosphaeria Höhn., Annls mycol. 15(5): 362 (1917)

Type species: ***Eosphaeria uliginosa*** (Kunze) Höhn., Annls mycol. 15(5): 362 (1917)

Fimetariella N. Lundq., Bot. Notiser 117: 239 (1964)

Type species: ***Fimetariella rabenhorstii*** (Niessl) N. Lundq., Bot. Notiser 117: 239 (1964)

Immersiella A.N. Mill. & Huhndorf, Mycol. Res. 108(1): 31 (2004)

Type species: ***Immersiella immersa*** (P. Karst.) A.N. Mill. & Huhndorf, Mycol. Res. 108(1): 31 (2004)

Jugulospora N. Lundq., Symb. bot. upsal. 20(no. 1): 256 (1972)

Type species: ***Jugulospora rotula*** (Cooke) N. Lundq., Symb. bot. upsal. 20(no. 1): 260 (1972)

Lacunospora Cailleux, Cahiers de La Maboké 6(2): 93 (1969) [1968]

Type species: ***Lacunospora stercoraria*** Cailleux, Cahiers de La Maboké 6(2): 96 (1969) [1968]

Mammaria Ces. ex Rabenh., Bot. Ztg. 12: 190 (1854)

Type species: ***Mammaria echinobotryoides*** Ces., in Rabenhorst, Klotzschii Herb. Viv. Mycol., Editio novo. Century 19: no. 1859 (1854)

Melanocarpus Arx, Stud. Mycol. 8: 17 (1975)

Type species: ***Melanocarpus albomyces*** (Cooney & R. Emers.) Arx, Stud. Mycol. 8: 175 (1975)

Periamphispora J.C. Krug, Mycologia 81(3): 476 (1989)

Type species: ***Periamphispora phacelodes*** J.C. Krug, Mycologia 81(3): 476 (1989)

Podospora Ces., in Rabenhorst, Klotzschii Herb. Viv. Mycol.: no. 259 (vel 258) (1856)

Type species: ***Podospora fimiseda*** (Ces. & De Not.) Niessl, Hedwigia 22: 156 (1883)

Pseudocercophora Subram. & Sekar, Journal of the Singapore National Academy of Science 15: 58 (1986)

Type species: ***Pseudocercophora ingoldii*** Subram. & Sekar, Journal of the Singapore National Academy of Science 15: 58 (1986)

Rinaldiella Deanna A et al., in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 32: 301 (2014)

Type species: ***Rinaldiella pentagonospora*** Deanna A. Sutton et al., in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 32: 301 (2014)

Schizothecium Corda, Icon. fung. (Prague) 2: 29 (1838)

Type species: ***Schizothecium fimicola*** Corda [as 'fimicolum'], Icon. fung. (Prague) 2: 29 (1838)

Strattonia Cif., Sydowia 8(1–6): 245 (1954)

Type species: ***Strattonia tetraspora*** (R. Stratton) Cif., Sydowia 8(1–6): 245 (1954)

Thaxteria Sacc., Syll. fung. (Abellini) 9: 687 (1891)

Type species: ***Thaxteria kunkelii*** Giard, C. r. Seanc. Soc. Biol. 44(4): 156 (1892)

Triangularia Boedijn, Annls mycol. 32(3/4): 302 (1934)

Type species: ***Triangularia bambusae*** (J.F.H. Beyma) Boedijn, Annls mycol. 32(3/4): 302 (1934)

Tripterosporella Subram. & Lodha, Curr. Sci. 37: 246 (1968)

Type species: ***Tripterosporella coprophila*** Subram. & Lodha, Curr. Sci. 37: 246 (1968)

Zygopleurage Boedijn, Persoonia 2(3): 316 (1962)

Type species: ***Zygopleurage zygospora*** (Speg.) Boedijn, Persoonia 2(3): 316 (1962)

Zygospermella Cain, Mycologia 27(2): 227 (1935)

Type species: ***Zygospermella setosa*** (Cain) Cain, Mycologia 27(2): 227 (1935)

Key to genera of *Lasiosphaeriaceae*

1. Hyphomycete 2
1. Ascomycete 4
2. Conidia brown to dark brown. . . . . ***Mammaria***
2. Conidia hyaline 3
3. Conidia globose to subglobose. . . . . ***Angulimaya***
3. Conidia ellipsoid to obovoid . . . . . ***Cladorrhinum***
4. Asci 4-spored. . . . . ***Lacunospora***
4. Asci 8-spored. 5
5. Ascomata carbonaceous 6
5. Ascomata coriaceous or membranaceous 9
6. Ascomata pyriform . . . . . ***Camptosphaeria***
6. Ascomata subglobose to ovoid. 7
7. Ascomata covered with variously coloured tomentum below neck . . . . . ***Lasiosphaeria***
7. Ascomata without tomentum below neck, with setae or tuberculate 8
8. Ascomata with hairy asexual morphs in *Mammaria* . . . . . ***Pseudocercophora***
8. Ascomata without hairy asexual morphs, ascospores L-shaped, multi-septate, with short appendages at the ends, sexual morphs *Cladorrhinum*-like . . . . . ***Eosphaeria***
9. Ascomata coriaceous 10
9. Ascomata membranaceous 17
10. Marine fungi . . . . . ***Biconiosporella***
10. Not marine fungi 11
11. Ascomata cleistothecial . . . . . ***Tripterosporella***
11. Ascomata perithecial 12
12. Ascomata sitting on or in the subiculum. 13
12. Ascomata superficial to immersed on the bark, without a subiculum 14
13. Ascospores cylindrical to ellipsoid, guttulate . . . . . ***Bombardia***
13. Ascospores allantoid . . . . . ***Thaxteria***
14. Ascomata with hairs. 15
14. Ascomata without hairs . . . . . ***Fimetariella***
15. Ascospores concolourous. . . . . ***Periamphispora***
15. Ascospores versicolored. 16
16. Ascomata ovoid or pyriform . . . . . ***Triangularia***
16. Ascomata globose or subglobose . . . . . ***Strattonia***
17. Ascospores with 1 or 2 germ pores 18
17. Ascospores without or with inconspicuous germ pore 20
18. Ascospores with 2 germ pores 19
18. Ascospores with a single germ pore 24
19. Ascospores ellipsoid to fusiform, surround by a gelatinous sheath. . . . . ***Bombardioidea***
19. Ascospores comprising two ellipsoid, not surround by a gelatinous sheath, with short appendages . . . . . ***Zygopleurage***
19. Ascospores cylindrical, with long appendages at the ends. . . . . ***Zygospermella***
20. Ascomata with hairs or setae 21
20. Ascomata without hairs . . . . . ***Immersiella***
21. Ascomata concolourous 22
21. Ascomata versicolored . . . . . ***Anopodium***
22. Ascomata ovoid to obpyriform. 23
22. Ascomata globose . . . . . ***Diffractella***
22. Ascomata pyriform to subglobose . . . . . ***Rinaldiella***
23. Ascospores without appendages. . . . . ***Jugulospora***
23. Ascospores with appendages at ends . . . . ***Podospora***
24. Ascomata smooth. . . . . ***Apodospora***
24. Ascomata with hairs or tomentose 25
25. Ascomata tomentose, with cylindrical neck . . . . . ***Bellojisia***
25. Ascomata with hairs. 26
26. Ascomata with swollen agglutinated hairs . . . . . ***Schizothecium***
26. Ascomata with cylindrical hairs 27
27. Ascospores concolourous. 28
27. Ascospores versicolored. . . . . ***Apiosordaria***
28. Ascospores surround by a gelatinous sheath. 29
28. Ascospores with appendage at ends 30
28. Ascospores without appendages and sheath 31
29. Asci with apical ring . . . . . ***Apodus***
29. Asci lacking apical ring . . . . . ***Arniella***
30. Ascospores oval to ellipsoid. . . . . ***Arnium***
30. Ascospores cylindrical, straight or the lower cell curved when mature, upper cell ventricose. . . . . ***Cercophora***
31. Ascospores oval to ellipsoid, divided in all directions . . . . . ***Emblemospora***
31. Ascospores globose to subglobose, smooth-walled . . . . . ***Melanocarpus***

Lautosporaceae Kohlm. et al., Bot. Mar. 38(2): 169 (1995)

Facesoffungi number: FoF 01764

Saprobic on submerged mangrove wood in marine habitats. **Sexual morph**: *Ascomata* fusiform to ellipsoidal, ostiolate, brown, coriaceous, solitary. *Hamathecium* of simple, septate persistent paraphyses. *Asci* 4-spored, cylindrical,

short pedicellate, thick-walled, unitunicate, with an ocular chamber. *Ascospores* uni- or biseriate, fusiform, muriform, distoseptate, hyaline, outer wall very thick. **Asexual morph**: Undetermined.

Type: ***Lautospora*** K.D. Hyde & E.B.G. Jones

Notes: Kohlmeyer et al. (1995) introduced this family for two marine *Lautospora* species, *Lautospora gigantea* K.D. Hyde & E.B.G. Jones and *Lautospora simillima* Kohlm. et al., thought to possess bitunicate asci and were not assigned to any order in the Dothideomycetes (Kohlmeyer et al. 1995). Based on LSU sequence data (S. Suetrong, unpublished data), *L. simillima* was referred to an unnamed clade in Sordariomycetes and in a basal clade to the orders *Diaporthales* (Jones et al. 2015). Jones et al. (2015) showed that *L. simillima* groups with the neotropical ascomycete *Mirannulata samuelsii* Huhndorf et al. with weak support, but they share few similar morphological features (Huhndorf et al. 2003). The *Lautospora/Mirannulata* clade formed a sister group to *Vertexicola caudatus* K.D. Hyde et al. and *Rhamphoria delicatula* Niessl (*Annulatascaceae*) in an unsupported clade hence, Jones et al. (2015) emended the diagnosis of the family *Lautosporaceae*.

Lautospora K.D. Hyde & E.B.G. Jones, Bot. Mar. 32(3): 479 (1989)

Facesoffungi number: FoF 02116; Fig. 81

Saprobic on submerged wood of *Rhizophora* spp. **Sexual morph**: *Ascomata* immersed, subglobose in frontal view, fusiform in side view, long axis parallel to the host surface, coriaceous, ostiolate, brown above, light brown to hyaline below. *Peridium* 17–65 μm thick composed of several layers of thin-walled cells. *Paraphyses* hyaline, septate, persistent. *Asci* uniseriate, 4-spored, cylindrical, unitunicate with an ocular chamber, thick-walled, pedicellate. *Ascospores* muriform, fusiform, hyaline, septate, thick-walled. **Asexual morph**: Undetermined.

Type species: ***Lautospora gigantea*** K.D. Hyde & E.B.G. Jones, Bot. Mar. 32(3): 479 (1989)

Notes: *Lautospora* was introduced to include taxa with immersed ascocarps, asci which are unitunicate, 4-spored, and with an ocular chamber and a ring, cellular pseudoparaphyses and large ascospores, which are muriform, hyaline and thick walled (Hyde and Jones 1989). Kohlmeyer et al. (1995) introduced the family *Lautosporaceae* to include this genus and assigned it to Ascomycotina *incertae sedis*.

Lopadostomataceae Daranagama & K.D. Hyde, [as '*Lopadostomaceae*'] in Senanayake et al., Fungal Divers 73: 1 (2015)

Facesoffungi number: FoF 00071

Saprobic on dead wood. **Sexual morph**: *Pseudostromata* (for *Lopadostoma*) immersed to erumpent, appearing as darkened areas, densely gregarious, scattered, compact. *Stromata* (for *Creosphaeria*) erumpent to nearly superficial, with abrupt margins, multi-perithecial, coalescing in linear rows, dull black, waxy, roughened, flattened at the top, with inconspicuous perithecial mounds. *Ascomata* multi-perithecial, single to multi-layered, clustered, having long ostiolar necks (for *Lopadostoma*) lined with whitish material (for *Creosphaeria*). *Ostioles* umbilicate or at the same level as stromatal surface. *Peridium* amorphous, comprised of dark brown to black cells. *Hamathecium* comprising numerous, long, hyaline, rarely branched paraphyses. *Asci* (4–)8-spored, cylindrical, pedicellate, rounded apex, with a J+, apical ring. *Ascospores* uniseriate or partly biseriate, oblong, initially

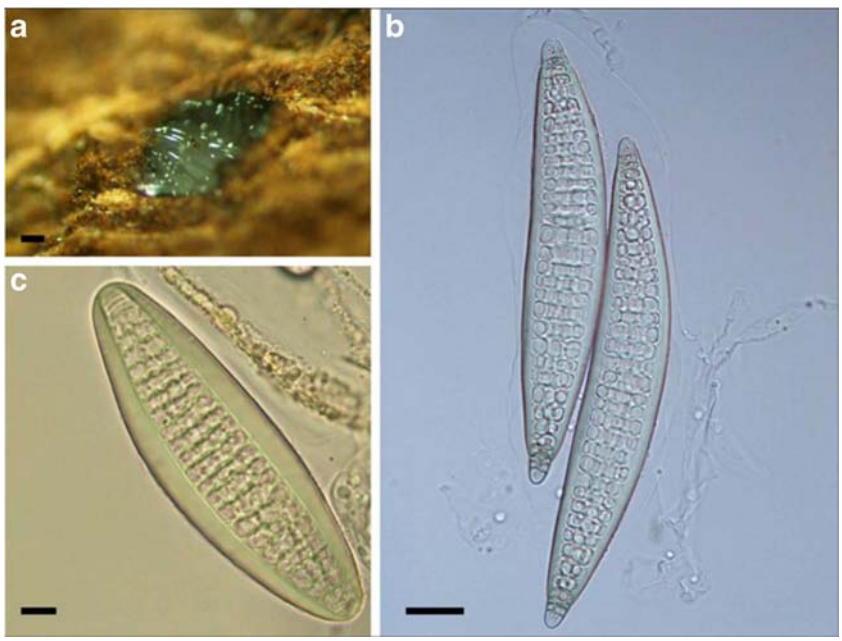


Fig. 81 ***Lautospora*** spp.: **a** *L. simillima* Ascoma immersed in substratum **b** Two ascospores with thick-walled apical region of ascus (Material examined: THAILAND, Chumporn Province, Wetland Development Office 12, mangrove forest, on mangrove wood, 18 January 2012 S. Suetrong, BBH 31841) **c** *L. gigantea* (Material examined: THAILAND, Chachoengsao, Bang Pakong Bowornwitthayayon School, mangrove forest, on mangrove wood, 20 June 2011 S. Suetrong) Thick-walled hyaline ascospore. Scale bars: **a** = 100 μm, **b** = 10 μm, **c** = 25 μm

hyaline, turning light brown to nearly black, narrowly ellipsoid, smooth-walled, with full length, straight germ slit. **Asexual morph**: Libertella-like. *Conidiomata* convoluted or multi-loculate, with black pycnidial wall. *Conidiophores* di- or trichotomously branched, stipes yellow, hyaline above, smooth-walled, arranged in dense palisade. *Conidiogenous cells* terminal, cylindrical, smooth-walled, bearing conidial secession scars. *Conidia* hyaline, falcate, strongly curved to semicircular, unicellular.

Type: ***Lopadostoma*** (Nitschke) Traverso; Fig. 82

Type species: ***Lopadostoma turgidum*** (Pers.) Traverso, Fl. ital. crypt., Pars 1: Fungi. Pyrenomycetae. *Xylariaceae*, *Valsaceae*, Ceratostomataceae 1 (2): 170 (1906)

Notes: *Lopadostomataceae* was introduced in Senanayake et al. (2015) in the order *Xylariales* to accommodate the genera *Creosphaeria* and *Lopadostoma*. *Creosphaeria* was introduced by Theissen (1910) with soft, light coloured stromata. Petrini and Müller (1986) reported a *Libertella* asexual morph from culture of *Creosphaeria* (Fig. 83), while Ju et al. (1993) observed the same type of conidia associated with the sexual morph. Jaklitsch et al. (2014) revised the genus *Lopadostoma* and also reported a *Libertella* asexual morph. The species *L. americanum* Jaklitsch et al., *L. fagi* Jaklitsch et al., *L. linospermum* (Durieu & Mont.) Jaklitsch et al., *L. meridionale* Jaklitsch et al. and *L. turgidum* (Pers.) Traverso, are known to have libertella-like asexual morphs. Ju et al. (1993) believed the two genera *Lopadostoma* and *Creosphaeria* should be represented separately as they are not similar in morphology with other xylariaceous members. In their phylogenetic analyses, Maharachchikumbura et al. (2015) and Senanayake et al. (2015) placed *Creosphaeria sassafras* (Schwein.) and *Lopadostoma* species as a distinct monophyletic group outside *Xylariaceae*. Although they form separate monophyletic groups, the close relationship between *Lopadostoma* and *Creosphaeria* noted in Senanayake et al. (2015), is in agreement with Jaklitsch et al. (2014).

Lopadostoma turgidum was lectotypified by Lu and Hyde (2000), which turned out to be invalid because the material selected was not from the original collection by Persoon (it was not possible to loan this material). Jaklitsch et al. (2014) was able to observe Persoon's original material by going to herbarium (L) and epitypified *L. turgidum* with a fresh collection. We do not described the genus here as it was detailed in Senanayake et al. (2015).

Other genus included

Creosphaeria Theiss., Beih. bot. Zbl., Abt. 2 27: 396 (1910); Fig. 83

Type species: ***Creosphaeria riograndensis*** Theiss., Beih. bot. Zbl., Abt. 2 27: 396 (1910)

Key to the genera of *Lopadostomataceae*

1. Stromata nearly superficial, effuse, surface dull black, waxy, roughened, flattened at the top, depressed and paler around the ostioles, the tissue between the perithecia waxy, orange to black mixed with orange granules, asci with a discoid, amyloid apical ring . . . . . ***Creosphaeria***

1. Stromata typically immersed in and erumpent from bark, subglobose to bluntly conical, surrounded by a narrow, black, carbonized encasement, the tissue between the perithecia black, lack orange granules, asci with a globose to ellipsoid apical ring . . . . . ***Lopadostoma***

Lulworthiaceae Kohlm. et al., Mycologia 92(3): 456 (2000)

Facesoffungi number: FoF 01295

Saprobic on wood or growing on sea grasses and marsh plants. **Sexual morph**: *Ascomata* dark brown to black, subglobose to cylindrical, swan-like, immersed or superficial, coriaceous, ostiolate, papillate, sometimes with a long neck. *Hamathecium* absent; centrum initially filled with a hyaline pseudoparenchyma, dissolving at maturity. *Peridium* mostly 2-layered, composed of an outer layer of cells of *textura angularis* and an inner layer of elongate cells. *Asci* 8-spored, unitunicate, cylindrical to fusiform, short pedicellate, deliquescent. *Ascospores* fasciculate, hyaline, filiform, septate or aseptate, with or without a mucus-containing, conical or semi-globose chamber at each end. **Asexual morph**: hyphomycetous. *Hyphae* hyaline, septate, branched. *Conidiophores* micronematous or semi-micronematous. *Conidia* ellipsoidal or helicoid, septate or aseptate, *spermatia*, enteroblastic, subglobose.

Type: ***Lulworthia*** G.K. Sutherl.

Notes: Spatafora et al. (1998) demonstrated that the order *Halosphaeriales* was polyphyletic and comprised two distinct lineages. The first clade, *Halosphaeriales*, included eleven representative genera, that were closely related to, and are now included in the order *Microascales*. The second clade, comprised the genera *Lulworthia* and *Lindra*, and was assigned to *Lulworthiaceae*, *Lulworthiales* (Kohlmeyer et al. 2000). Jones et al. (2008) showed that some asexual morph species of *Cirrenalia*, *Cumulospora*, *Zalerion* and *Orbimyces* grouped in *Lulworthiaceae*. Subsequently, Abdel-Wahab et al. (2010) in an analysis of a larger data set of SSU and LSU rDNA sequence data, showed that the genera *Cirrenalia* and *Cumulospora* were polyphyletic and introduced a number of new genera to accommodate taxa grouping in *Lulworthiaceae*: *Halazoon* (= *Cirrenalia fusca* I. Schmidt), *Hydea* (= *Cirrenalia pygmea* Kohlm.), *Matsusporium* (= *Cirrenalia tropicalis* Kohlm.), and *Moromyces* (= *Cumulospora varia* Chatmala & Somrithipol). A further new genus *Moleospora* was introduced for the new species *M. maritima* Abdel-Wahab et al. (Abdel-Wahab et al. 2010). Studies by Inderbitzin et al. (2004), Campbell et al.

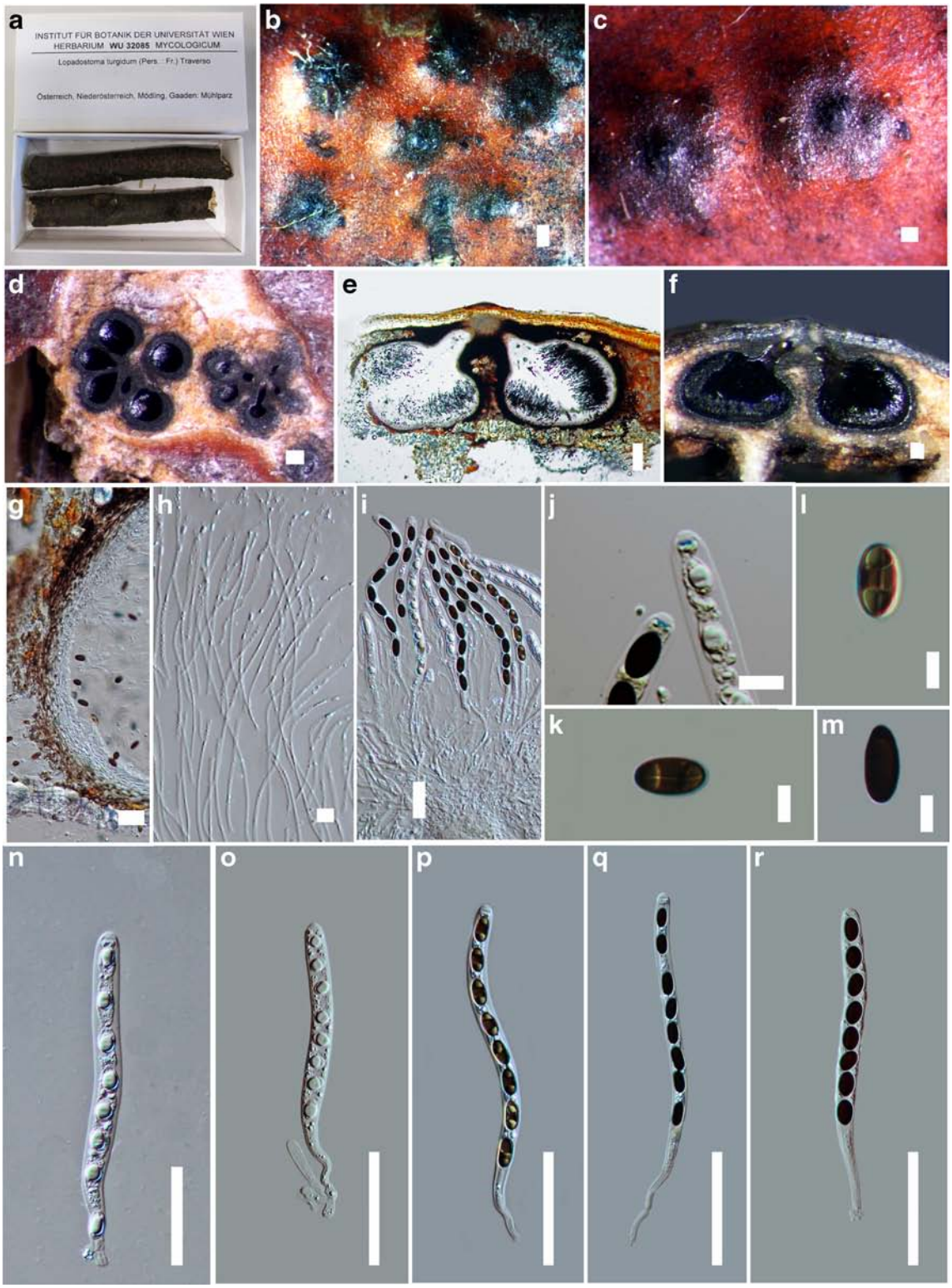


Fig. 82 ***Lopadostoma turgidum*** (Material examined: AUSTRIA, Niederösterreich, Gaaden, 3 December 2011, H. Voglmayr, WU 32085, **epitype**). **a** Herbarium specimen **b** Stromata in face view **c** Ectostromatic disc **d** Valsoid configuration of ascomata **e-f** Cross sections of stroma **g** Peridium **h** Paraphyses **i** Mature and immature asci **j** Apical ring bluing at Melzer's reagent **k–m** Ascospores **n-r** Asci. Scale bars: **b** = 500 μm, **c–d** = 200 μm, **e–f** = 100 μm, **g** = 20 μm, **j**, **h** = 10 μm, **I** = 20 μm, **i**, **n–r** = 50 μm, **k–m** = 5 μm

(2009) showed that the sexual morph *Haloguignardia* with five species parasitic on brown seaweeds, grouped in *Lulworthiaceae* with high statistical support. Currently, *Lulworthiaceae* comprises seven asexual

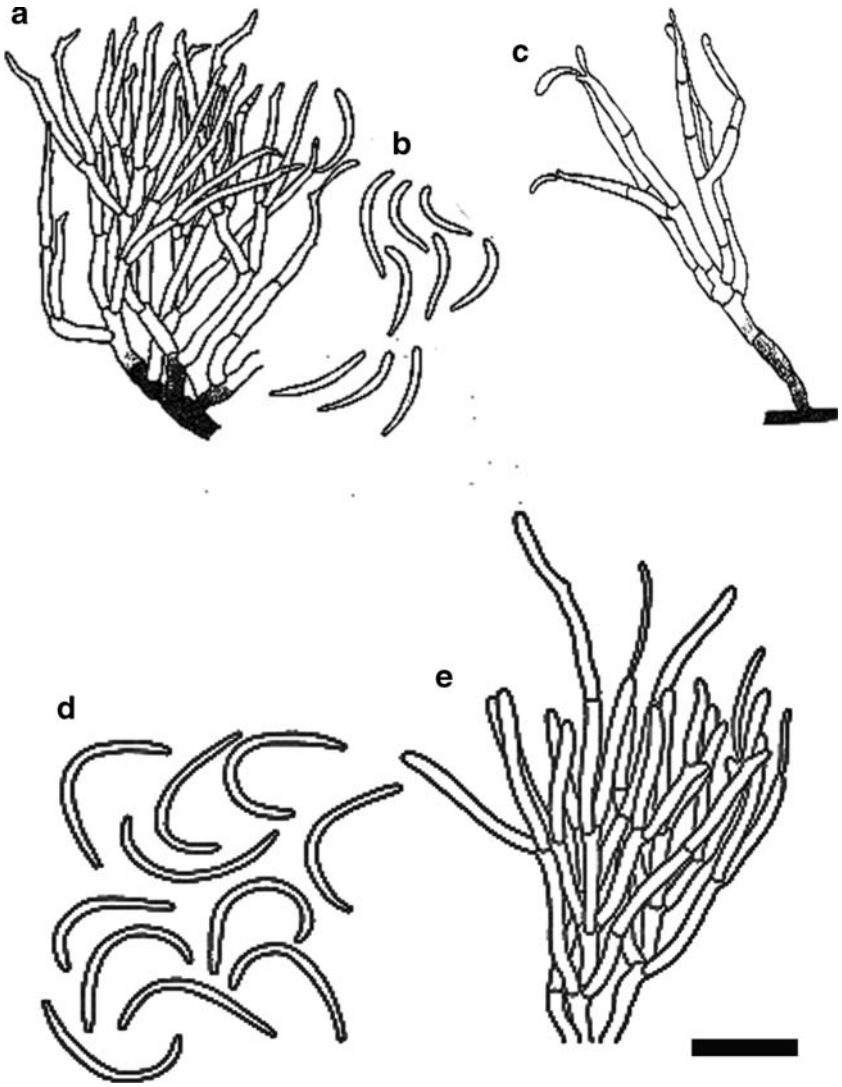


Fig. 83 ***Creosphaeria sassafras*** (redrawn from Ju et al. 1993) a-c *Creosphaeria sassafras* **a**, **c** Conidiophores and conidiogenesis cells **b** Conidia d-e *Lopadostoma turgidum* **d** Conidia **e** Conidiophores and conidiogenesis cells. Scale bar: **a**–**e** = 10 μm

morphs genera. Maharachchikumbura et al. (2015) showed that the orders *Lulworthiales* and *Koralionastetales* clustered together in a well-supported clade, based on analysis of combined sequence data and a new subclass was introduced as Lulworthiomycetidae.

Lulworthia G.K. Sutherl., Trans. Br. mycol. Soc. 5(2): 259 (1916) [1915]

Facesoffungi number: FoF 02117; Fig. 84

Saprobic on wood or *parasitic* on algae. **Sexual morph**: *Ascomata* sphaerical to ellipsoidal, often swan-shaped, immersed to superficial, carbonaceous to coriaceous, ostiolate, dark brown with or without a long neck up to 154 mm. *Peridium* 1–2 layered, composed of an outer layer of cells of *textura angularis* and an inner layer of elongate cells. *Asci* 8-spored, clavate to fusiform, short pedicellate, unitunicate, deliquescing early. *Ascospores* filiform, mostly hyaline, septate, with apical chambers. **Asexual morph**: Undetermined.

Type species: ***Lulworthia fucicola*** G.K. Sutherl., Trans. Br. mycol. Soc.5(2): 259 (1916) [1915]

Notes: The type genus *Lulworthia* was described by Sutherland (1915) to accommodate the species *L. fucicola* G.K. Sutherl., a taxon found on the brown seaweed, commonly known as the bladder wrack, at Lulworth Cove on the Dorset coast, UK. Later, the genera *Lulworthia* and *Lindra* were included in the family *Halosphaeriaceae*, order *Halosphaeriales* by Müller and von Arx (1962). The type species of *Lulworthia* (*L. fucicola*) has never been isolated from the marine alga *Fucus vesiculosus*, so a collection from Chile was designated as neotype by Campbell et al. (2005). Subsequently, based on molecular analysis, a new family *Lulworthiaceae* in *Lulworthiales* was designated to include halosphaerialean species with filamentous ascospores (Kohlmeyer et al. 2000). Several new *Lulworthia* species were described from marine habitats and the genus became one of the largest in marine habitats (Kohlmeyer et al. 2000). *Lulworthia* has been subjected to revisions over many years

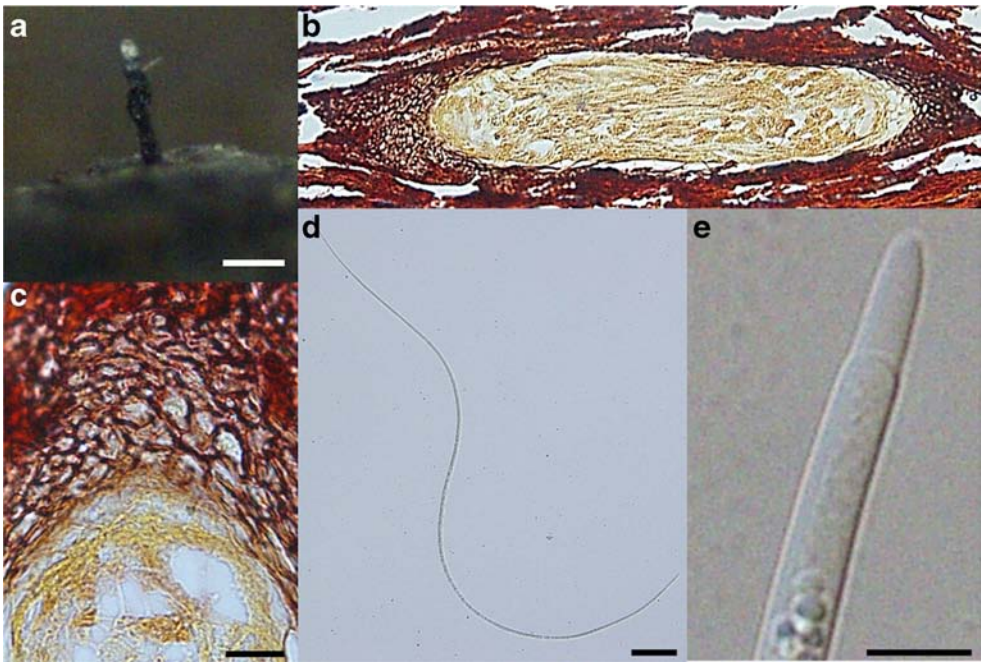


Fig. 84 ***Lulworthia*** sp. (Material examined: TAIWAN, New Taipei City, Tamsui, mangrove, on dead mangrove wood, 20 September 2009, K.L. Pang) **a** Neck protruding from the wood surface **b** Immersed ascoma on bark **c** Peridium composed of thick-walled angular cells **d** Filamentous ascospore **e** Polar end chamber of ascospore. Scale bars: **a** = 100 μm, **b**, **d** = 50 μm, **c**, **e** = 10 μm

(Kohlmeyer 1972; Kohlmeyer and Kohlmeyer 1979; Koch and Jones 1984;). Johnson and Sparrow (1961) introduced 12 new *Lulworthia* species, but Cavaliere and Johnson (1965) synonymized all species with *L. medusa* (Ellis & Everh.) Cribb & J.W. Cribb. Kohlmeyer (1972) recognized at least three species; and Koch and Jones (1984) recognized six species. Currently eleven species are included with a number of other taxa (Kohlmeyer et al. 2000). As a result of sequence analysis of LSU, a number of transfers have been proposed, such as *Lulworthia crassa* Nakagiri to *Kohlmeyeriella*, *Lulworthia lignoarenaria* Jørg. Koch & E.B.G. Jones to *Lulwoidea* and *Lulworthia uniseptata* Nakagiri to *Lulwoana* (Campbell et al. 2005). Currently only one species (the type species *L. fucicola*) is accepted in *Lulworthia sensu stricto*, while eleven species are referred to *Lulworthia sensu lato* until they are recollected and sequenced (Jones et al. 2015).

Other genera included

Cumulospora I. Schmidt, Mycotaxon 24: 420 (1985)

Type species: ***Cumulospora marina*** I. Schmidt, Mycotaxon 24: 421 (1985)

Halazoon Abdel-Aziz et al., Mycol. Progr. 9(4): 545 (2010)

Type species: ***Halazoon melhae*** Abdel-Aziz et al. in Abdel-Wahab et al., Mycol. Progr. 9(4): 546 (2010)

Haloguignardia Cribb & J.W. Cribb, Pap. Dept. Bot.) Univ. Qd.3: 97 (1956)

Type species: ***Haloguignardia decidua*** Cribb & J.W. Cribb, Pap. Dept. Bot. Univ. Qd.3: 97 (1956)

Hydea K.L. Pang & E.B.G. Jones, in Abdel-Wahab et al., Mycol. Progr. 9(4): 549 (2010)

Type species: ***Hydea pygmea*** (Kohlm.) K.L. Pang & E.B.G. Jones, in Abdel-Wahab et al., Mycol. Progr. 9(4): 549 (2010)

Kohlmeyeriella Jones et al., Soc., Bot. 87: 208 (1983)

Type species: ***Kohlmeyeriella tubulata*** (Kohlm.) E.B.G. Jones et al., J. Linn. Soc., Bot. 87(2): 210 (1983)

Lindra I.M. Wilson, Trans. Br. mycol. Soc. 39(4): 411 (1956)

Type species: ***Lindra inflata*** I.M. Wilson, Trans. Br. mycol. Soc. 39(4): 411 (1956)

Lulwoana Kohlm. et al., Mycol. Res. 109(5): 562 (2005)

Type species: ***Lulwoana uniseptata*** (Nakagiri) Kohlm. et al., Mycol. Res.109(5): 562 (2005)

Lulwoidea Kohlm. et al., Mycol. Res. 109(5): 564 (2005)

Type species: ***Lulwoidea lignoarenaria*** (Jørg. Koch & E.B.G. Jones) Kohlm. et al., Mycol. Res.109(5): 564 (2005)

Matsusporium E.B.G. Jones & K.L. Pang, in Abdel-Wahab et al., Mycol. Progr. 9(4): 550 (2010)

Type species: ***Matsusporium tropicale*** (Kohlm.) E.B.G. Jones & K.L. Pang, in Abdel-Wahab et al., Mycol. Progr. 9(4): 550 (2010)

Moleospora Abdel-Wahab et al., Mycol. Progr. 9(4): 547 (2010)

Type species: ***Moleospora maritima*** Abdel-Wahab et al., in Abdel-Wahab et al., Mycol. Progr. 9(4): 548 (2010)

Moromyces Abdel-Wahab et al., in Abdel-Wahab et al., Mycol. Progr. 9(4): 555 (2010)

Type species: ***Moromyces varius*** (Chatmala & Somrith.) Abdel-Wahab et al., in Abdel-Wahab et al., Mycol. Progr. 9(4): 555 (2010)

Orbimyces Linder, Farlowia 1: 404 (1944)

Type species: ***Orbimyces spectabilis*** Linder, Farlowia1: 404 (1944)

Rostrupiella Jørg. Koch et al., Bot. Mar. 50(5–6): 295 (2007)

Type species: ***Rostrupiella danica*** Jørg. Koch et al., Bot. Mar. 50(5/6): 295 (2007)

Spathulospora A.R. Caval. & T.W. Johnson, Mycologia 57(6): 927 (1965)

Type species: ***Spathulospora phycophila*** A.R. Caval. & T.W. Johnson, Mycologia 57(6): 927 (1965)

Key to genera of *Lulworthiaceae*

1. Ascomycete with filamentous ascospores 9
1. Hyphomycete. 2
2. Conidia tetraradiate . . . . . ***Orbimyces***
2. Conidia helicoid. 3
3. Conidia initially spiral, becoming a tangled knot of cells after cell division in several planes 4
3. Conidia initially spiral, not forming a tangled knot of cells after cell division 5
4. Conidia irregularly helicoid, muriform . . . . ***Moromyces***
4. Conidia rosette-like, globose, forming pseudochains . . . . . ***Cumulospora***
5. Cells of the conidia are more or less similar in size and colour 6
5. Cells increasing in diam. and pigmentation from the base to the apex 7
6. Conidia irregularly helicoid, cells of the conidia tightly joined and appearing muriform . . . . . ***Moheitospora***
6. Conidia helicoid when young, soon become a mass of cells . . . . . ***Moleospora***
7. Conidia terminal or lateral . . . . . ***Halazoon***
7. Conidia acrogenous 8
8. Conidia 3–4-septate, black or fuscous . . . . . ***Hydea***
8. Conidia up to 12 septate, immature conidia surrounded by a sheath. . . . . ***Matsusporium***
9. Ascospores with apical chambers or appendages . . . 10
9. Ascospores lacking appendages . . . . . ***Lindra***
10. Ascospores aseptate 11
10. Ascospores septate 15
11. Ascospores filiform 14
11. Ascospores fusiform, ellipsoidal. 12
12. Ascospore appendages tubular, longer than 35 μm . . . . . ***Kohlmeyeriella***
12. Ascospore appendages apiculate or conical, less than 35 μm 13
13. Ascomata superficial, with sterile hairs, parasitic on red algae . . . . . ***Spathulospora***
13. Ascomata immersed in a gall, lacking sterile hairs, on brown algae . . . . . ***Haloguignardia***
14. Ascomata with bell-like structure within the centrum . . . . . ***Rostrupiella***
14. Ascomata lacking a bell-like structure . . . ***Lulworthia***
15. Ascospores 1-septate . . . . . ***Lulwoana***
15. Ascospores multi-septate . . . . . ***Lulwoidea***

Macrohilaceae Crous, in Crous et al., IMA Fungus 6(1): 180 (2015)

Facesoffungi number: FoF 01394

Pathogenic forming leaf spots. **Sexual morph**: Undetermined. **Asexual morph**: *Conidiomata* pycnidial, immersed, becoming erumpent, medium brown, globose. *Conidiophore* reduced to conidiogenous cells. *Conidiogenous cells* lining the inner cavity, pale brown, cylindrical, proliferating percurrently near the apex. *Conidia* solitary, medium to dark brown, ovoid, smooth, guttulate, medially septate, apex obtuse, base truncate with a visible scar.

Type: ***Macrohilum*** H.J. Swart

Notes: The family *Macrohilaceae* was introduced by Crous et al. (2015a) based on a phylogenetic analysis of LSU sequence data and it was accommodated in *Diaporthales*. This family is typified by *Macrohilum*. *Macrohilaceae* differs from other families of *Diaporthales* in having single, dark brown, guttulate, thick-walled, medially septate, oval conidia with obtuse apex and truncate base. Species in this family are commonly associated with leaf spots of *Eucalyptus* species.

Macrohilum H.J. Swart, Trans. Br. mycol. Soc. 90(2): 288 (1988)

Facesoffungi number: FoF 02118; Fig. 85

Pathogenic forming leaf spots. **Sexual morph**: Undetermined. **Asexual morph**: Coelomycetous. *Conidiomata* immersed, becoming erumpent, medium brown, globose, coriaceous. *Conidiophore* reduced to conidiogenous cells. *Conidiogenous cells* lining the inner cavity, pale brown, cylindrical, proliferating percurrently near the apex. *Conidia* solitary, medium to dark brown, ovoid, smooth, guttulate, developing a single supramedian septum, thick-walled, frequently constricted at the septum, apex obtuse, base truncate with a visible scar.

Type species: ***Macrohilum eucalypti*** H.J. Swart, Trans. Br. mycol. Soc. 90(2): 288 (1988)

Notes: The coelomycetous genus *Macrohilum* is typified by *Macrohilum eucalypti*. Swart (1988) provided a detailed description for this genus. The New Zealand isolate (CPC 10945) of *Macrohilum eucalypti* differs from the Australian epitype isolate (CPC 19421) by four base pairs in the ITS region.

Magnaporthaceae P.F. Cannon, Syst. Ascom. 13(1): 26 (1994)

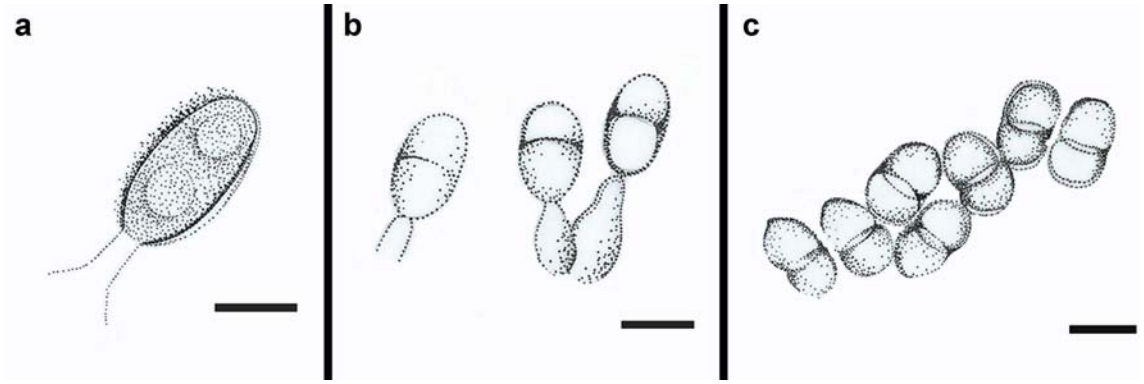


Fig. 85 ***Macrohilum eucalypti*** (CPC 19421, **epitype**) (illustration based on Crous et al. 2015a). **a**, **b** Conidiogenous cells **c** Conidia. Scale bars: **a**–**c** = 10 μm

Facesoffungi number: FoF 01101

Pathogenic on a wide range of monocotyledonous plants or saprobic on plant material, terrestrial some aquatic. **Sexual morph**: *Ascomata* perithecial, solitary or scattered, black, superficial or immersed in plant tissue, globose to subglobose, with long, unilateral, cylindrical, black, periphysate neck. *Peridium* comprising a few to several layers of cells of *textura epidermoidea*. *Hamathecium* comprising hyaline, septate, paraphyses, intermingled among asci. *Asci* 8-spored, unitunicate, subcylindrical, short-pedicellate, with apical ring. *Ascospores* biseriate, hyaline to olivaceous, filiform or fusoid, curved to sigmoid, with or without transverse septate ends, bluntly rounded, lacking sheaths. **Asexual morph**: Hyphomycetous, at times formed from sclerotia. *Conidiophores* unbranched or branched. *Conidiogenous cells* integrated, pigmented, phialidic with collarettes, or denticulate. *Conidia* variable in shape, hyaline to pale brown, straight or curved, with or without septa.

Type: ***Nakataea*** Hara

Notes: The family *Magnaporthaceae* was introduced by Cannon (1994). The placement of taxa of *Magnaporthaceae* has long been problematic due to the lack of convincing morphological characters and inconclusive molecular data (Thongkantha et al. 2009). *Magnaporthaceae* was placed as a family within the class *Sordariomycetes* (Kirk et al. 2001, Lumbsch and Huhndorf 2007a). Thongkantha et al. (2009) established a new order, *Magnaporthales* to accommodate *Magnaporthaceae* based on morphological characters of both sexual and asexual morphs together with phylogenetic analyses of combined SSU and LSU sequence data. According to the phylogenetic analysis by Klaubauf et al. (2014) of combined LSU and RPB1 sequence data, *Magnaporthaceae* is sister to *Pyriculariaceae* and *Ophioceraceae*.

The exact number of genera in this family is still unclear (Thongkantha et al. 2009, Bussaban et al. 2005, Thongkantha et al. 2009, Zhang et al. 2011, 2014). The family was originally described with six genera and 20 species (Cannon 1994). Kirk et al. (2001) accepted nine genera, while Kirk et al. (2008) accepted 13 genera. Luo et al. (2014) recently established the genus *Pseudophialophoda* in the family. Maharachchikumbura et al. (2015) provided an updated outline of the family *Magnaporthaceae* with 20 genera, which included both sexual and asexual morphs. In the same report, they also confirmed that *Magnaporthaceae* belongs to the order *Magnaporthales*, which was introduced based on molecular data and morphology (Maharachchikumbura et al. 2015).

Nakataea Hara, Diseases Rice Plant, Edn 2: 185 (1939)

Facesoffungi number: FoF 01102; Figs 86, 87

Pathogenic or saprobic on plants. **Sexual morph**: *Ascomata* perithecial, globose, dark brown, immersed, with ostiolar neck frequently protruding from the leaf tissue. *Peridium* thick-walled, comprising 5–12 layers, with dark cells. *Asci* 8-spored, unitunicate, thin-walled, subcylindrical, short pedicellate, deliquescent at maturity. *Ascospores* parallel to spirally twisted, hyaline at median cells, turning yellowish brown, fusiform, curved, 3-septate, slightly constricted at septa, granular. **Asexual morph**: *Conidiophores* brown, solitary, erect, smooth, septate, branched, with integrated terminal. *Conidiogenous cells* forming a rachis with several denticles. *Conidia* solitary, 3-septate, falcate to sigmoid, smooth-walled, wider in the middle, end cells hyaline, median cells medium brown.

Type species: ***Nakataea oryzae*** (Catt.) J. Luo & N. Zhang, Mycologia 105: 1025 (2013)

Notes: The genus *Nakataea* was established by Hara (1939) based on *Nakataea oryzae* (Catt.) Luo & Zhang (2013) (synonym *Nakataea sigmoidea* (Cavara) Hara) isolated from *Oryza sativa* in Italy. Krause and Webster (1972) showed that *Nakataea* and *Magnaporthe* are congeneric and their type species, *Nakataea oryzae* (Catt.) J. Luo & N. Zhang and *Magnaporthe salvinii* (Catt.) Krause & Webster (1972) are the same species. Therefore Luo and Zhang (2013), based on Article 59.1 of the The International Code of Nomenclature for algae, fungi, and plants (Melbourne Code; ICN; McNeill

Fig. 86 ***Nakataea oryzae*** (Material examined: INDIA, New Orleans, on *Oryzae sativa* L. (*Poaceae*) (Rice Straw), 4 August 1967, B.E. Devis (621662)) **a**, **b**, **c** Herbarium material **d**, **e** Sclerotium on substrate **f** Sclerotium **g**, **h** Cross section of sclerotium. Scale Bars: **d** = 2 mm, **e** = 1 mm, **f** = 300 μm, **g and h** = 100 μm

et al. 2012), synonymized *Magnaporthe oryzae* under *N. oryzae* because the name *Nakataea* (1939) is older than *Magnaporthe* (1972). This resulted in the introduction of *Nakataea* as the correct name for the type of the family (Murata et al. 2014, Klaubauf et al. 2014, Luo et al. 2015, Maharachchikumbura et al. 2015).

Other genera included

Budhanggurabania P. Wong et al., Persoonia, Mol. Phyl. Evol. Fungi 34: 241 (2015)

Type species: ***Budhanggurabania cynodonticola*** P. Wong et al., Persoonia, Mol. Phyl. Evol. Fungi 34: 241 (2015)

Buergenerula Syd., Annls mycol. 34(4/5): 392 (1936)

Type species: ***Buergenerula biseptata*** (Rostr.) Syd., Annls mycol. 34(4/5): 392 (1936)

Bussabanomyces Klaubauf et al., Stud. Mycol. 79: 99 (2014)

Type species: ***Bussabanomyces longisporus*** (Bussaban) Klaubauf et al., Stud. Mycol. 79: 99 (2014)

Ceratosphaerella Huhndorf et al., Mycologia 100(6): 941 (2008)

Type species: ***Ceratosphaerella castillensis*** (C.L. Sm.) Huhndorf et al., Mycologia 100(6): 944 (2008)

Ceratosphaeria Niessl, Verh. nat. Ver. Brünn 14: 203 (1876)

Type species: ***Ceratosphaeria lampadophora*** (Berk. & Broome) Niessl, Verh. nat. Ver. Brünn 14: 203 (1876)

Clasterosphaeria Sivan., Trans. Br. mycol. Soc. 83(4): 710 (1984)

Type species: ***Clasterosphaeria cyperi*** Sivan., Trans. Br. mycol. Soc. 83(4): 710 (1984)

Clasterosporium Schwein., Trans. Am. phil. Soc., New Series 4(2): 300 (1832) [1834]

Type species: ***Clasterosporium caricinum*** *Schwein*. [as 'Clasterisporium'], Trans. Am. phil. Soc., New Series 4(2): 300 (1832) [1834]

Clavatisporella K.D. Hyde, Mycotaxon 55: 276 (1995)

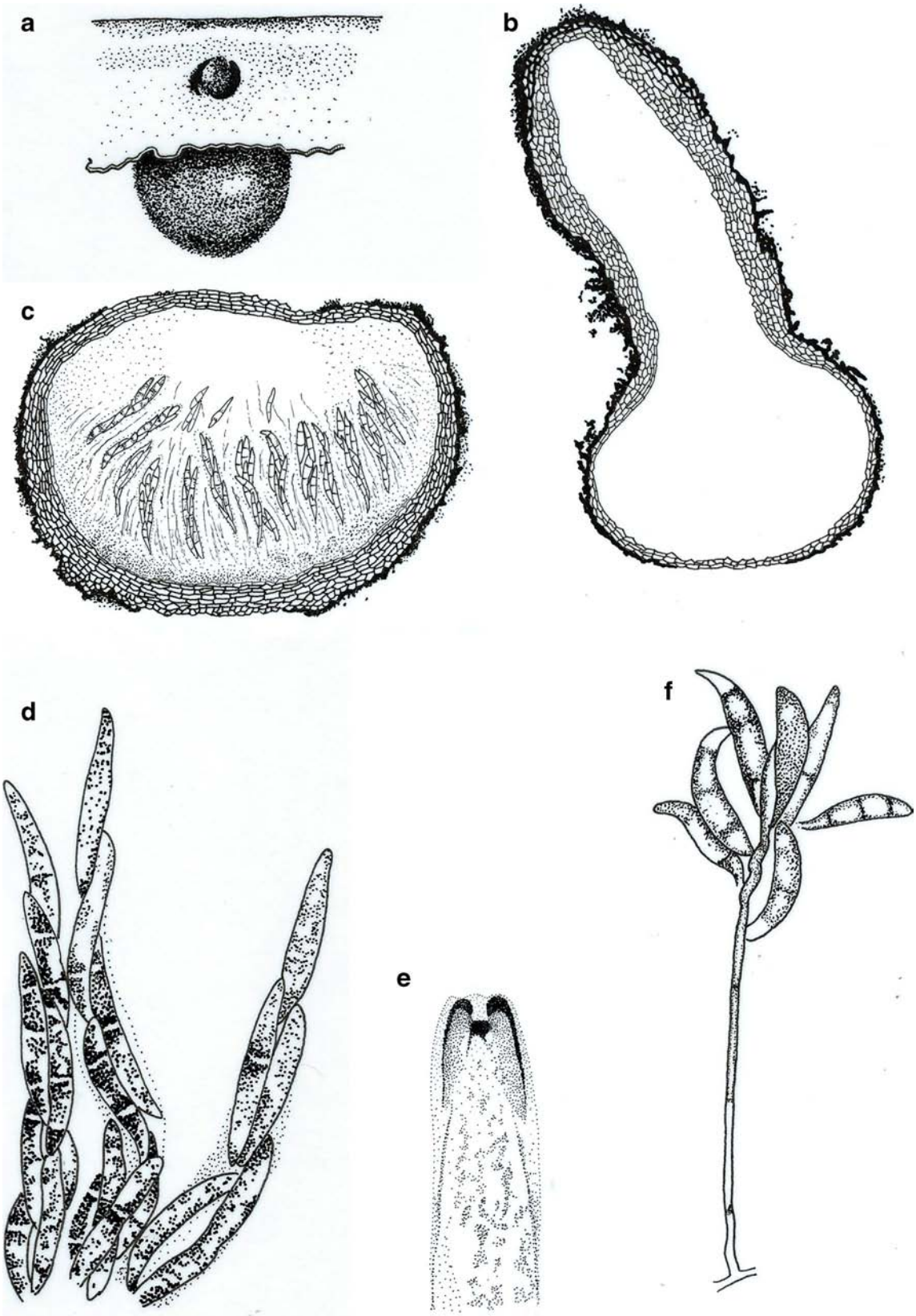


Fig. 87 *Nakataea oryzae* **a** Ascomata **b** Cross section of ascomata **c** Peridium **d** Ascus **e** Apex **f** Conidiophore with conidia of asexual morph (redrawn from Krause and Webster 1972)

Type species: ***Clavatisporella musicola*** K.D. Hyde, Mycotaxon 55: 276 (1995)

Gaeumannomyces Arx & D.L. Olivier, Trans. Br. mycol. Soc. 35(1): 32 (1952)

Type species: ***Gaeumannomyces graminis*** (Sacc.) Arx & D.L. Olivier, Trans. Br. mycol. Soc. 35(1): 32 (1952)

Harpophora W. Gams, Stud. Mycol. 45: 192 (2000)

Type species: ***Harpophora radicicola*** (Cain) W. Gams, Stud. Mycol. 45: 192 (2000)

Herbampulla Scheuer & Nograsek, Mycotaxon 47: 419 (1993)

Type species: ***Herbampulla crassirostris*** Scheuer & Nograsek, Mycotaxon 47: 419 (1993)

Kohlmeyeriopsis Klaubauf et al. Stud. Mycol. 79: 101 (2014)

Type species: ***Kohlmeyeriopsis medullaris*** (Kohlm. et al.) Klaubauf et al., Stud. Mycol. 79: 101 (2014)

Magnaporthiopsis J. Luo & N. Zhang, Mycologia 105(4): 1021 (2013)

Type species: ***Magnaporthiopsis poae*** (Landsch. & N. Jacks.) J. Luo & N. Zhang, Mycologia 105(4): 1024 (2013)

Muraeriata Huhndorf et al., Mycologia 100(6): 948 (2008)

Type species: ***Muraeriata collapsa*** Huhndorf et al., Mycologia 100(6): 949 (2008)

Mycoleptodiscus Ostaz., Mycologia 59(6): 970 (1968) [1967]

Type species: ***Mycoleptodiscus terrestris*** (Gerd.) Ostaz., Mycologia 59(6): 970 (1968) [1967]

Neogaeumannomyces D.Q. Dai & K.D. Hyde, in Liu et al., Fungal Diversity: 10.1007/s13225-015-0324-y, [34] (2015)

Type species: ***Neogaeumannomyces bambusicola*** D.Q. Dai & K.D. Hyde, in Liu et al., Fungal Diversity: 10.1007/s13225-015-0324-y, [35] (2015)

Omnidemptus P.F. Cannon & Alcorn, Mycotaxon 51: 483 (1994)

Type species: ***Omnidemptus affinis*** P.F. Cannon & Alcorn, Mycotaxon 51: 483 (1994)

Phomatospora Sacc., Nuovo G. bot. ital. 7: 306 (1875)

Type species: ***Phomatospora berkeleyi*** Sacc., Nuovo G. bot. ital. 7: 306 (1875)

Pseudophialophora J. Luo & N. Zhang, *Mycologia* 106(3): 581 (2014)

Type species: ***Pseudophialophora eragrostis*** J. Luo & N. Zhang, Mycologia 106(3): 581 (2014)

Pyriculariopsis M.B. Ellis, Dematiaceous Hyphomycetes (Kew): 206 (1971)

Type species: ***Pyriculariopsis parasitica*** (Sacc. & Berl.) M.B. Ellis, Dematiaceous Hyphomycetes (Kew): 207 (1971)

Slopeiomyces Klaubauf et al., Stud. Mycol. 79: 102 (2014)

Type species: ***Slopeiomyces cylindrosporus*** (D. Hornby et al.) Klaubauf et al., Stud. Mycol. 79: 103 (2014)

Key to the sexual genera of *Magnaporthaceae*

1. Ascomata superficial 2
1. Ascomata immersed or semi-immersed 3
2. Peridium with several layers. 4
2. Peridium with two layers . . . . . ***Clasterosphaeria***
3. Peridium more than 4 layers. 5
3. Peridium 2–4 layers 6
4. Asci with an apical ring 7
4. Asci without an apical ring. . . . . ***Slopeiomyces***
5. Asci clavate 8
5. Asci cylindrical 9
6. Asci clavate 10
6. Asci cylindrical 11
7. Ascospores 1–3-septate 12
7. Ascospores more than 3-septate . . . . ***Ceratosphaerella***
8. Ascospores oblong-fusoid, with 2-septa. . . . . ***Buergenerula***
8. Ascospores narrowly fusiform, with 3-septa . . . . . ***Muraeriata***
9. Ascospores without septa. . . . . ***Phomatospora***
9. Ascospores with septa 13
10. Ascospores with mucilaginous pad-like appendage at the end. . . . . ***Clavatisporella***
10. Ascospores without appendages. . ***Magnaporthiopsis***
11. Ascospores filamentous, tapering towards the base . . . . . ***Kohlmeyeriopsis***
11. Ascospores fusiform, curved, partially gelatinized at maturity. . . . . ***Magnaporthe***
12. Asci obovoid to saccate; ascospores multi-seriate. . . . . ***Budhanggurabania***
12. Asci cylindric-clavate; ascospores bi-seriate . . . . . ***Omnidemptus***
13. Ascospores hyaline 14
13. Ascospores median cells turning yellowish brown. 15
14. Ascus apical ring tall, with narrow or short furcate pedicel. 16
14. Ascus apical ring small distinct (2 small refringent dots) . . . . . ***Gaeumannomyces***
15. Ascospores 3-septate, median cells turning yellowish brow . . . . . ***Nakataea***
15. Ascospores 5-septate with pallid at end cells. . . . . ***Herbampulla***
16. Ascospores 5–7-septate . . . . . ***Ceratosphaeria***
16. Ascospores 2–3-septate . . . . . ***Neogaeumannomyces***

Key to the asexual genera of *Magnaporthaceae*

1. Conidiogenous cell forming phialides. 2
1. Conidiogenous cell cylindrical, forming denticles. . . . 3
2. Conidia aseptate. 4

2. Conidia septate 5
3. Conidia with 1-septum . . . . . ***Kohlmeyeriopsis***
3. Conidia multi-septate 6
4. Conidiogenous cell straight 7
4. Conidiogenous cell curved 8
5. Conidia solitary brown to dark brown, without setulae. . . . . ***Clasterosporium***
5. Conidia hyaline, with a simple setula at the apex and often at the base. . . . . ***Mycoleptodiscus***
6. Conidia lacking mucoid cap 9
6. Conidia with persistent mucoid cap . . . ***Pyriculariopsis***
7. Conidia cylindrical, curved 10
7. Conidia subglobose to ovoid . . . . . ***Magnaporthiopsis***
8. Conidiogenous cells without pigments . . . . . ***Budhanggurabania***
8. Conidiogenous cells pigmented . . ***Pseudophialophora***
9. Conidia obclavate, 4(−5)-septate . . . ***Bussabanomyces***
9. Conidia falcate to sigmoid, 3-septate . . . . . ***Nakataea***
10. Conidia phialidic, apex rounded, pointed towards base. . . . . ***Slopeiomyces***
10. Conidia borne on slimy heads, cylindrical . . . . . ***Harpophora***

Melanconidaceae G. Winter [as 'Melanconideae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 764 (1886)

Facesoffungi number: FoF 01395

Saprobic or *pathogenic* on plants and wood, in terrestrial aquatic habitats. **Sexual morph**: *Pseudostromata* well-developed, obvious, erumpent. *Ectostromatic disc* surrounded by bark or not, yellowish-white, ostiolar canal opening around the disc. *Ascomata* perithecial, arranged as circles around the ectostromatic disc, oblique or horizontal, globose to subglobose, coriaceous, black, with long, periphysate, lateral ostiolar canals. *Peridium* comprising outer, thick-walled, brown cells of *textura globosa* to *textura angularis* and inner, thick-walled, flat, hyaline cells of *textura angularis*. *Hamathecium* comprising wide, hyphae-like paraphyses, deliquescent at maturity. *Asci* 8-spored, unitunicate, oblong to fusiform, short pedicellate, with distinct, J- apical ring. *Ascospores* overlapping uniseriate to biseriate, hyaline, ellipsoid, 1-septate. **Asexual morph**: Coelomycetous. Melanconium-like. *Conidiomata* acervular, scattered, solitary, superficial, black, coriaceous. *Conidiophores* branched at the base, septate, *Conidiogenous cells* annellidic, cylindrical. *Conidia* hyaline to brown, ellipsoid or subglobose, smooth-walled, thick-walled.

Type: ***Melanconis*** Tul. & C. Tul.

Notes: The family *Melanconidaceae* was introduced by Winter (1886) to accommodate species having yellowish-white ectostromatic discs surrounding ascomata in a circle. Members of this family are plant pathogens causing disease of economic plant species, as well as saprobes. Castlebury et al. (2002) and Rossman et al. (2007) showed this family comprises a single genus *Melanconis* and its asexual morph *Melanconium* based on their morphology and phylogeny. Voglmayr and Jaklitsch (2014) opined that a clear delineation of *Melanconium* was not possible as similar asexual morphs occur in both *Melanconis* and *Melanconiella*. Maharachchikumbura et al. (2015) listed 26 genera under this family.

Melanconis Tul. & C. Tul., Selecta fungcarpol (Paris) 2:115 (1863).

Facesoffungi number: FoF 02119; Figs 88, 89

Saprobic or *pathogenic* on plants. **Sexual morph**: *Pseudostromata* well-developed, obvious, erumpent. *Ectostromatic disc* surrounded by bark or not, yellowish-white, causing a coarse bark surface, inverted conical, ostioles open margin and middle of the disc. *Ascomata* perithecial, oblique or horizontal, globose to subglobose, coriaceous, black, with long periphysate, lateral ostiolar canals. *Hamathecium* comprising wide, hyphae-like, hyaline, septate paraphyses, deliquescent at maturity. *Peridium* comprising outer, thick-walled, brown cells of *textura globosa* to *textura angularis* and inner, thick-walled, flat, hyaline cells of *textura angularis*. *Asci* 8-spored, unitunicate, oblong to fusiform, short pedicellate, with distinct, J- apical ring. *Ascospores* overlapping uniseriate to biseriate, hyaline, ellipsoid, 1-septate, not or slightly constricted at the septum, smooth-walled, with or without blunt or pointed appendages. **Asexual morph**: Coelomycetous. Melanconium-like. *Conidiomata* acervular, scattered, solitary, superficial, black, coriaceous. *Conidiophores* hyaline, branched at the base, septate, few-celled, smooth walled. *Conidiogenous cells* hyaline, annellidic, cylindrical. *Conidia* hyaline to brown, ellipsoid or subglobose smooth-walled, thick-walled, outer layer produced continuously, with the inner layer of the conidiogenous cell.

Type species: ***Melanconis stilbostoma*** (Fr.) Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 115 (1863)

Notes: The genus *Melanconis* is typified by *M. stilbostoma* and currently it comprises three species, including *M. alni* Tul. & C. Tul. and *M. marginalis* (Peck) Wehm. (Castlebury et al. 2002). The asexual morph of *Melanconis* is placed in the genus *Melanconium* and both of these genera have been linked. Species in both *Melanconis* and *Melanconium* form diseases on plants such as cankers and shoot blight.

Other genera included

Botanamphora Nograsek & Scheuer, in Nograsek, Biblthca Mycol. 133: 50 (1990)

Type species: ***Botanamphora pachycarpa*** (Sacc. & Marchal) Nograsek & Scheuer, in Nograsek, Biblthca Mycol. 133: 51 (1990)

Ceratoporthe Petr., Annls mycol. 23(1/2): 14 (1925)

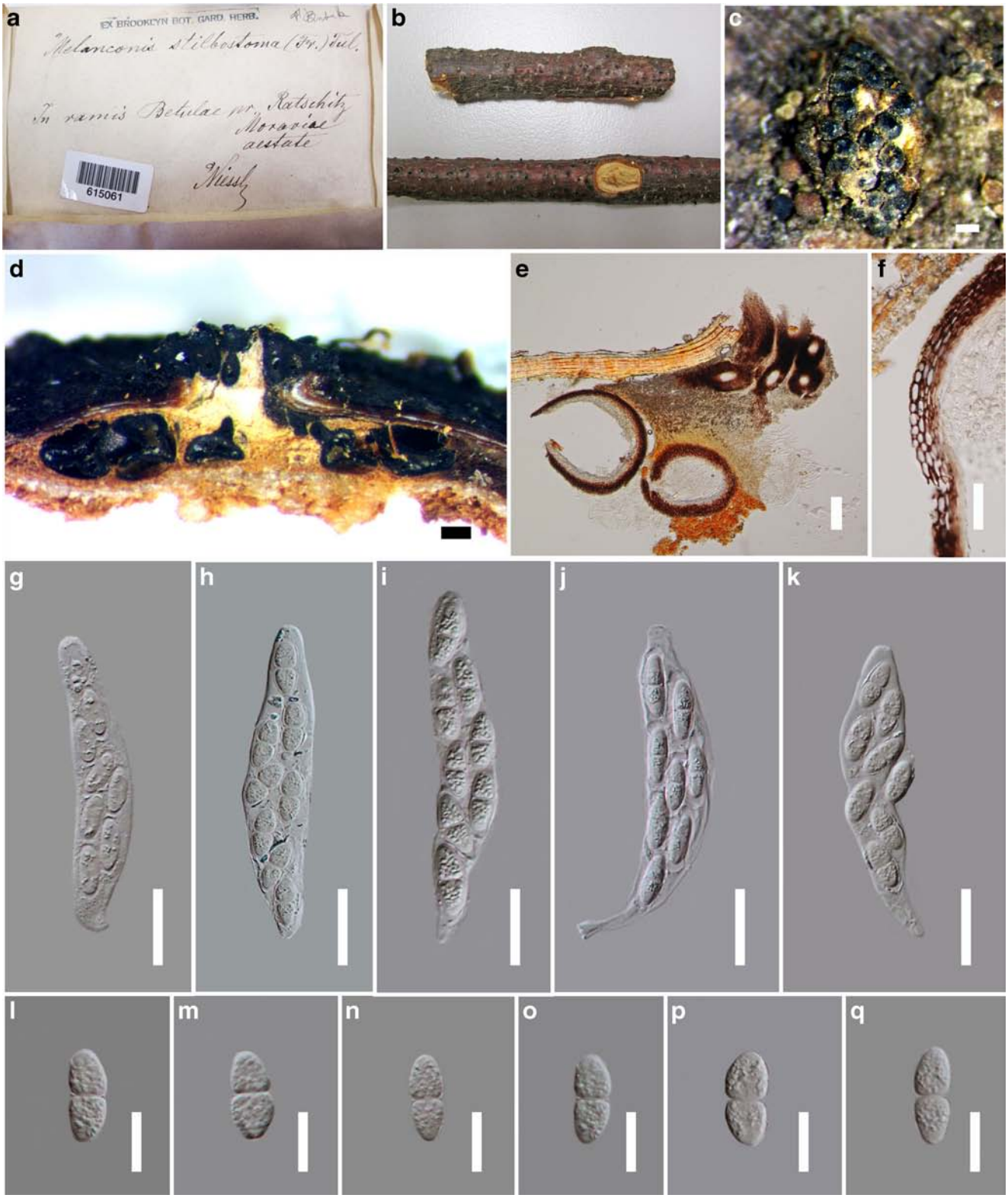


Fig. 88 ***Melanconis stilbostoma*** (Material examined: CZECHOSLOVAKIA, Moravia, Ratschitz, on branches of *Betula* sp., Niessl, BPI 615061) **a** Herbarium packet **b** Herbarium specimen **c** Stromata on substrate **d**, **e** Cross section of stroma **f** Peridium **g-k** Asci **l-q** Ascospores. Scale bars: **c**, **d** = 200 μm, **e** = 100 μm, **f–k** = 20 μm, **l–q** = 10 μm

Type species: ***Ceratoporthe didymospora*** Petr., Annls mycol. 23(1/2): 14 (1925)

Cytomelanconis Naumov, Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 7: 108 (1951)

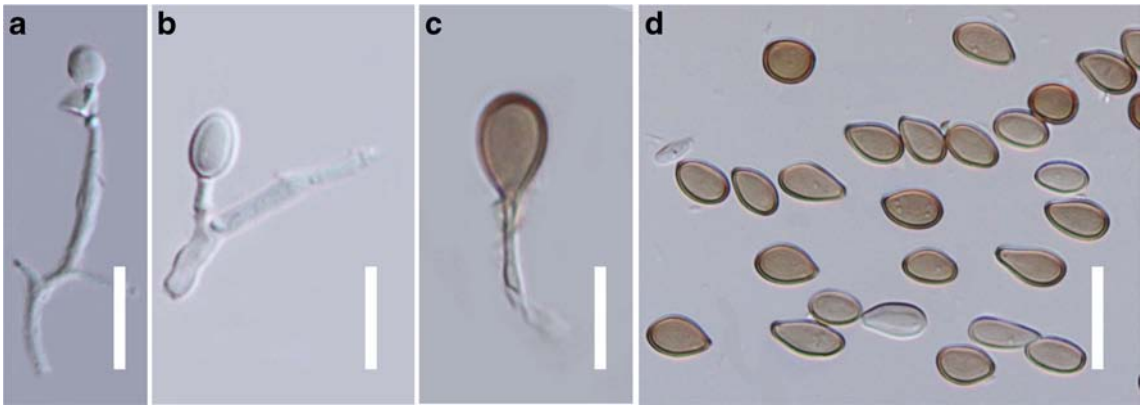


Fig. 89 **Asexual morph of *Melanconis stilbostoma*** (Material examined: RUSSIA, Sakhalin Island, Valley of the river Evay, on stems of Betula sp., 27 August 2000, A. Bogachova, BPI 748234, living cultures AR 3548 = CBS 109493) **a-d** Conidia and to the conidiogenous cells. Scale bars: **a–d** = 10 μm

Type species: ***Cytomelanconis systema-solare*** Naumov, Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 7: 109 (1951)

Dicarpella Syd. & P. Syd., Annls mycol. 18(4/6): 181 (1921) [1920]

Type species: ***Dicarpella bina*** (Harkn.) Syd. & P. Syd., Annls mycol. 18(4/6): 181 (1921) [1920]

Dictyoporthe Petr., Sydowia 9(1–6): 556 (1955)

Type species: ***Dictyoporthe ahmadii*** Petr., Sydowia 9(1–6): 556 (1955)

Fremineavia Nieuwl., Am. Midl. Nat. 4: 501 (1916)

Type species: ***Fremineavia berkeleyi*** (Berl.) Nieuwl., Am. Midl. Nat. 4: 501 (1916)

Gibellia Sacc., Atti Inst. Veneto Sci. lett., ed Arti, Sér. 6 3: 714 (1885)

Type species: ***Gibellia dothideoides*** Sacc. & Berl., Revue mycol., Toulouse 7: 94 (1885)

Hypophloeda K.D. Hyde & E.B.G. Jones, Trans. mycol. Soc. Japan 30(1): 61 (1989)

Type species: ***Hypophloeda rhizospora*** K.D. Hyde & E.B.G. Jones, Trans. mycol. Soc. Japan 30(1): 62 (1989)

Kensinjia J. Reid & C. Booth, Can. J. Bot. 67(3): 896 (1989)

Type species: ***Kensinjia umbrina*** (Jenkins) J. Reid & C. Booth, Can. J. Bot. 67(3): 896 (1989)

Macrodiaporthe Petr., Annls mycol. 17(2/6): 94 (1920) [1919]

Type species: ***Macrodiaporthe occulta*** (Fuckel) Petr., Annls mycol. 17(2/6): 94 (1920) [1919]

Massariovalsa Sacc., Michelia 2(no. 8): 569 (1882)

Type species: ***Massariovalsa sudans*** (Berk. & M.A. Curtis) Sacc., Syll. fung. (Abellini) 2: LV (1883)

Mebarria J. Reid & C. Booth, Can. J. Bot. 67(3): 898 (1989)

Type species: ***Mebarria thujina*** (Nag Raj & DiCosmo) J. Reid & C. Booth, Can. J. Bot. 67(3): 898 (1989)

Melanamphora Lafl., Sydowia 28(1–6): 243 (1976) [1975–1976]

Type species: ***Melanamphora spinifera*** (Wallr.) Lafl., Sydowia 28(1–6): 245 (1976) [1975–1976]

Melanconiella Sacc., Syll. fung. (Abellini) 1: 740 (1882)

Type species: ***Melanconiella spodiaea*** (Tul. & C. Tul.) Sacc., Syll. fung. (Abellini) 1: 740 (1882)

Melanconiopsis Ellis & Everh., Bull. Torrey bot. Club 27: 575 (1900)

Type species: ***Melanconiopsis inquinans*** Ellis & Everh., Bull. Torrey bot. Club 27: 575 (1900)

Phragmodiaporthe Wehm., Mycologia 33(1): 54 (1941)

Type species: ***Phragmodiaporthe caryae*** (Peck) Wehm., Mycologia 33(1): 55 (1941)

Plagiophiale Petr., Sydowia 9(1–6): 585 (1955)

Type species: ***Plagiophiale eucarpa*** (P. Karst.) Petr., Sydowia 9(1–6): 586 (1955)

Plagiostigme Syd., Annls mycol. 23(3/6): 341 (1925)

Type species: ***Plagiostigme couraliae*** Syd., Annls mycol. 23(3/6): 342 (1925)

Prostratus Sivan.et al., Mycol. Res. 97(10): 1179 (1993)

Type species: ***Prostratus cyclobalanopsidis*** Sivan.et al., Mycol. Res. 97(10): 1179 (1993)

Pseudovalsella Höhn., Annls mycol. 16(1/2): 123 (1918)

Type species: ***Pseudovalsella thelebola*** (Fr.) Höhn., Annls mycol. 16(1/2): 123 (1918)

Wehmeyera J. Reid & C. Booth, Can. J. Bot. 67(3): 895 (1989)

Type species: ***Wehmeyera acerina*** (Wehm.) J. Reid & C. Booth, Can. J. Bot. 67(3): 895 (1989)

Wuestneia Auersw. Ex Fuckel, Hedwigia 3: 159 (1864)

Type species: ***Wuestneia aurea*** (Fuckel) Auersw., in Fuckel, Hedwigia 3: 159 (1864)

Wuestneiopsis J. Reid & Dowsett, Can. J. Bot. 68(11): 2406 (1990)

Type species: ***Wuestneiopsis georgiana*** (J.H. Mill. & G.E. Thomps.) J. Reid & Dowsett, Can. J. Bot. 68(11): 2406 (1990)

Key to genera of *Melanconidaceae*

1. Stromata well-developed 5
1. Stromata absent or reduced 2
2. Ascospores aseptate . . . . . ***Dicarpella***
2. Ascospores 3–5-septate 3
3. Ascospores fusiform; brown with pale ends. . . . . ***Botanamphora***
3. Ascospores broadly oblong to clavate or cylindrical; hyaline 4
4. Associated with submerged marine wood; perithecia with long necks and cylindrical ascospores . . . . . ***Hypophloeda***
4. Associated with plant leaves, perithecia without necks and with broadly oblong to clavate ascospores . . . . . ***Plagiostigme***
5. Asexual morph common in nature 6
5. Asexual morph not common in nature; sexual morph common 8
6. Stromatic tissues prosenchymatous. 7
6. Stromatic tissues pseudoparenchymatous ***Melanconium***
7. Conidia hyaline subfusoid . . . . . ***Kensinjia***
7. Conidia dark brown, obovoid to subglobose . . . . . ***Melanconiopsis***
8. Stromatic tissues pseudoparenchymatous 9
8. Stromatic tissues prosenchymatous. 12
9. Appendages present; elongate strap-like. . . . . ***Macrodiaporthe***
9. Appendages absent 10
10. Asci 1-celled; ascospores dark brown, cylindrical to fusoid, 5–11-septate. . . . . ***Fremineavia***
10. Asci 8-spored; ascospores hyaline, spindle-shaped to ellipsoid, 0–1-septate 11
11. Ascospores spindle-shaped, 1-septate . . ***Ceratoporthe***
11. Ascospores broadly ellipsoid, aseptate . . . . . ***Gibellia***
12. Asci 2-spored. . . . . ***Cytomelanconis***
12. Asci 4–8-spored. 13
13. Sheath present 14
13. Sheath absent. 15
14. Ascospores brown . . . . . ***Massariovalsa***
14. Ascospores hyaline to yellow. . . . . ***Plagiophiale***
15. Ectostromatic disc present 16
15. Ectostromatic disc absent 20
16. Appendages present 17
16. Appendages lacking 18
17. Ascospores multi-septate . . . . . ***Dictyoporthe***
17. Ascospores 1-septate . . . . . ***Melanconis***
18. Stromatic tissues prosenchymatous hyphae . . . . . ***Phragmodiaporthe***
18. Stromatic tissues pseudoparenchymatous hyphae . . 19
19. Ectostromatic disc yellowish orange to pale brown. . . . . ***Wuestneiopsis***
19. Ectostromatic disc black. . . . . ***Wehmeyera***
20. Ascospores hyaline at maturity. . . . . ***Wuestneia***
20. Ascospores yellowish brown to dark brown at maturity 21
21. Ascospores with hyaline basal or apical end cell/cells22
21. Ascospores without hyaline basal or apical end cell/cells 23
22. Beak lateral; ascospores oval to globose. . . ***Prostratus***
22. Beak erect; ascospores allantoid to lunate . . . . . ***Melanamphora***
23. Appendages present . . . . . ***Pseudovalsella***
23. Appendages absent. 24
24. Ascospores hyaline, yellowish or brown, fusoid or ellipsoid. . . . . ***Melanconiella***
24. Ascospores dark brown, globose to broadly ellipsoid . . . . . ***Mebarria***

Meliolaceae G.W. Martin ex Hansf., Mycol. Pap. 15: 23 (1946)

Facesoffungi number: FoF 00741

Epiphytes, or *pathogens* on leaves, occasionally on stems, branches, bark, or fruits. *Superficial hyphae* branched, septate, brown to dark brown, hyphal setae present or absent. *Hyphopodia* capitate on hyphae, variously shaped, alternate or opposite, 2-celled, brown. *Hyphal setae* when present, developing from hyphae, septate, branched or unbranched at apex, or with bulbous apices or apical part, brown to dark brown. **Sexual morph**: *Ascomata* superficial on surface of web-like colonies on host, globose to subglobose, or flattened. *Peridium* comprising brown cells of *textura angularis* when viewed in squash mounts, with two strata, outer stratum of brown to dark brown cells, raised conoid cells, appendages or setae, inner stratum of hyaline to pale brown cells. *Hamathecium* comprising evanescent paraphyses. *Asci* 2–4-spored, unitunicate, subglobose to broadly clavate. *Ascospores* 2–3-seriate, hyaline to brown, ellipsoid or cylindrical to ovoid, 3–4-septate. **Asexual morph**: *Phialides* ampulliform or flask-shaped, alternate or opposite on hyphae. *Conidiogenous* cells formed directly from vegetative hyphae. *Conidia* unicellular, small and hyaline (Cannon and Kirk 2007; Hongsanan et al. 2015).

Type: ***Meliola*** Fr., Syst. orb. veg. (Lundae) 1: 111 (1825); Fig. 90

Type species: ***Meliola nidulans*** (Schwein.) Cooke, Grevillea 11(no. 57): 37 (1882)

Notes: The family *Meliolaceae* was revised by Hongsanan et al. (2015) and is not discussed further here. The genus *Meliola* was introduced by Fries (1825), and is the largest genus in the family *Meliolaceae*, which comprises over 1200 species (Kirk et al. 2008). Most species have been introduced primarily on the basis of host association, and followed by morphology of branching or habit of hyphae, shape and size of hyphopodia, size and shape of phialides as well as distribution, or size and shape of ascospores (Mibey and

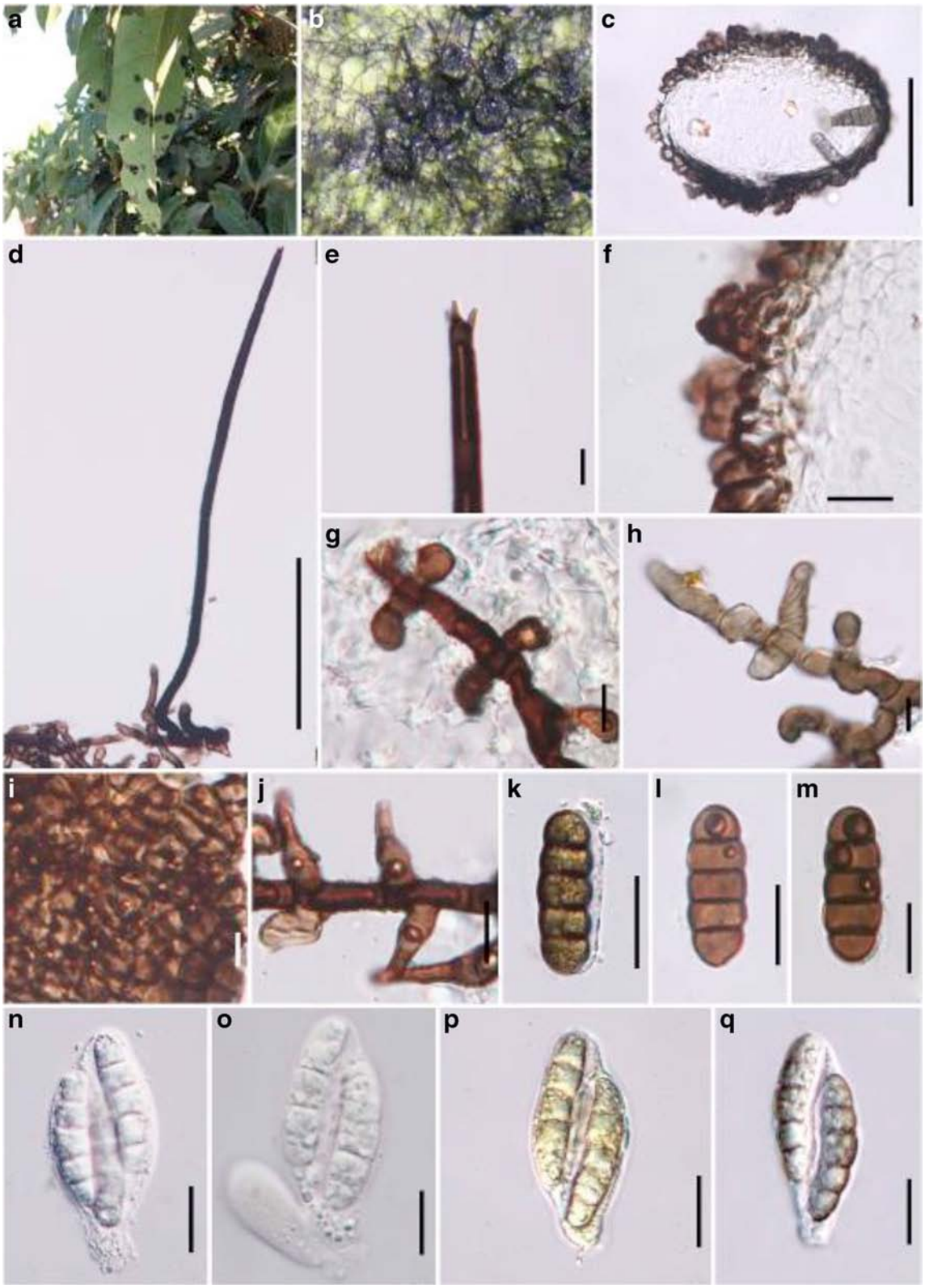


Fig. 90 ***Meliola thailandicum*** (Material examined: Thailand, Chiang Rai, Mueang, Rai Chun Tawan Meditation Centre, on living leaves of *Dimocarpus longan* Lour. (*Sapindaceae*), 3 January 2015, S. Hongsanan, MFLU 15-0044, **holotype**) **a** Leaf specimens **b** Ascomata on host substrate **c** Section through ascoma **d** Hyphal setae **e** Hyphal setae with forked apices **f** Peridium **g** Hyphae with capitate hyphopodia **h** Terminal hyphae **i** Upper wall of ascoma **j** Phialides **k** Immature ascospore when in Melzer's reagent **l**, **m** Mature ascospores **n**, **o**, **q** Immature asci **p** Immature ascus in Melzer's reagent. Scale bars: **c**, **d** = 100 μm, **e**, **f** = 20 μm, **g**–**j** = 10 μm, **k**–**q** = 20 μm

Hawksworth 1997; Justavino et al. 2015). Molecular data are needed to determine if species really are host-specific (Hongsanan et al. 2015).

Other genera included

Amazonia Theiss., Annls mycol. 11(6): 499 (1913)

Type species: ***Amazonia psychotriae*** (Henn.) Theiss., Annls mycol. 11(6): 499 (1913)

Appendiculella Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 556 (1919)

Type species: ***Appendiculella calostroma*** (Desm.) Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 556 (1919)

Asteridiella McAlpine, Proc. Linn. Soc. N.S.W. 22(1): 38 (1897)

Type species: ***Asteridiella solani*** McAlpine, Proc. Linn. Soc. N.S.W. 22(1): 38 (1897)

Cryptomeliola S. Hughes & Piroz., Mycol. Pap. 174: 14 (1997)

Type species: ***Cryptomeliola orbicularis*** (Berk. & M.A. Curtis) S. Hughes & Piroz., in Mibey & Hawksworth, Mycol. Pap. 174: 15 (1997)

Endomeliola S. Hughes & Piroz., N.Z. Jl Bot. 32(1): 53 (1994)

Type species: ***Endomeliola dingleyae*** S. Hughes & Piroz., N.Z. Jl Bot. 32(1): 54 (1994)

Irenopsis F. Stevens, Annls mycol. 25(5/6): 411 (1927)

Type species: ***Irenopsis tortuosa*** (G. Winter) F. Stevens, Annls mycol. 25(5/6): 439 (1927)

Key to genera of *Meliolaceae*

1. Hyphae with intercellular hyphopodia. . . . . ***Endomeliola***
1. Hyphae with superficial hyphopodia 2
2. Ascomata flattened. . . . . ***Amazonia***
2. Ascomata globose to subglobose 3
3. Hyphae with setae 4
3. Hyphae without setae. 5
4. Hyphal setae with bulbous tips, apical part curved, covering ascomata . . . . . ***Cryptomeliola***
4. Hyphal setae straight or sometimes slightly curved . . . . . ***Meliola***
5. Ascomata with appendages or setae 6
5. Ascomata without appendages and setae, raised conical cells on the ascoma wall. . . . . ***Asteridiella***
6. Ascomata with larviform to cylindrical appendages . . . . . ***Appendiculella***
6. Ascomata with long setae, mostly curved at the apex . . . . . ***Irenopsis***

Melogrammataceae G. Winter [as 'Melogrameae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 797 (1886)

Facesoffungi number: FoF 00840

Saprobic on bark of woody plants. **Sexual morph**: *Stromata* superficial, erumpent, pulvinate or discoid, reddish-brown, subglobose, soft-textured, with pseudoparenchymatous cells, with black ostiole. *Ascomata* perithecial, dark brown to black, immersed, globose, ostiole periphysate. *Peridium* comprising rows of cells, externally brown, internally hyaline. *Hamathecium* of septate, paraphyses. *Asci* 8-spored, unitunicate, clavate, or fusoid, short pedicellate, with a shallow, J-, apical ring. *Ascospores* 0-3-seriate, hyaline or brown, filiform, aseptate or 1–3 septate, cylindrical or falcate. **Asexual morph**: Coelomycetous. *Mycelium* hyphae to yellow-brown, septate, branched. *Conidiophores* long, cylindrical, stiffly upright, septate, verticillate and whorled or not. *Conidiogenous cells* holoblastic, proliferating sympodially, hyaline, thin-walled. *Conidia* elongate falcate or filiform.

Type: ***Melogramma*** Fr.

Notes: The family *Melogrammataceae* is characterized by parasitic species possessing oblong to cylindrical asci, a reduced apical annulus at the ascal apex and narrow paraphyses (Schatz 1983). *Melogramma* was introduced by Fries (1849), and represented in Nitschke ex Fuckel (1870) as "*Melogrammaeae*" (Fuckel 1870; Laflamme 1976). Winter (1886) placed "*Melogrammaeae*" in *Sphaeriales* and included the genera *Botryosphaeria*, *Endiothia*, *Melogramma* and *Valsaria*. *Melogramma* was placed in *Diaporthaceae*, also in the order *Sphaeriales* from 1957 to 1976 (Laflamme 1976). Munk (1957), Laflamme (1976) revised the family *Melogrammataceae*. Barr (1990) transferred *Melogrammataceae* to *Xylariales*, and accepted only *Melogramma*, with *Melogramma campylosporum* as its type species. She redescribed the family and its asexual morph (Barr 1990). Kirk et al. (2008) listed *Melogrammataceae* in *Diaporthales*. The family *Melogrammataceae* was not listed by Lumbsch and Huhndorf (2010), and the type of *Melogramma* was classified in the family *Melanconidaceae* under *Diaporthales*. Jaklitsch and Voglmayr (2012) used sequence data to show that *Melogrammataceae* nested in *Xylariales* in a distinct genus and was used to accommodate *Melogramma*. Maharachchikumbura et al. (2015) confirmed the placement of *Melogramma* in *Melogrammataceae* in *Xylariales*, while Senanayake et al. (2015) showed its placement in *Xylariaceae*.

Melogramma Fr., Summa veg. Scand., Section Post. (Stockholm): 386 (1849)

Facesoffungi number: FoF 01320 Figs 91, 92

Saprobic on woody plants. **Sexual morph**: *Stromata* reddish-brown, solitary, scattered or aggregated in lines, immersed when young, erumpent from bark and becoming superficial when mature, pulvinate or discoid, soft textured, with

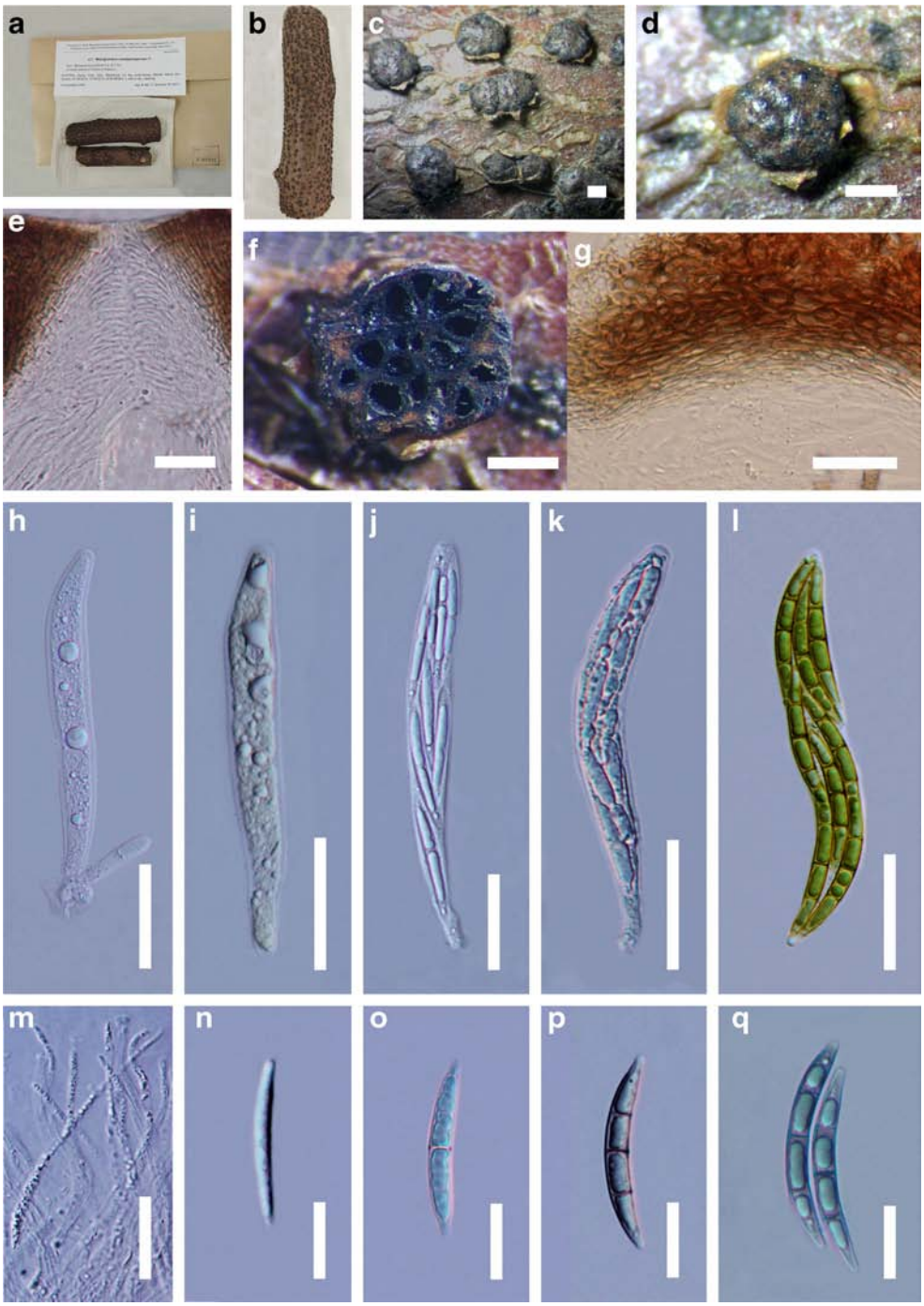


Fig. 91 ***Melogramma campylosporum*** (Material examined: AUSTRIA, Styria, Graz, distr. Mariatrost, on the north-facing hillside below the church, 47°06′29″N, 15°29′32″E, MTB 8858/4, c. 440 m alt.; clearing, on dead shoots of *Carpinus betulus* L. (*Betulaceae*), 5 November 2006, leg. and det. C. Scheuer (#5321), S F123341) **a** Herbarium material **b** Substrate **c** Stromata **d** Ostioles as black spots on stroma **e** Periphyses **f** Ascomata formed in a stroma **g** Peridium **h-l** Asci **m** Paraphyses **n-q** Ascospores. Scale bars: **c**, **d**, = 500 μm, **f** = 200 μm, **e**, **h**–**l** = 30 μm, **g**, **m**–**q** = 15 μm

pseudoparenchymatous cells, apex papillate with black ostiole. *Ascomata* perithecial, dark brown to black, sometimes confluent, immersed, globose, ostiolate. *Ostiole* periphysate. *Peridium* comprising of two layers, outer layer dark brown to black, composed of *textura angularis* to *prismatica*, inner layer hyaline, with thin-walled cells. *Hamathecium* of narrow, septate, hyphae-like paraphyses. *Asci* 8-spored, unitunicate, straight, clavate, fusoid, sigmoid, short pedicellate, with a shallow, J-, apical ring. *Ascospores* overlapping 2-seriate to fasciculate, brown, young ascospores 0–1-septate, hyaline, straight, mature ascospores 3-septate, falcate, often strongly curved, ends subacute, guttulate, smooth-walled. **Asexual morph**: Coelomycetous. *Conidiomata* formed as pycnidia. *Mycelium* composed of hyphae hyaline to yellow-brown, septate, branched. *Conidiophores* long, cylindrical, stiff, upright, septate, verticillate and whorled at the tip or not. *Conidiogenous cells* holoblastic, polyblastic, hyaline, elongate, thin-walled, and proliferating sympodially. *Conidia* acrogenous, elongate, falcate or filiform, tapering slightly to rounded ends,

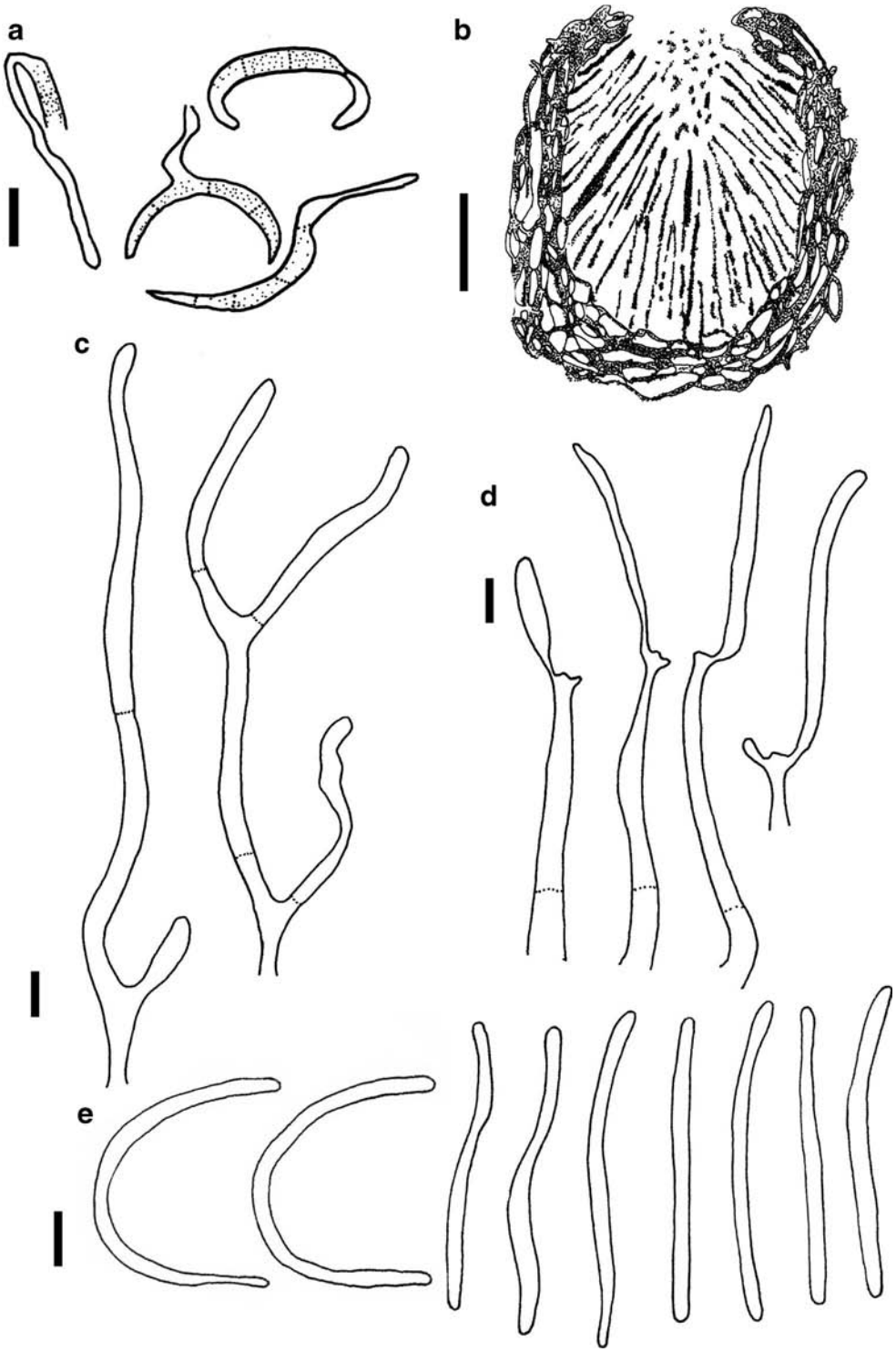


Fig. 92 ***Melogramma campylosporum*** (redrawn from Laflamme 1976) **a**. Germinated ascospore **b** Pycnidia **c** Young hyphae at the edge of culture **d** Conidiophores with conidia **e** Conidia. Scale bars: **a** = 15 μm, **b** = 30 μm, **c**–**e** = 3 μm

hyaline, simple, smooth (Laflamme 1976; Barr 1990; Sutton 1980; Fungi of Great Britain and Ireland).

Type species: ***Melogramma campylosporum*** Fr., Summa veg. Scand., Section Post. (Stockholm): 386 (1849)

Notes: The genus *Melogramma* was established by Fries (1849) with *Melogramma campylosporum* as its type species. Laflamme (1976) provided descriptions of two species *Melogramma campylosporum* and *M. caucasicum* and the asexual morphs. Breitenbach and Kränzlin (1984) provided illustrations for *Melogramma*. Jaklitsch and Voglmayr (2012) further illustrated and provided descriptions after checking the herbarium of type species. Kirk et al. (2008) estimated there were three *Melogramma* species, however, other papers (Fries 1849; Lumbsch and Huhndorf 2010;

Maharachchikumbura et al. 2015) have rarely mentioned the genus.

Microascaceae Luttr. ex Malloch, Mycologia 62(4): 734 (1970)

Facesoffungi number: FoF 01798

Saprobic on soil, decaying plant material and animal dung or opportunistic *pathogens* of insects and animals, including humans, in terrestrial and aquatic habitats. **Sexual morph**: *Ascomata* perithecial or cleistothecial, immersed or superficial, scattered or aggregated, black, globose to ampulliform, glabrous or covered with scattered hairs, ostiolate. *Ostiole* usually with a neck of variable length and shape, sometimes with a tuft of ostiolar hairs. *Peridium* dark brown or black, composed of thick-walled, slightly flattened cells of *textura angularis* or *textura intricata*. *Hamathecium* lacking interascal tissues. *Asci* 8-spored, very thin-walled, unitunicate, obovate, barrel-shaped or nearly globose, formed in basipetal rows, evanescent. *Ascospores* reddish brown to copper coloured, 1-celled, asymmetrical, reniform, heart-shaped, triangular or quadrangular, dextrinoid when young, smooth-walled, with germ slits. As**exual morph**: *Conidiophores* simple, macronematous, mononematous or sporodochial to synnematous, with or without rhizoids. *Conidiogenous cells* annellidic, borne singly and laterally on the vegetative hyphae, or in groups of 2–5 on short simple or little branched conidiophores, ampulliform or lageniform, subhyaline or darkening with age, smooth- or rough-walled with a distinct cylindrical annellated zone. *Conidia* 1-celled, pale yellowish to dark brown, globose to subglobose, obovate or clavate, with a truncate base and rounded or pointed at the apex, smooth- and thin-walled or finely roughened and thick-walled, produced singly or in basipetal dry chains. Solitary conidia present in some species, borne sessile or on short stalks from the vegetative hyphae.

Type: ***Microascus*** Zukal

Notes: The family *Microascaceae* and order *Microascales* were proposed by Luttrell (1951) and validly published with Latin descriptions by Malloch (1970) and Benny and Kimbrough (1980). Luttrell (1951) described the family *Microascaceae* for taxa with ascomata with necks and evanescent, apedicellate asci, disposed irregularly throughout the filamentous centrum. The description by Luttrell (1951) was confirmed by Corlett (1963, 1966) who showed that asci of *Microascus* and *Petriella* develop directly from the cells of the ascogenous hyphae, and not from croziers. Benny and Kimbrough (1980) suggested that members of the family *Microascaceae* had evolved away from a hymenial configuration; in the microascaceous centrum, a peripheral layer of paraphysoid elements that grows inward towards the ascogenous hyphae. Malloch (1970) reviewed the family *Microascaceae* and included both ostiolate and non-ostiolate taxa; ascomata are darkly pigmented, usually hairy, rarely glabrous; asci arise singly or in chains, without croziers, evanescent, and irregularly disposed throughout the centrum and ascospores are reddish brown to copper coloured with germ slits, dextrinoid when young, and smooth-walled, extruded through the ostiole into a gelatinous drop or a long cirrhus. The asexual morphs of this family are annellidic, such as, *Cephalotrichum* and *Scopulariopsis*. Some produce aleurioconidia as in *Petriella*, and also arthroconidia as in *Kernia* (Malloch 1970, 1971). The *Microascaceae* forms a sister clade to the *Halosphaeriaceae* with moderate support in phylogenies based on SSU sequence data (Réblová et al. 2011). However, few taxa in the family have been sequenced and further collections, isolation and sequencing is warranted to resolve its relationship with the *Halosphaeriaceae* within the order *Microascales*. Maharachchikumbura et al. (2015) confirmed the placement of *Microascus* and *Petriella* within the family *Microascaceae* in the order *Microascales*, *Hypocreomycetidae*, with support from molecular data.

Microascus Zukal, Verh. zool.-bot. Ges. Wien 35: 342 (1886)

Facesoffungi number: FoF 02120; Fig. 93

Saprobic on soil, decaying plant material and animal dung or opportunistic pathogens of insects and animals, including humans. **Sexual morph**: *Ascomata* superficial or immersed, subglobose to globose, solitary to gregarious, dark brown to black, carbonaceous, hairy or glabrous, ostiolate. *Ostioles* papillate to long necked. *Peridium* composed of several cell layers of hyaline, pseudoparenchymatous cells. *Asci* 8-spored, ovoid to subglobose sometimes clavate, sessile or short pedicellate, disposed at all levels within the centrum, evanescent. *Ascospores* seriate, pale red-brown to dark red-brown in mass, ellipsoidal, or mostly asymmetrical, sometimes triangular or tetra-angular, with two germ pores, dextrinoid when immature, smooth-walled. **Asexual morph**: *Conidiophores* often elongate, sometimes synnematous, dark and usually smooth-walled. *Conidiogenous cells* annellidic, borne singly and laterally on the vegetative hyphae, or in groups of 2–5 on short simple or rarely branched conidiophores, ampulliform or lageniform, subhyaline or darkening with age, smooth- or rough-walled with a distinct cylindrical, annellate zone. *Conidia* 1-celled, pale yellowish to dark brown, globose to subglobose, obovate or clavate, with a truncate base and rounded or pointed at the apex, smooth, thin-walled or finely roughened, thick-walled, produced singly or in basipetal dry chains. Solitary conidia present in some species, borne sessile or on short stalks from the vegetative hyphae.

Type species: ***Microascus longirostris*** Zukal, Verh. zool.-bot. Ges. Wien 35: 339 (1886)

Notes: The genus *Microascus* was established by Zukal (1886) with *Microascus longirostris* as the type species.

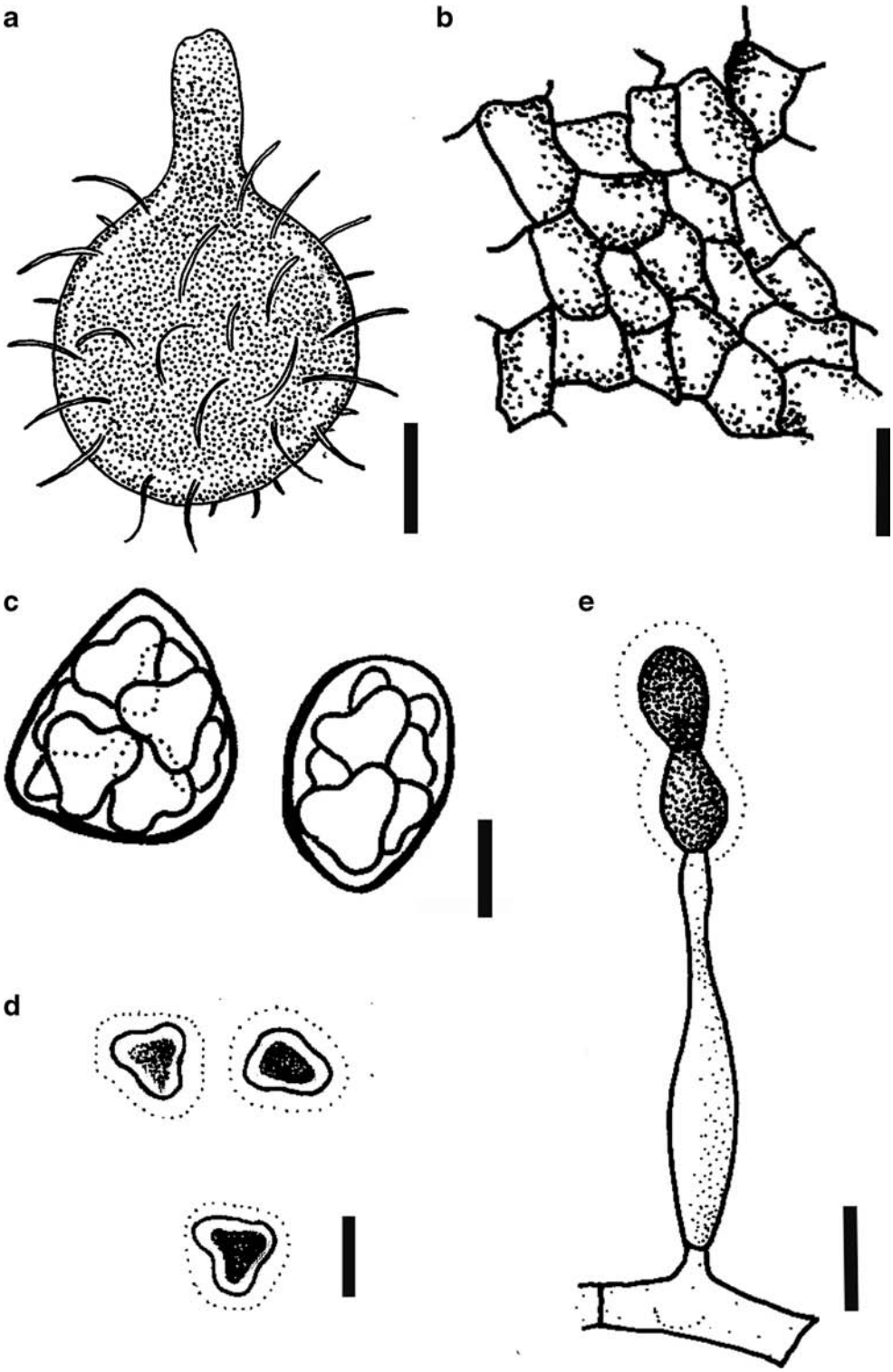


Fig. 93 *Microascus alveolaris* **CBS 139501 a**. Ascomata **b** Peridium **c** Asci **d** Ascospores **e** Conidiophores, annellides and conidia (redrawn from Sandoval-Denis et al. 2016). Scale bars: **a** = 30 μm, **b–e** = 5 μm

Microascus (1886) was initially characterized by carbonaceous, ostiolate, more or less spherical perithecia and evanescent asci distributed at all levels throughout the venter of the ascomata. *Microascus* was initially included in the *Eurotiales* based on the close similarities in the development and organization of the perithecial centrum (Emmons and Dodge 1931; Moreau 1953; Doguet 1957). Barron et al. (1961) and Morton and Smith (1963) evaluated the taxonomy of the genus, and its generic concept remains unchanged. *Microascus* groups with *Pseudallescheria* with low bootstrap support (Réblová et al. 2011).

Other genera included

Anekabeeja Udaiyan & V.S. Hosag., J. Econ. Taxon. Bot. 15(3): 649 (1992) [1991]

Type species: ***Anekabeeja lignicola*** Udaiyan & V.S. Hosag., J. Econ. Taxon. Bot. 15(3): 649 (1992) [1991]

Brachyconidiellopsis Decock et al., Cryptog. Mycol. 25(2): 140 (2004)

Type species: ***Brachyconidiellopsis fimicola*** Decock et al., Cryptog. Mycol. 25(2): 142 (2004)

Canariomyces Arx, Persoonia 12(2): 185 (1984)

Type species: ***Canariomyces notabilis*** von Arx, Persoonia 12(2): 185 (1984)

Cephalotrichum Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 20 (1809)

Type species: ***Cephalotrichum stemonitis*** (Pers.) Nees, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 20 (1809)

Doratomyces Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 2: 65 (1829)

Type species: ***Doratomyces neesii*** Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 2(7): 65 (1829)

Echinobotryum Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 3(12): 51 (1831)

Type species: ***Echinobotryum atrum*** Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 3(12): 51 (1831)

Enterocarpus Locq.-Lin., Revue Mycol., Paris 41(4): 510 (1977)

Type species: ***Enterocarpus uniporus*** Locq.-Lin., Revue Mycol., Paris 41(4): 513 (1977)

Kernia Nieuwl., Am. Midl. Nat. 4: 379 (1916)

Type species: ***Kernia nitida*** (Sacc.) Nieuwl., Am. Midl. Nat. 4: 379 (1916)

Knoxdaviesia M.J. Wingf. et al., Mycologia 80(1): 26 (1988)

Type species: ***Knoxdaviesia proteae*** M.J. Wingf. et al., Mycologia 80(1): 26 (1988)

Lophotrichus R.K. Benj., Mycologia 41(3): 347 (1949)

Type species: ***Lophotrichus ampullus*** R.K. Benj., Mycologia 41(3): 347 (1949)

Parascedosporium Gilgado et al., Int. J. Syst. Evol. Microbiol. 57(9): 2176 (2007)

Type species: ***Parascedosporium tectonae*** (C. Booth) Gilgado et al., Int. J. Syst. Evol. Microbiol. 57(9): 2176 (2007)

Petriella Curzi, Boll. R. Staz. Patalog. Veget. Roma 10: 384 (1930)

Type species: ***Petriella asymmetrica*** Curzi, Boll. R. Staz. Patalog. Veget. Roma 10: 392 (1930)

Pseudallescheria Negr. & I. Fisch., Revista Inst. Bacteriol. Dr. Carlos G. Malbrán' 12 (201): 5–9 (1944)

Type species: ***Pseudallescheria shearii*** Negroni & I. Fisch., Rev. Inst. bact., B. Aires 12: 201 (1944)

Pseudoscopulariopsis Sandoval-Denis et al., in Sandoval-Denis et al., Persoonia, Mol. Phyl. Evol. Fungi 36: 24 (2015)

Type species: ***Pseudoscopulariopsis schumacheri*** (E.C. Hansen) Sandoval-Denis et al., in Sandoval-Denis et al., Persoonia, Mol. Phyl. Evol. Fungi 36: 24 (2015)

Scedosporium Sacc. ex Castell. & Chalm., Manual of tropical medicine (London): 1122 (1919)

Type species: ***Scedosporium apiospermum*** Sacc. ex Castell. & Chalm., Manual of tropical medicine (London): 1122 (1919)

Scopulariopsis Bainier, Bull. Soc. Mycol. Fr. 23: 98 (1907)

Type species: ***Scopulariopsis brevicaulis*** (Sacc.) Bainier, Bull. Soc. mycol. Fr. 23: 99 (1907)

Tinhaudeus K.L. Pang et al., in Ariyawansa et al., Fungal Diversity: 10.1007/s13225-015-0346-5, [134] (2015)

Type species: ***Tinhaudeus formosanus*** K.L. Pang et al., in Ariyawansa et al., Fungal Diversity: 10.1007/s13225-015-0346-5, [138] (2015)

Wardomyces F.T. Brooks & Hansf., Trans. Br. mycol. Soc. 8(3): 137 (1923)

Type species: ***Wardomyces anomalus*** F.T. Brooks & Hansf. [as 'anomala'], Trans. Br. mycol. Soc. 8(3): 137 (1923)

Wardomycopsis Udagawa & Furuya, Mycotaxon **7**(1): 92 (1978)

Type species: ***Wardomycopsis inopinata*** Udagawa & Furuya, Mycotaxon 7(1): 92 (1978)

Key to sexual genera of *Microascaceae*

1. Ascomata with a peridium of *textura epidermoidea* 2
   1. Ascomata with a peridium of pseudoparenchymatous cells. 4
2. Ascomata perithecial, ascospores asymmetrical 2
2. Ascomata cleistothecial, ascospores symmetrical. . . . . ***Pseudallescheria***
3. Ascospores reddish brown . . . . . ***Petriella***
3. Ascospores subhyaline. . . . . ***Pseudoscopulariopsis***
4. Ascospores embedded in a hyphal capillitium at maturity, with a prominent germ pore. . . . . ***Enterocarpus***
4. Ascospores not embedded in a capillitium, without or with 1–2 germ pores 5
5. Ascospores pale red-brown to dark red-brown when arranged in a mass extruded from the mature perithecium as a gelatinous ball at the ostiole . . . . . ***Microascus***
5. Ascospores hyaline, reddish, yellowish or brownish not in a mass extruded from the mature perithecium. 6
6. Ascospores without or with one germ pore. 7
6. Ascospores with two germ pores 8
7. Ascospores ellipsoidal or broadly fusiform . . . . . ***Scopulariopsis***
7. Ascospores broadly reniform or lunate. . ***Canariomyces***
8. Ascomata non-ostiolate, with or without tufts of hairs, ascospores hyaline, reddish, yellowish or brownish . . . . . ***Kernia***

8. Ascospores usually ostiolate, with an apical tuft of thick-walled hairs, ascospores yellowish or brownish . . . . . ***Lophotricus***

Key to asexual genera of *Microascaceae*

1. Conidia with germ slits. 2
1. Conidia without germ slits 3
2. Conidia produce as short chains from annellidic conidiogenous cells. . . . . ***Wardomycopsis***
2. Conidia single, produce from polyblastic conidiogenous cells . . . . . ***Wardomyces***
3. Conidiophores macronematous, mononematous, arising from well-developed rhizoids. . . . . ***Knoxdaviesia***
3. Conidiophores unbranched or sporodochial to synnematous, without rhizoids 4
4. Conidia greyish to greyish black, cheirosporous, with divergent branches, composed of chains of narrowly ellipsoid to slightly barrel-shaped cells. . . . . ***Brachyconidiellopsis***
4. Conidia subhyaline, pale brown to brown, without branches, solitary, catenate or clustered 5
5. Conidia ovate, ellipsoidal to cylindrical, catenate, truncate at the base and pointed at the apex 6
5. Conidia not as above 7
6. Conidiophores synnematous, upper half of the synnema covered with flask-shaped annellides . . . .***Doratomyces***
6. Conidiophores synnematous with dark brown to blackish brown stipes, with cylindrical or ellipsoidal heads . . . . . ***Cephalotrichum***
7. Conidiophores flask-shaped with swollen base part and elongated neck. . . . . .***Scedosporium***
7. Conidiophores erect, simple, branched or irregularly branched 8
8. Conidia brown, pear-shaped, beaked, roughened . . . . . .***Echinobotryum***
8. Conidia subhyaline to brown, sub cylindrical, smooth-walled . . . . . ***Parascedosporium***

Microdochiaceae Hern.-Restr. et al., in Hernández-Restrepo et al., Persoonia 36: 64 (2015)

Facesoffungi number: FoF 01907

Saprobic, *endophytic* or *pathogenic* on leaves, seeds and soil. **Sexual morph**: *Stroma* present or absent. *Ascomata* perithecial, immersed, scattered, solitary, papilla of *textura intricata*, *Peridium* 3–4 layers, in surface view *textura epidermoidea. Asci* cylindrical, oblong, clavate, unitunicate, with an amyloid funnel-shaped apical ring and 8 biseriate or uniseriate ascospores. *Paraphyses* persisting between asci, apically free, filamentous, unbranched or infrequently branched, thin-walled, septate. *Ascospores* ellipsoid or oblong, fusoid, hyaline to pale brown, smooth-walled. **Asexual morph**: *Conidiomata* if present, sporodochial. *Conidiophores* solitary or aggregated, mono- or biverticillate. *Conidiogenous cells* solitary or in whorls, polyblastic, sympodial, denticulate, cylindrical often ampulliform, lageniform with elongated necks and minute annellides from percurrent proliferations, hyaline to pale brown. *Conidia* lunate, oblong, fusiform or cylindrical, straight or curved, hyaline, flattened at base. *Chlamydospores* if present, brown (Hernández-Restrepo et al. 2015b).

Type: ***Microdochium*** Syd.

Notes: Based on the results of LSU sequence data *Microdochium*, *Idriella* and *Selenodriella* form a distinct clade in *Xylariales* (Hernández-Restrepo et al. 2015b). Therefore, the novel family *Microdochiaceae* was introduced for the taxa producing monographella-like sexual morphs and an asexual morph characterized by polyblastic, sympodial or annellidic conidiogenous cells, with hyaline conidia without appendages (Hernández-Restrepo et al. 2015b). The genera placed in *Microdochiaceae* are phytopathogenic and saprobic on leaves, seeds and soil.

Microdochium Syd. & P. Syd., Annls mycol. 22(3/6): 267 (1924)

Facesoffungi number: 02121; Figs 94, 95

Saprobic or *pathogenic* on plants. **Sexual morph**: Monographella-like, on natural substrate. *Ascomata* perithecial, immersed, subepidermal, solitary or in groups, pale brown to black, globose, subglobose to oval, with central, papillate and often acute ostiole, *ostioles* usually more distinctly pigmented than the perithecial body, filled with slightly clavate periphyses. *Peridium* brown, thin-walled, thickened and darker around the ostiole, in surface view of *textura angularis-epidermoidea. Paraphyses* filamentous, apically free, thin-walled. *Asci* unitunicate, oblong to clavate with 8 bi- to multi-seriate ascospores, apex with an amyloid, refractive, flat, funnel-shaped ring. *Ascospores* clavate, fusoid or oblong, hyaline to brownish, straight or curved, smooth-walled and septate. **Asexual morph**: Coelomycetous. *Mycelium* branched and septate. *Sporodochia*, if present, epidermal, subepidermal to erumpent through stromata; hyaline, pseudoparenchymatic, spreading after egress. *Conidiophores* more or less verticillate, reduced to conidiogenous cells, hyaline, smooth. *Conidiogenous cells* holoblastic, discrete, hyaline, smooth, solitary or aggregated in small sporodochia. Two kinds: with sympodial proliferation, cylindrical or slightly tapering, or clavate, denticulate with one or more apical denticles. Or with percurrent proliferation (annellidic), subcylindrical, obpyriform, ampulliform to lageniform. *Conidia* dry or slimy in mass, unicellular or multi-septate, hyaline, smooth, lunate, falcate, fusiform, filiform, obovoid or subpyriform, straight or curved, apex rounded, base flattened. Sometimes the conidia originate directly from hyphae. *Chlamydospores* terminal or intercalary,

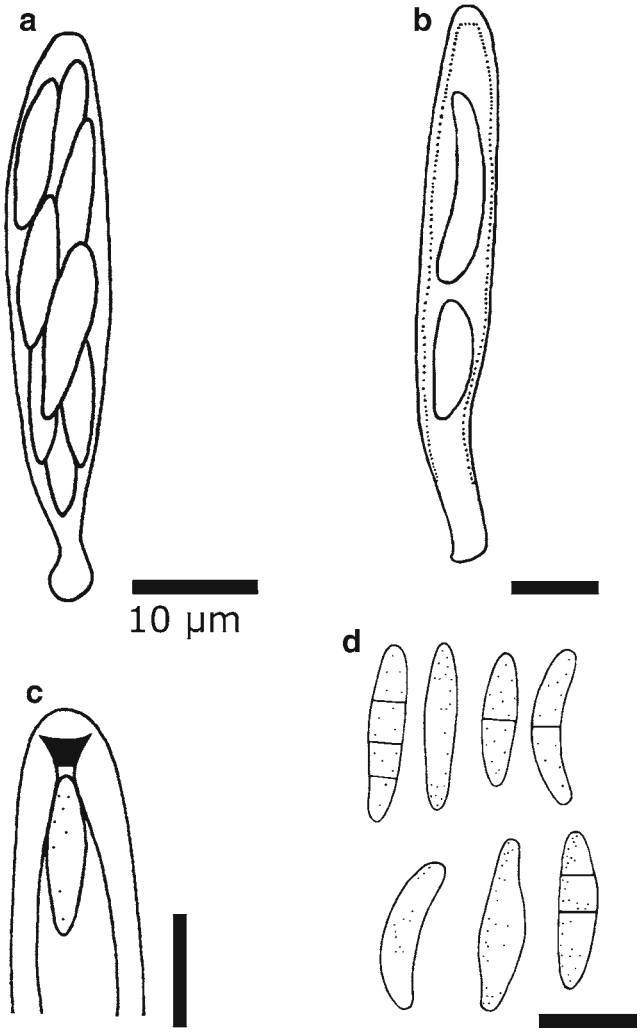


Fig. 94 ***Microdochium seminicola*** **- sexual morph** (CBS 139951, **ex-type**) **a**, **b** Asci **c** Ascus ring in Melzer's reagent; **d** Ascospores (redrawn from Hernández-Restrepo et al. 2015b)

solitary, in chains or grouped in clusters, brown (Hernández-Restrepo et al. 2015b).

Type species: ***Microdochium phragmitis*** Syd. & P. Syd., Annls mycol. 22(3/6): 267 (1924)

Notes: *Microdochium* was introduced by Sydow (1924) with the type *M. phragmitis* Syd. for a fungus on living on discoloured leaves of *Phragmites australis*. To date 31 *Microdochium* species have been described, which includes saprotrophs, some endophytes that produce secondary metabolites and pathogens of various plants (Zhang et al. 2015). The sexual morphs of *Microdochium* were identified as *Monographella* and many of them cause plant diseases predominantly on grasses and cereals (Jaklitsch & Voglmayr 2012. Since, *Microdochium* has more species and the name is more frequently used in the literature, Hernández-Restrepo et al. (2015b) gave priority to *Microdochium* over *Monographella*.

Other genera included

Idriella P.E. Nelson & S. Wilh., Mycologia 48: 550. 1956

Type species: ***Idriella lunata*** P.E. Nelson & S. Wilh., Mycologia 48: 550.

Selenodriella R.F. Castañeda & W.B. Kendr., Univ. Waterloo Biol. Ser. 33: 34 (1990)

Type species: ***Selenodriella fertilis*** (Piroz. & Hodges) R.F. Castañeda & W.B. Kendr., Univ. Waterloo Biol. Ser. 33: 34 (1990)

Key to genera of *Microdochiaceae*

1. Chlamydospores absent . . . . . ***Microdochium***
1. Chlamydospores present 2
2. Conidiophores setiform, conidiogenous cells and branches are arranged in whorls along the main axis of setiform conidiophores . . . . . ***Selenodriella***
2. Conidiophores reduced to conidiogenous cells . . . . . ***Idriella***

Myelospermataceae K.D. Hyde & S.W. Wong [as 'Myelospermaceae'], Mycol. Res. 44(1): 349 (1999)

Facesoffungi number: FoF 02098

Saprobic or *endophytic* on palms. **Sexual morph**: *Ascomata* occurring in host tissues, in pseudostromata, appearing as weakly raised, blister-like regions on the host surface, immersed, solitary, or aggregated in a valsoid configuration, if aggregated clustered around a common central pore, subglobose to ellipsoidal, dark brown, necks mostly eccentric. *Peridium* comprising a thick layer of pale brown-walled compressed cells of *textura angularis*. *Paraphyses* filamentous, basal cell globose, cylindrical, septate, unbranched, tapering distally. *Asci* 8-spored, unitunicate, thin-walled, cylindrical, short pedicellate, apically rounded, with a J-, or J+, refractive, subapical ring. *Ascospores* overlapping uniseriate, hyaline, olivaceous brown when mature, reniform to ellipsoidal, unicellular, guttulate, smooth walled and surrounded by a mucilaginous sheath. **Asexual morph**: Undetermined.

Type: ***Myelosperma*** Syd. & P. Syd.; Fig. 96

Type species: ***Myelosperma tumidum*** Syd. & P. Syd., Annls mycol. 13(1): 38 (1915)

Notes: *Myelospermataceae* was introduced by Hyde and Wong (1999) and is typified by *Myelosperma* with *Myelosperma tumidum* as the type species. Characters include cylindrical asci, with a refractive subapical ring, and reniform, olivaceous brown ascospores (Hyde 1993; Hyde and Wong 1999). Hyde and Wong (1999) first placed this family under *Diaporthales*. Subsequently, Kirk et al. (2001) placement the genus in *Xylariales*, which seemed controversial due to lack of

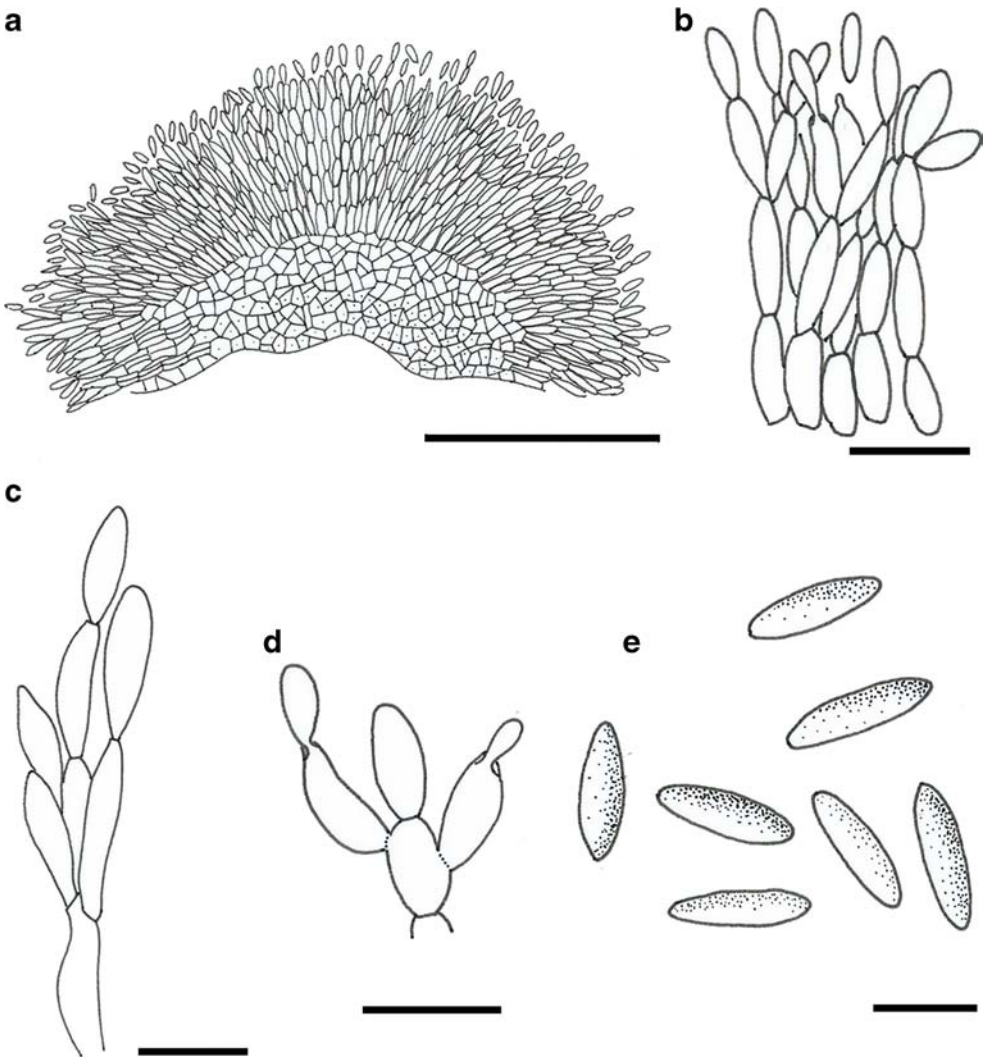


Fig. 95 ***Microdochium phragmitis*** **– asexual morph** (CBS 423.78) **a**, **b** Sporodochia **c**, **d** Conidiophores with conidiogenous cells **e** Conidia (redrawn from Hernández-Restrepo et al. 2015b). Scale bars: **a** = 50 μm, **b**–**e** = 10 μm

suitable reference taxa and sequence analysis (Eriksson 1999; Kang et al. 2002). Later, Eriksson et al. (2003) placed *Myelosperma* in *Lasiosphaeriaceae* based on molecular phylogenetic analysis of LSU and SSU data. The taxonomic placement of this genus is confused, thus further taxon sampling and multi-gene analysis is required (Smith et al. 2003). Currently, five species are recorded in Index Fungorum (2016).

We collected a new species of *Myelosperma* from southern Thailand, also on a palm rachis. LSU sequence data indicate the species belongs in the order *Xylariales*, which is in agreement with the asci having a J+, subapical ring. However, multi-gene analysis is needed to confirm *Myelospermataceae* is a distinct family. Our taxon comprised individual ascomata clustered in a raised pseudostroma, and may be a new species, which will be the subject of a future publication.

Nectriaceae Tul. & C. Tul. [as 'Nectriei'], Select. fung. carpol. (Paris) 3: 3 (1865)

= *Tuberculariaceae* Fr. [as *'Tuberculariini'*], Syst. orb. veg. (Lundae) 1: 169 (1825)

Facesoffungi number: FoF 01396

Folicolous, *entomogenous*, *endophytic* or *saprobic* mostly on woody plant hosts, a few species being human *pathogens*, in terrestrial and aquatic habitats. **Sexual morph:** *Ascomata* stromatic or non-stromatic, white, red, dark red, reddish-brown, orange, orange-red, orange-brown, umber, yellow, pale yellow, brown, greyish yellow-green, dark bluish, bluish purple, bluish black or black, solitary or aggregated in groups, perithecial, globose to subglobose, ovoid, elongate-ovoid, obpyriform, obovoid or pyriform, changing or not changing colour in KOH, surface smooth to papillate, striate, warted, verrucose or scaly, with or without setae, periphysate, ostiolar region sometimes papillate. *Paraphyses* present or absent. *Asci* 4–8-spored, unitunicate, clavate to narrowly clavate, cylindrical or ellipsoidal, with or without apical ring, with pointed or pedicellate base. *Ascospores* uniseriate to biseriate or overlapping, hyaline to yellow, yellow-brown, golden-brown, pale-brown or green, fusiform, long-fusiform, ellipsoidal,

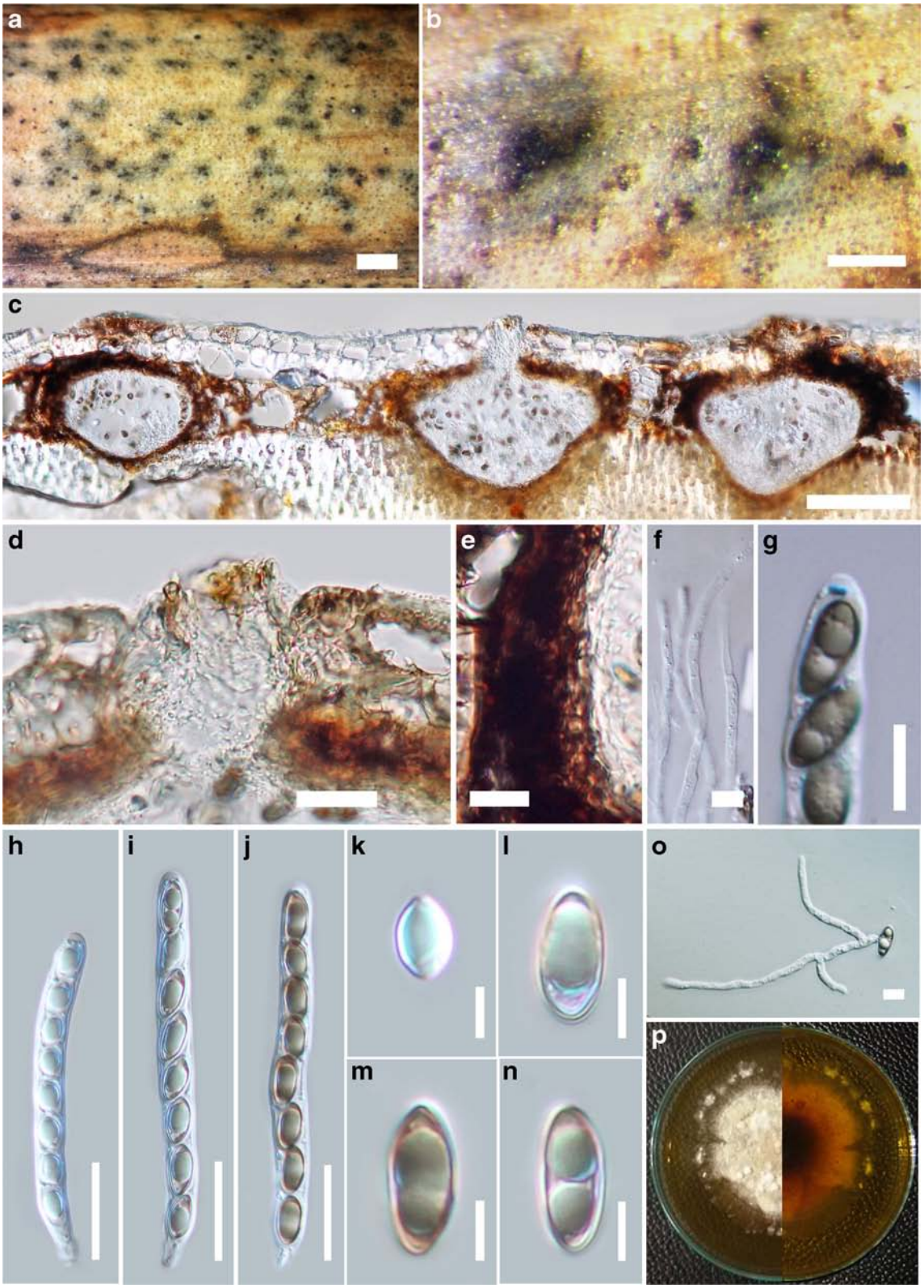


Fig. 96 ***Myelosperma*** **sp. (**Material examined: THAILAND, Krabi Province, 3 December 2014, S. Konta, MFLU 15-0269**) a**, **b** Ascomata **c** Section of ascoma **d** Neck **e** Peridium **f** Paraphyses **g** +, apical ring, bluing in Melzer's reagent **h-j** Asci **k-n** Ascospores **o** Germinated ascospore **p** Colony on culture. Scale bars: **a** = 1 mm, **b** = 200 μm, **c** = 100 μm, **d**, **h–j** = 20 μm, **e** = 10 μm, **f-g**, **k–o** = 5 μm

oblong, biconic, pyriform, reniform or allantoid, aseptate to multi-septate or muriform, constricted at the septum or not, smooth-walled, spinulose, verruculose or striate. **Asexual morph**: Hyphomycetous or coelomycetous. *Conidiomata* synnematous, sporodochial or pycnidial. *Conidiophores* unbranched or branched, penicillate, verticillate. *Conidiogenous cells* monophialidic to polyphialidic, ampulliform to lageniform, cylindrical, elongate-ampulliform or subcylindrical, hyaline, smooth-walled. *Conidia* globose, ovate, ellipsoidal, cylindrical to subcylindrical, fusiform, long-fusiform, filiform, allantoid or falcate, straight to slightly or strongly curved, hyaline, aseptate to multi-septate, constricted at septum or not, with or without visible abscission scars, sometimes guttulate, smooth-walled. *Chlamydospores* present or absent.

Type: ***Nectria*** (Fr.) Fr.

Notes: Seaver (1909a, b, 1910a, b, 1911) divided the order *Hypocreales* into two families (*Nectriaceae* and *Hypocreaceae*) by considering stromatic and perithecial characters. Petch (1938) also accepted *Nectriaceae* as a separate family in *Hypocreales*, while Munk (1957) and Dennis (1960) placed it in *Sphaeriales*. Miller (1949); Bessy (1950); Luttrell (1951); Dingley (1951a, b, 1952a, b, 1953, 1954, 1956); von Arx and Müller (1954); Müller and von Arx (1962); Gäumann (1964); Rogerson (1970); Barr (1990) placed *Nectriaceae* under *Hypocreaceae* as one family. However, Kreisel (1969); Rossman et al. (1999) accepted that *Nectriaceae* and *Hypocreaceae* are two separate families within *Hypocreales*. *Nectriaceae* was provisionally accepted as a separate family based on cladistic analyses of rRNA data (Spatafora and Blackwell 1993). *Nectriaceae* is characterized by uniloculate, pigmented ascomata and phialidic amerosporous to phragmosporous conidia. Ascomata are yellow, orange-red or purple and KOH+ (Rossman et al. 1999; Rossman 2000; Lombard et al. 2015). Some members of this family are weak or even virulent pathogens, while some are saprobes, fungicolous or insecticolous (Rossman et al. 1999; Rossman 2000; Chaverri et al. 2011; Schroers et al. 2011; Hyde et al. 2014). Rossman et al. (1999) restricted *Nectria sensu stricto* to species considered congeneric with *N. cinnabarina* and accepted 20 genera in *Nectriaceae*. Lumbsch and Huhndorf (2010) listed 26 genera under *Nectriaceae*, while Maharachchikumbura et al. (2015) accepted 67 genera. Of these, Lombard et al. (2015) synonymized ten (*Chaetopsinectria*, *Dialonectria*, *Glionectria*, *Heliscus*, *Antipodium*, *Viridispora*, *Actinostilbe*, *Pleonectria*, *Volutellonectria* and *Xenocalonectria*) under other genera in the *Nectriaceae*, while four (*Pseudocosmospora*, *Stalagmites*, *Pleurocolla* and *Pleogibberella*) were excluded or not treated due to lack of molecular data, and *Rodentomyces* was transferred to the *Hypocreales* as *genera incertae sedis*. However, Lombard et al. (2015) did not consider ten of the genera (*Allonectella*, *Baipadisphaeria*, *Chaetonectrioides*, *Curvicladium*, *Cyanochyta*, *Cyanophomella*, *Dacryoma*, *Persiciospora*, *Stachybotryna* and *Xenonectriella*) accepted by Maharachchikumbura et al. (2015), but they did include an additional five genera (*Cylindrocarpostylus*, *Dactylonectria*, *Sarcopodium*, *Xenocylindrocladium* and *Xenogliocladiopsis*). Lombard et al. (2015) accepted 47 genera in the family based on rDNA sequence data. The present study follows Lombard et al. (2015)

Nectria *(*Fr.) Fr., Summa veg. Scand., Section Post. (Stockholm): 387 (1849)

Facesoffungi number: FoF 02122; Figs 97, 98

Saprobic on decaying wood and occurring as *pathogens* of trees. **Sexual morph**: *Stromata*, erumpent. *Ascomata* perithecial, on or nearly or completely immersed in a stroma, aggregated in groups, red to bay to sienna, turning bright red, blood red to purple in KOH, globose to subglobose, with a smooth to warted surface. *Asci* 8-spored, unitunicate, clavate to narrowly clavate or cylindrical, apical ring inconspicuous. *Ascospores* 0–4-septate, ellipsoidal, oblong, fusiform, pyriform or allantoid, with rounded ends, straight to slightly curved, hyaline, smooth-walled or spinulose. **Asexual morph**: *Conidiophores* pycnidial, sporodochial, lateral phialidic pegs or acropleurogenous. *Microconidia* ellipsoid to fusoid or sometimes curved, aseptate, hyaline. *Macroconidia* 0–1-septate, ellipsoidal, oblong, cylindrical to allantoid or subglobose to ellipsoidal, straight to slightly curved, rounded at ends, hyaline, smooth-walled. *Chlamydospores* rare (description based on Hirooka et al. 2012; Lombard et al. 2015).

Type species: ***Nectria cinnabarina*** (Tode) Fr., Summa veg. Scand., Section Post. (Stockholm): 388 (1849)

Notes: Fries (1849) introduced the genus *Nectria* based on *Hypocrea* sect. *Nectria* Fr. Since then many species have been added to the genus. Based on morphological characteristics such as structure of perithecial and asexual morphs (Hirooka et al. 2010; Rossman et al. 1999) and LSU sequence data (Rehner and Samuels 1995) *Nectria sensu lato* was separated into a number of genera. Rossman et al. (1999) restricted *Nectria sensu stricto* to species considered congeneric with the type species *Nectria cinnabarina* and accepted 27 species within the genus.

≡ *Tubercularia vulgaris* Tode, Fung. mecklenb. sel. (Lüneburg) 1: 18 (1790)

Other genera included

Albonectria Rossman & Samuels, in Rossman et al., Stud. Mycol. 42: 105 (1999)

Type species: ***Albonectria rigidiuscula*** (Berk. & Broome) Rossman & Samuels, in Rossman et al., Stud. Mycol. 42: 105 (1999)

Allantonectria Earle, in Greene, Plant. Bak. 2(1): 11 (1901)

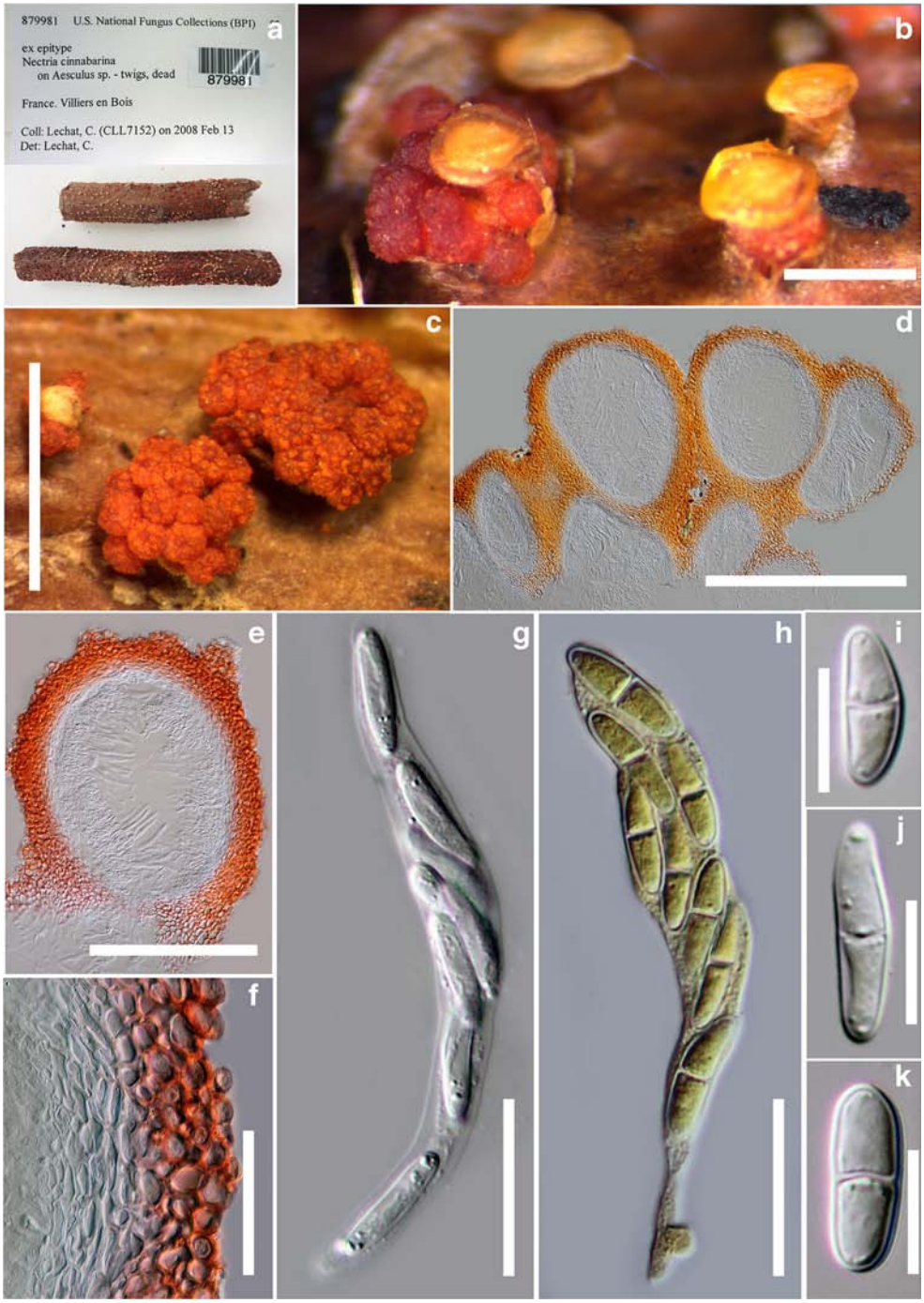


Fig. 97 ***Nectria cinnabarina*** (Material examined: FRANCE**:** Villiers en Bois, on dead twigs of *Aesculus* sp., Lechat, C. (CLL7152), 2008 February 13, Detr: Lechat, C. BPI 879981, **epitype) a** Herbarium material **b** Ascomata and long stipitate sporodochia on host substrate **c** Ascomata on host substrate **d**, **e** Transverse section through ascoma **f** Transverse section through peridium **g** Ascus **h** Ascus in Melzer's reagent **i-k** Ascospores. Scale bars: **b** = 1 mm, **c** = 2 mm, **d** = 500 μm, **e** = 200 μm, **f** = 50 μm, **g**, **h** = 20 μm, **i–k** = 10 μm

Type species: ***Allantonectria yuccae*** Earle, in Greene, Plant. Bak. 2(1): 11 (1901)

Allonectella Petr., Sydowia 4(1–6): 345 (1950)

Type species: ***Allonectella rubescens*** Petr., Sydowia 4(1–6): 345 (1950)

Aquanectria L. Lombard & Crous, in Lombard et al., Stud. Mycol. 80: 207 (2015)

Type species: ***Aquanectria penicillioides*** (Ingold) L. Lombard & Crous, Lombard et al., Stud. Mycol. 80: 207 (2015)

Atractium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 10 (1809)

Type species: ***Atractium stilbaster*** Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 10 (1809)

Bisifusarium L. Lombard, Crous & W. Gams, in Lombard et al., Stud. Mycol. 80: 223 (2015)

Type species: ***Bisifusarium dimerum*** (Penz.) L. Lombard & Crous, in Lombard et al., Stud. Mycol. 80: 224 (2015)

Calonectria De Not., Comm. Soc. crittog. Ital. 2(3): 477 (1867)

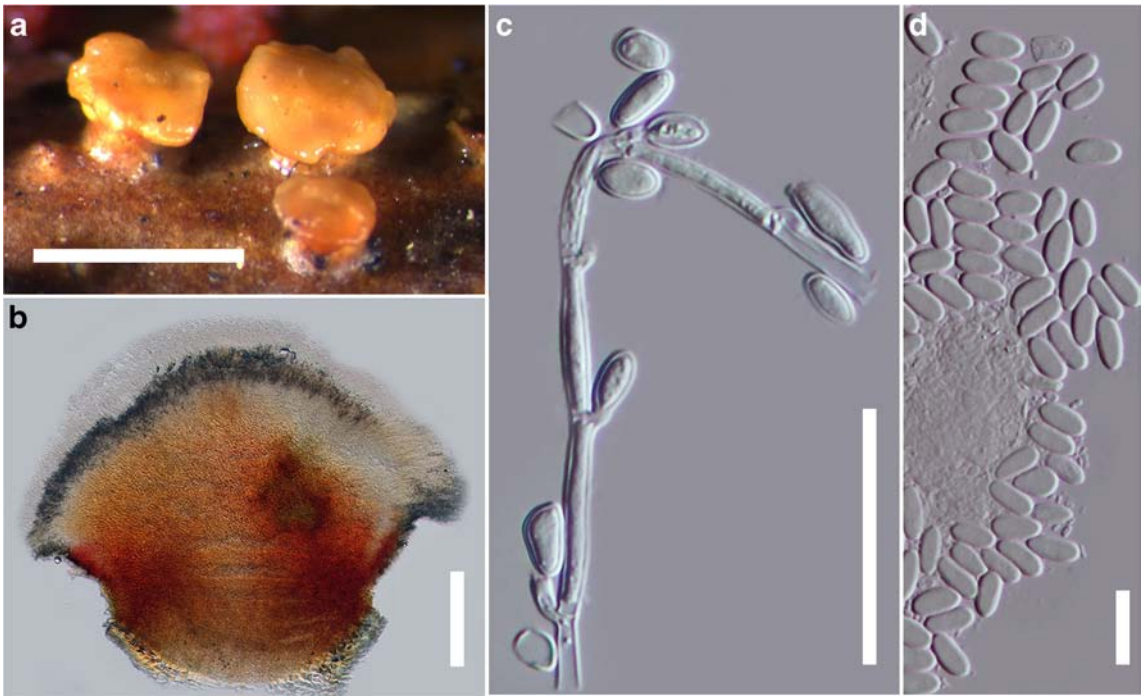


Fig. 98 *Nectria cinnabarina* (Material examined: FRANCE**:** Villiers en Bois, on dead twigs of *Aesculus* sp., Lechat, C. (CLL7152), 2008 February 13, Detr: Lechat, C. BPI 879981, **epitype) a** Long stipitate sporodochia on host substrate **b** Transverse section through sporodochium **c** Conidiophore **d** Conidia. Scale bars: **a** = 2 mm, **b** = 200 μm, **c** = 20 μm, **d** = 10 μm

= *Cylindrocladium Morgan*, *Bot. Gaz. 17*: *191 (1892)*

Type species: ***Calonectria daldiniana*** De Not., Comm. Soc. crittog. Ital. 2(3): 477 (1867)

Calostilbe Sacc. & P. Syd., Syll. fung. (Abellini) 16: 591 (1902)

= *Calostilbella* Höhn., Ber. dt. bot. Ges. 37: 160 (1919)

Type species: ***Calostilbe longiasca*** (Möller) Sacc. & P. Syd., Syll. fung. (Abellini) 16: 591 (1902)

Campylocarpon Halleen et al., Stud. Mycol. 50(2): 448 (2004)

Type species: ***Campylocarpon fasciculare*** Schroers et al., in Halleen et al., Stud. Mycol. 50(2): 448 (2004)

Chaetonectrioides Matsush., Matsush. Mycol. Mem. 9: 5 (1996)

Type species: ***Chaetonectrioides malaysiana*** Matsush., Matsush. Mycol. Mem. 9: 5 (1996)

Chaetopsina Rambelli, Atti Accad. Sci. Ist. Bologna, Cl. Sci. Fis. Rendiconti 3: 5 (1956)

= *Chaetopsinectria* J. Luo & W.Y. Zhuang, Mycologia 102(4): 979 (2010)

Type species: ***Chaetopsina fulva*** Rambelli, Diagn. IV 3: 5 (1956)

Coccinonectria L.Lombard & Crous, in Lombard et al., Stud. Mycol. 80: 218 (2015)

Type species: ***Coccinonectria pachysandricola*** (B.O. Dodge) L. Lombard & Crous. in Lombard et al., Stud. Mycol. 80: 218 (2015)

Corallomycetella Henn., Hedwigia 43: 245 (1904)

Type species: ***Corallomycetella heinsenii*** Henn. [as 'heinesii'], Hedwigia 43: 245 (1904)

Corallonectria C. Herrera & P. Chaverri, Mycosystema 32(3): 539 (2013)

Type species: ***Corallonectria jatrophae*** (Möller) C. Herrera & P. Chaverri, Mycosystema 32(3): 539 (2013)

Cosmospora Rabenh., Hedwigia 2: 59 (1862)

Type species: ***Cosmospora coccinea*** Rabenh., Fungi europ. exsicc.: no. 459 (1862)

Curvicladiella Decock & Crous, Stud. Mycol. 55: 225 (2006)

Type species: ***Curvicladiella cignea*** (Decock & Crous) Decock & Crous, in Crous et al., Stud. Mycol. 55: 225 (2006)

Curvicladium Decock & Crous, Mycologia 90(2): 276 (1998)

Type species: ***Curvicladium cigneum*** Decock & Crous, Mycologia 90(2): 277 (1998)

Cyanochyta Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 124: 92 (1915)

Type species: ***Cyanochyta cyanogena*** (Speg.) Höhn., Öst. bot. Z. 68: 120 (1915)

Cyanonectria Samuels & P. Chaverri, in Samuels et al., Mycol. Progr. 8(1): 56 (2009)

Type species: ***Cyanonectria cyanostoma*** (Sacc. & Flageolet) Samuels & P. Chaverri, Mycol. Progr. 8(1): 56 (2009)

Cyanophomella Höhn., Hedwigia 60: 156 (1918)

Type species: ***Cyanophomella acervalis*** (Sacc.) Höhn., Hedwigia 60: 157 (1918)

Cylindrocarpostylus R. Kirschner & Oberw., Mycol. Res. 103: 1155. 1999.

Type species: ***Cylindrocarpostylus gregarius*** (Bres.) R. Kirschner & Oberw., Mycol. Res. 103: 1155. 1999.

Cylindrocladiella Boesew., Can. J. Bot. 60(11): 2289 (1982)

Type species: ***Cylindrocladiella*** parva (P.J. Anderson) Boesew., Can. J. Bot. 60(11): 2289 (1982)

Cylindrodendrum Bonord., Handb. Allgem. mykol. (Stuttgart): 98 (1851)

Type species: ***Cylindrodendrum album*** Bonord., Handb. Allgem. mykol. (Stuttgart): 48 (1851)

Dacryoma Samuels, Brittonia 40(3): 328 (1988)

Type species: ***Dacryoma album*** Samuels [as 'alba'], Brittonia 40(3): 328 (1988)

Dactylonectria L. Lombard & Crous, Phytopathol. Medit. 53: 348. 2014.

Type species: ***Dactylonectria macrodidyma*** (Halleen et al.) L. Lombard & Crous, Phytopathol. Medit. 53: 352. 2014.

Dematiocladium Allegr.et al., Mycol. Res. 109(7): 836 (2005)

Type species: ***Dematiocladium celtidis*** Allegr. et al., Mycol. Res. 109(7): 836 (2005)

Fusarium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 10 (1809)

Type species: ***Fusarium roseum*** Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 10 (1809)

Fusicolla Bonord., Handb. Allgem. mykol. (Stuttgart): 150 (1851)

Type species: ***Fusicolla betae*** Bonord., Handb. Allgem. mykol. (Stuttgart): 150 (1851)

Geejayessia Schroers et al., in Schroers et al., Stud. Mycol. 68(1): 124 (2011)

Type species: ***Geejayessia cicatricum*** (Berk.) Schroers, in Schroers et al., Stud. Mycol. 68(1): 124 (2011)

Gliocephalotrichum J.J. Ellis & Hesselt., Bull. Torrey bot. Club 89: 21 (1962)

= *Leuconectria* Rossman, Samuels & Lowen, Mycologia 85(4): 686 (1993)

Type species: ***Gliocephalotrichum bulbilium*** J.J. Ellis & Hesselt., Bull. Torrey bot. Club 89: 22 (1962)

Gliocladiopsis S.B. Saksena, Mycologia 46: 662 (1954)

= *Glionectria* Crous & C.L. Schoch, Stud. Mycol. 45: 58 (2000)

Type species: ***Gliocladiopsis sagariensis*** S.B. Saksena, Mycologia 46: 662 (1954)

Ilyonectria P. Chaverri & C. Salgado, in Chaverri et al., Stud. Mycol. 68(1): 69 (2011)

Type species: ***Ilyonectria radicicola*** (Gerlach & L. Nilsson) P. Chaverri & C. Salgado, in Chaverri et al., Stud. Mycol. 68(1): 71 (2011)

Macroconia (Wollenw.) Gräfenhan, Seifert & Schroers, in Gräfenhan et al., Stud. Mycol. 68(1): 101 (2011)

Type species: ***Macroconia leptosphaeriae*** (Niessl) Gräfenhan & Schroers, in Gräfenhan et al., Stud. Mycol. 68(1): 102 (2011)

Mariannaea G. Arnaud, Bull. trimest. Soc. mycol. Fr. 68: 196 (1952)

Type species: ***Mariannaea elegans*** G. Arnaud, Bull. trimest. Soc. mycol. Fr. 68: 196 (1952)

Microcera Desm., Annls Sci. Nat., Bot., sér. 3 10: 359 (1848)

Type species: ***Microcera coccophila*** Desm., Annls Sci. Nat., Bot., sér. 3 10: 359 (1848)

Nalanthamala *Subram*., J. Indian bot. Soc. 35: 478 (1956)

Type species: ***Nalanthamala madreeya*** Subram., J. Indian bot. Soc. 35: 478 (1956)

Nectricladiella Crous & C.L. Schoch, Stud. Mycol. 45: 54 (2000)

Type species: ***Nectricladiella camelliae*** (Shipton) Crous & C.L. Schoch, in Schoch et al., Stud. Mycol. 45: 54 (2000)

Neonectria Wollenw., Annls mycol. 15(1/2): 52 (1917)

Type species: ***Neonectria ramulariae*** Wollenw., Annls mycol. 15(1/2): 52 (1917)

Neocosmospora E.F. Sm., U.S.D.A. Div. Veg. Pathol. Bull. 17: 45 (1899)

Type species: ***Neocosmospora vasinfecta*** E.F. Sm., Bull. U.S. Department of Agriculture 17: 45 (1899)

Ophionectria Sacc., Michelia 1(no. 3): 323 (1878)

Type species: ***Ophionectria trichospora*** (Berk. & Broome) Sacc., Michelia 1(no. 3): 323 (1878)

Paracremonium L. Lombard & Crous, in Lombard et al., Stud. Mycol. 80: 233 (2015)

Type species: ***Paracremonium inflatum*** L. Lombard & Crous, in Lombard et al., Stud. Mycol. 80: 233 (2015)

Payosphaeria W.F. Leong, in Leong, Tan, Hyde & Jones, Bot. Mar. 33: 511 (1990)

Type species: ***Payosphaeria minuta*** H.Y.M. Leung, in Leong, Tan, Hyde & Jones, Bot. Mar. 33: 511 (1990)

Penicillifer Emden, Acta bot. neerl. 17: 54 (1968)

Type species: ***Penicillifer pulcher*** Emden, Acta bot. neerl. 17: 54 (1968)

Persiciospora P.F. Cannon & D. Hawksw., J. Linn. Soc., Bot. 84: 133 (1982)

Type species: ***Persiciospora moreaui*** P.F. Cannon & D. Hawksw., J. Linn. Soc., Bot. 84(2): 134 (1982)

Pleogibberella Sacc. ex Berl. & Voglino, in Saccardo, Syll. fung., Addit. I-IV (Abellini): 217 (1886)

Type species: ***Pleogibberella calamia*** (Cooke) Berl. & Voglino, in Saccardo, Syll. fung., Addit. I-IV (Abellini): 217 (1886)

Pleonectria Sacc., Nuovo G. bot. ital. 8(2): 178 (1876)

Type species: ***Pleonectria lamyi*** (Desm.) Sacc. [as 'lamyii'], Michelia 1(no. 3): 325 (1878)

Pleurocolla Petr., Annls mycol. 22(1/2): 15 (1924)

Type species: ***Pleurocolla tiliae*** Petr., Annls mycol. 22(1/2): 15 (1924)

Pseudocosmospora C. Herrera & P. Chaverri, Mycologia 105: 1291 (2013)

Type species: ***Pseudocosmospora eutypellae*** C. Herrera & P. Chaverri, Mycologia 105: 1293 (2013)

Pseudonectria Seaver, Mycologia 1(2): 48 (1909)

Type species: ***Pseudonectria rousseliana*** (Mont.) Wollenw., Z. ParasitKde 3(3): 489 (1931)

Rectifusarium L. Lombard et al., in Lombard et al., Stud. Mycol. 80: 229 (2015)

Type species: ***Rectifusarium ventricosum*** (Appel & Wollenw.) L. Lombard & Crous., in Lombard et al., Stud. Mycol. 80: 229 (2015)

Rugonectria P. Chaverri & Samuels, in Chaverri et al., Stud. Mycol. 68(1): 73 (2011)

Type species: ***Rugonectria rugulosa*** (Pat. & Gaillard) Samuels et al., in Chaverri et al., Stud. Mycol. 68(1): 73. (2011)

Sarcopodium Ehrenb. ex Schlecht., Synop. Pl. Crypt. 2: 101. (1824).

Type species: ***Sarcopodium circinatum*** Ehrenb. ex Schlecht., Synop. Pl. Crypt. 2: 101. 1824.

Stachybotryna Tubaki & T. Yokoy., Trans. Mycol. Soc. Japan 12(1): 18 (1971)

Type species: ***Stachybotryna columaris*** Tubaki & T. Yokoy. [as 'columare'], Trans. Mycol. Soc. Japan 12(1): 18 (1971)

Stalagmites Theiss. & Syd., Annls mycol. 12(2): 189 (1914)

Type species: ***Stalagmites tumefaciens*** (Syd. & P. Syd.) Theiss. & Syd., Annls mycol. 12(2): 189 (1914)

Stylonectria Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 124: 52 (1915)

Type species: ***Stylonectria applanata*** Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 124: 52 (1915)

Thelonectria P. Chaverri & C. Salgado, in Chaverri et al., Stud. Mycol. 68(1): 76 (2011)

Type species: ***Thelonectria discophora*** (Mont.) P. Chaverri & C. Salgado, in Chaverri et al., Stud. Mycol. 68(1): 76 (2011)

Thyronectria Sacc., Grevillea 4(no. 29): 21 (1875)

Type species: ***Thyronectria patavina*** Sacc., Grevillea 4(no. 29): 21 (1875)

Volutella Fr., Syst. mycol. (Lundae) 3(2): 458, 466 (1832)

Type species: ***Volutella ciliata*** (Alb. & Schwein.) Fr., Syst. mycol. (Lundae) 3(2): 467 (1832)

Xenoacremonium L. Lombard & Crous, in Lombard et al., Stud. Mycol. 80: 234 (2015)

Type species: ***Xenoacremonium recifei*** (Leão & Lõbo) L. Lombard & Crous., in Lombard et al., Stud. Mycol. 80: 235 (2015)

Xenocalonectria Crous & C.L. Schoch, Stud. Mycol. 45: 50 (2000)

Type species: ***Nectria serpens*** Decock, Hennebert & Crous, Mycol. Res. 101(7): 788 (1997)

Xenogliocladiopsis Crous & W.B. Kendr., Canad. J. Bot. 72: 63. 1994.

Type species: ***Xenogliocladiopsis eucalyptorum*** Crous & W.B. Kendr., Can. J. Bot. 72: 63. 1994.

Xenonectriella Weese, Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 749 (1919)

Type species: ***Xenonectriella lutescens*** (Arnold) Weese, Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 749 (1919)

Key to the genera of *Nectriaceae* with sexual morph

1. Ascospores always aseptate 2
1. Ascospores 1 to multi-septate or muriform, rarely aseptate 4
2. Ascomata on well-developed erumpent stromata, ... 3
2. Ascomata with basal stromata, superficial 5
3. Ascospores fusoid with rounded ends. . . . . ***Calonectria***
3. Ascospores allantoid to cylindrical with rounded corners . . . . . ***Allantonectria***
5. Ascomata, pale yellow to greyish yellow-green, not changing color in KOH . . . . . ***Pseudonectria***
5. Ascomata brilliant red, turning purple in KOH . . . . . ***Gliocephalotrichum***
6. Ascospores green . . . . . ***Penicillifer***
6. Ascospores hyaline or pigmented, not green. 7
7. Ascomata white to pale yellow, pale brownish-yellow or greyish yellow-green, never red, black, blue or purple. . . . . ***Albonectria***
7. Ascomata yellow, red, redish orange, orange, orange-brown, black, dark blue or purple, rarely white 8
8. Ascomata stromatic, erumpent, fully or partially immersed in a slimy, pale orange sheet of hyphae over the substrate . . . . . ***Fusicolla***
8. Ascomata stromatic or not, if stromatic not immersed in a slimy sheet of hyphae 9
9. Ascospores more than 1-septate or muriform, rarely 1 septate 10
9 Ascospores always 1-septate, not muriform or multi-septate 11
10. Ascospores sometimes budding in the ascus to produce oblong to allantoid, aseptate, hyaline, ascoconidia . . . . . ***Thyronectria***
10. Ascospores do not produce ascoconidia 33
11. Ascomata seated on short red stalks . . ***Corallonectria***
11. Ascomata not seated on stalks 12
12. Ascomata broadly ampulliform with a short necks, or broadly ellipsoidal, pale orange, brownish to reddish orange, bright red or black . . . . . ***Geejayessia***

12. Ascomata globose, ovoid, pyriform to obpyriform, yellow to orange-brown to red, but never black. 13
13. Found only in aquatic habitats, ascomata ovate to subglobose . . . . . ***Aquanectria***
13. Mainly in terrestrial habitats, ascomata globose to subglobose 14
14. Ascomata with a rounded or broad, circular, flat disc on a venter-like neck, ascospores cylindrical to allantoid to ellipsoidal . . . . . ***Stylonectria***
14. Ascomata papillate or non-papillate, without flat disc on a venter-like neck, ascospores ellipsoidal to fusiform, oblong or globose. 15
15. Ascomatal wall with hyphal hairs (sometimes forming a tomentum on the ascomatal surface) or with minute brown setae, very rarely smooth, not warted, scaly or scruffy 16
15. Ascomatal wall smooth, warted, scaly or scruffy . . 17
16. Ascomata developing on old sporodochia, previously conidial stroma, or at the base of a synnema 35
16. Ascomata with a inconspicuous stroma, basal stroma present or absent, not associated with old sporodochia, previously conidial stroma or synnema 36
17. Ascomata with orange (rarely green) or red scales 18
17. Ascomatal surface not scaly 19
18. Ascomata with orange, rarely green scales, turning dark red in KOH, ascospores pale brown to golden-brown, coarsely striate . . . . . ***Nalanthamala***
18. Ascomata with red scales, turning purple-red in KOH, ascospores hyaline, smooth . . . . . ***Ilyonectria***
19. Ascospores aggregated in the upper third of the ascus, fusoid. . . . . ***Xenocylindrocladium***
19. Ascospores not aggregated in the upper third of the ascus, ellipsoidal, oblong, fusiform, pyriform or allantoid 20
20. Ascomata associated with reddish rhizomorphs or synnemata, changing to purple in KOH. . . . . ***Corallomycetella***
20. Ascomata not associated with reddish rhizomorphs or synnemata, changing or not changing color in KOH, if change becoming dark red, purple-red, violet or sienna 21
21. Stromata well-developed and/or byssus covering host, rarely reduced 22
21. Stromata inconspicuous, absent, or with a basal stroma, ... 24
22. Ascomata turning sienna in KOH, ascospores yellow-brown, coarsely striate, appearing as longitudinal furrows . . . . . ***Calostilbe***
22. Ascomata turning dark red, dark red-brown or violet in KOH, ascospores hyaline to pale yellow-brown, smooth or finely warted, sometimes becoming tuberculate when mature 23
23. Ascomata globose with a blunt papilla, orange to dark red, ascomatal surface finely roughened . . . . . ***Microcera***
23. Ascomata ampulliform to obpyriform or pyriform, dark bluish or red to red-brown, ascomatal surface smooth. . . . . ***Cyanonectria***
24. Ascomata red-brown with a dark red stromatic base . . . . . ***Gliocladiopsis***
24. Ascoamat pale yellow, orange, red to dark red or brown 25
25. Ascomata not reacting in KOH 26
25. Ascomata changing color in KOH 28
26. Asci clavate, ascospores light brown, verrucose. . . . . ***Rectifusarium***
26. Asci cylindrical to narrowly clavate, ascospores hyaline or becoming brownish with age, smooth, spinulose or rarely striate 27
27. Ascomata globose with a flat apex, pale yellow, orange or brown . . . . . ***Mariannaea***
27. Ascomata globose, subglobose, or pyriform to elongated, red . . . . . ***Thelonectria***
28. Ascomata dark red, becoming purple-red in KOH . . . . . ***Dactylonectria***
28. Ascomata orange red or bright red, red, yellow to orange or orange-brown, becoming dark red, dark yellow to dark orange-brown. 29
29. Ascomata orange-red, surface conspicuously warted, sometimes smooth 30
29. Ascomata yellow to orange-brown to red, surface generally smooth, very rarely scruffy 31
30. Ascospores initially hyaline, becoming yellow brown to reddish brown, striate. . . ***Cosmospora/Dialonectria***
30. Ascospores hyaline or sometimes yellow, becoming tuberculate when mature . . . . . ***Rugonectria***
31. Ascomata globose to pyriform, yellow to orange-brown . . . . . ***Neocosmospora***
31. Ascomata subglobose to obpyriform or broadly obpyriform, generally red 32
32. Ascomata non-stromatic, obpyriform, with an acute apex . . . . . ***Chaetopsina***
32. Ascomata seated on an erumpent stroma, subglobose to broadly obpyriform, rarely papillate . . . . . ***Neonectria***
33. Ascomata astromatic, or on a thin stroma or seated on a subiculum of thick-walled, minutely warted septate hyphae 34
33. Ascomata on or nearly or completely immersed in an erumpent stroma . . . . . ***Nectria***
34. Ascomata ovoid to elongate-ovoid to cylindrical, ascospores long-fusiform, often somewhat bent, vermiform . . . . . ***Ophionectria***

34. Ascomata globose to subglobose to pyriform ascospores mostly ellipsoidal . . . . . ***Fusarium***
35. Ascomata orange to orange-red to carmine red, becoming pink to purple in KOH, ascospores finely verrucose . . . . . ***Coccinonectria***
35. Ascomata red, becoming dark red in KOH, ascospores striate . . . . . ***Sarcopodium***
36. Stroma inconspicuous or absent, ascospores yellowish . . . . . ***Macroconia***
36. With or without basal stroma, ascospores hyaline 37
37. Basal stroma absent, ascospores ellipsoid to fusoid with obtuse ends . . . . . ***Cylindrocladiella***
37. Ascomata on a thin basal stromata, Ascospores fusiform to biconic . . . . . ***Volutella***

Key to the genera of *Nectriaceae* with asexual morph

1. Conidiophores separate or aggregated into sporodochia or synnemata 2
1. Conidiophores simple, not produce sporodochia. 6
2. Conidiophores sporodochial or synnematous, consist of fertile branches and sterile vesiculate stipe extensions, generally not pathogenic to other fungi or insects 3
2. Conidiophores simple sporodochial, consist of conidiogenous ring only, sterile stipe extensions absent, generally pathogenic to other fungi or insects 5
3. Conidia (0–)1–5-septate, clavate, obovoid or gently curved, rarely ellipsoidal . . . . . ***Atractium***
3. Conidia 0–3-septate, cylindrical to fusiform 4
4. Conidia 0–3-septate, cylindrical, stipe with a verruculose, pale brown apical cell . . . . ***Curvicladiella***
4. Conidia aseptate, cylindrical to fusiform, stipe smooth, hyaline. . . . . ***Xenogliocladiopsis***
5. Microconidia absent or present, 0–1(−2)-septate; macroconidia uniseptate to multi-septate, falcate, with or without a hooked apical cell . . . . . ***Fusarium***
5. Microconidia 0(−1)-septate, ellipsoidal and straight or allantoid, broadly lunate to reniform or curved and tapering at both ends; macroconidia (0–)1–2(−3)-septate, curved to lunate. . . . . ***Bisifusarium***
6. Conidiophores/Conidiogenous cells bearing 1 to several phialides. 7
6. Conidiogenous cells monophialidic 9
7. Conidiophores arising from pseudoparenchymatous cells in a basal stroma, phialides elongate doliiform to reniform or subcylindrical . . . . . ***Dematiocladium***
7. Conidiophores as lateral phialidic pegs or arising laterally from somatic hyphae, phialides cylindrical to allantoid or narrowly flask-shaped 8
8. Phialides cylindrical or narrowly flask-shaped, macroconidia cylindrical, curved, (1–)3–4(−5)-septate, with minutely tapered, obtuse ends . . ***Campylocarpon***
8. Phialides cylindrical to allantoid, conidia cylindrical, straight or slightly curved, 0–3-septate, rounded at both ends. . . . . ***Cylindrocarpostylus***
9. Conidiophores elongate doliiform to reniform to obpyriform, conidia do not form slimy heads on the conidiophore. . . . . ***Cylindrodendrum***
9. Conidiophores elongate-ampulliform or subcylindrical, conidia forming slimy heads on the conidiophore . . 10
10. Forming sterile coils with conidiophores radiating outwards, hyphal septa inconspicuously swollen . . . . . ***Paracremonium***
10. Not forming sterile coils, hyphae inconspicuously swollen septa. . . . . ***Xenoacremonium***

Niessliaceae Kirschst., Annls mycol. 37(1/2): 89 (1939

Facesoffungi number: FoF 01126

Saprobic or *parasitic* on wood, leaves and stems in freshwater and terrestrial habitats, some possibly fungicolous and lichenicolous. **Sexual morph**: *Ascomata* perithecial or cleistothecial, yellow, brown, dark brown to black, solitary or gregarious, superficial, erumpent to immersed in a subiculum or crustose stroma, cupulate, globose to subglobose, membranaceous, tuberculate, with or without circinately coiled, lightly pigmented, brown, septate, apical setae, collabent, or collapsing laterally, or not collapsing, papilla present or lacking, when present with periphysate ostiole. *Peridium* thick, membranaceous, outer layer composed of yellow, light brown or brown cells of *textura angularis*; inner layer composed of hyaline cells of *textura prismatica*. *Hamathecium* of filiform, hyaline, septate paraphyses, or paraphyses absent. *Asci* 8-spored, unitunicate, oblong to clavate, long or short pedicellate, with narrowly discoid J- apical ring or absent, evanescent at maturity. *Ascospores* 1–3-seriate, hyaline to brown, ellipsoid to fusiform, slightly curved, aseptate to 1-septate, striate or verrucose, smooth-walled. **Asexual morph**: Hyphomycetous. *Mycelium* white to light brown, superficial, effused, thick subiculum. *Conidiophores* thin-walled, hyaline, unbranched, aseptate, swollen, with a short and distinct collarette, teminating in a single conidium. *Phialides* straight, smooth. *Conidia* oval to ellipsoid, aseptate to 1-septate, hyaline, smooth. Coelomycetous, *Conidiomata* sub-immersed, globose to subglobose, dark brown. *Peridium* thick-walled, wall composed of brown to hyaline cells of *textura angularis*, becoming hyaline towards inner conidiogenous region. *Conidiophores* hyaline, subcylindrical, branched apically, 1–2-septate. *Conidiogenous cells* phialidic, hyaline, fusiform to ellipsoid, straight to curved, tapering towards a subtruncate apex. *Conidia* oval to ellipsoid, aseptate to 2-septate, hyaline, with guttulate, smooth-walled (Descriptions based on Samuels and Barr 1997, Crous et al. 2007b).

Type: ***Niesslia*** Auersw.

Notes: The family *Niessliaceae* was introduced by Kirschstein (1939) based on superficial, dark, setose perithecial ascomata, and is typified by *Niesslia*. Barr (1990) proposed that the family be accepted in a narrow sense and removed it from the *Sphaeriaceae* (Müller and von Arx 1962, 1973) and *Trichosphaeriaceae* (Hawksworth et al. 1983; Barr 1983). Samuels and Barr (1997) referred the family to the order *Hypocreales*, based on the short paraphyses, periphysate ostiole, dark pigmented peridium and phialidic conidiogenesis cells. Eriksson and Hawksworth (1993) and Hawksworth et al. (1995) accepted its disposition in the *Hypocreales* based on morphological features. Species are generally saprobic or parasitic on wood, leaves or lichens. Lumbsch and Huhndorf (2010) accepted 17 genera in the family. The placement of *Niessliaceae* in the *Hypocreales* is supported by molecular data with Jaklitsch and Voglmayr (2012) showing *Niesslia exilis* (Alb. & Schwein.) G. Winter, grouping with *Eucasphaeria capensis* Crous with high support and the new genus *Rosasphaeria* in a sister group. *Valetoniellopsis* was transfered to *Hypocreales* genera *incertae sedis* (Maharachchikumbura et al. 2015). Eighteen genera were recognized in *Niessliaceae* by Maharachchikumbura et al. (2015).

Niesslia Auersw., in Gonnermann & Rabenhorst, Myc. Europ. Pyren. 5–6: 30 (1869)

Facesoffungi number: FoF 01127; Figs 99, 100, 101

Saprobic on leaves in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, solitary, superficial, cupuliform, dark brown to black, membranaceous, tuberculate, collabent when dry, surround by brown, septate setae, with spiny termination, with periphysate ostiole. *Peridium* thick, outer layer hard, composed of dark tissues, basal part mixed with host cells; inner layer composed of brown to dark brown cells of *textura angularis*. *Hamathecium* of filiform, hyaline, septate paraphyses or paraphyses absent. *Asci* 8-spored, unitunicate, oblong to clavate, stipitate, apical ring present or absent, evanescent at maturity. *Ascospores* ellipsoid to fusiform, aseptate to 1-septate, hyaline, slightly curved, smooth, mostly with guttules. **Asexual morph**: Undetermined.

Type species: ***Niesslia chaetomium*** (Corda) Auersw., in Gonnermann & Rabenhorst, Myc. Europ. Pyren. 5–6: 30 (1869)

Current name:

Niesslia exosporioides (Desm.) G. Winter, Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 197 (1885)

Notes: The genus *Niesslia* was introduced by Auerswald and includes 39 epithets according to Index Fungorum (2016). The type species, is characterized by tuberculate perithecia, surrounded by brown, septate setae, clavate asci and filiform ascospores.

Other genera included

Atronectria Etayo, in Etayo & Rosato, Biblthca Lichenol. 98: 52 (2008)

Type species: ***Atronectria magellanica*** Etayo, in Etayo & Sancho, Biblthca Lichenol. 98: 52 (2008)

Circinoniesslia Samuels & M.E. Barr, Can. J. Bot. 75(12): 2166 (1998) [1997]; Fig. 100

Type species: ***Circinoniesslia nectriae*** Samuels & M.E. Barr, Can. J. Bot. 75(12): 2166 (1998) [1997]

Cryptoniesslia Scheuer, Mycol. Res. 97(5): 543 (1993)

Type species: ***Cryptoniesslia setulosa*** Scheuer, Mycol. Res. 97(5): 543 (1993)

Eucasphaeria Crous, in Crous et al., Fungal Divers 25: 21 (2007b)

Type species: ***Eucasphaeria capensis*** Crous, in Crous et al., Fungal Divers 25: 21 (2007b)

Hyaloseta A.W. Ramaley, Mycotaxon 79: 269 (2001)

Type species: ***Hyaloseta nolinae*** A.W. Ramaley, Mycotaxon *79*: *269 (2001)*

Malmeomyces Starbäck, Bih. K. svenska Vetensk Akad. Handl., Afd. 3 25(no. 1): 32 (1899)

Type species: ***Malmeomyces pulchellus*** Starbäck [as 'pulchella'], Bih. K. svenska Vetensk Akad. Handl., Afd. 3 25(no. 1): 32 (1899)

Melanopsamma Niessl, Verh. nat. Ver. Brünn 14: 200 (1876)

Type species: ***Melanopsamma pomiformis*** (Pers.) Sacc., Michelia 1(no. 3): 347 (1878)

Melchioria Penz. & Sacc., Malpighia 11(9–10): 399 (1897)

Type species: ***Melchioria leucomelaena*** Penz. & Sacc., Malpighia 11(9–10): 399 (1897)

Miyakeomyces Hara, Bot. Mag., Tokyo 27(no. 317): (248) (1913)

Type species: ***Miyakeomyces bambusae*** Hara [as 'Miyakeamyces'], Bot. Mag., Tokyo 27(no. 317): (248) (1913)

Myrmaeciella Lindau, in Engler & Prantl, Nat. Pflanzenfam., Teil. I (Leipzig) 1: 478 (1897)

Type species: ***Myrmaeciella endoleuca*** (Sacc.) Lindau, in Engler et al., Teil. I (Leipzig) 1(1): 478 (1897)

Paraniesslia K.M. Tsui et al., Mycologia 93(5): 1002 (2001)

Type species: ***Paraniesslia tuberculata*** K.M. Tsui et al., Mycologia 93(5): 1002 (2001)

Pseudonectriella Petr., Sydowia 13(1–6): 127 (1959)

Type species: ***Pseudonectriella ahmadii*** Petr., Sydowia 13(1–6): 128 (1959)

Pseudorhynchia Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1206 [50 repr.] (1909)

Type species: ***Pseudorhynchia polyrhyncha*** (Penz. & Sacc.) Höhn. [as 'Pseudorhynchia polyrrhyncha'], (1909)

Rosasphaeria Jaklitsch & Voglmayr, Fungal Diversity 52(1): 93 (2012)

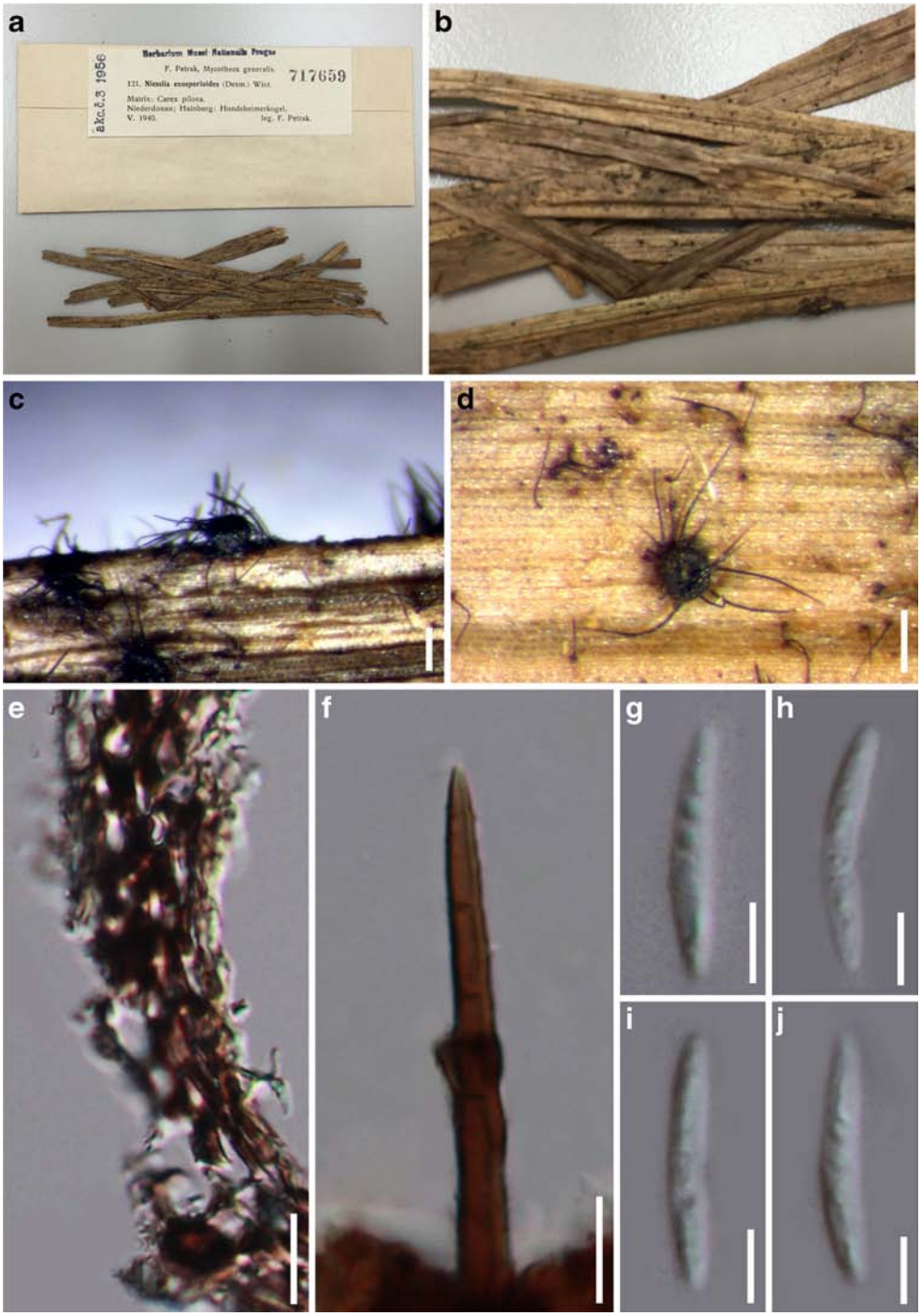


Fig. 99 ***Niesslia exosporioides*** (Material examined: GERMANY, Hainburg, Hundsheimer Kogel, Lower Danube, on dead leaves of *Carex pilosa* Scop. (*Cyperaceae*), Petrak F, May 1940, PRM 717659) **a** Material label **b** Material **c**, **d** Ascoma of the side view **d** Ascoma **e** Peridium **f** Septate seta **g-j** Ascospores. Notes: Figs e-j soaked in 3 % KOH. Scale bars: **c–d** = 200 μm, **e-f** = 10 μm, **g–j** = 5 μm

Type species: ***Rosasphaeria moravica*** (Petr.) Jaklitsch & Voglmayr, Fungal Divers 52(1): 93 (2012)

Taiwanascus Sivan. & H.S. Chang, Mycol. Res. 101(2): 176 (1997)

Type species: ***Taiwanascus tetrasporus*** Sivan. & H.S. Chang, Mycol. Res. 101(2): 176 (1997)

Trichosphaerella E. Bommer et al., Syll. fung. (Abellini) 9: 604 (1891)

Type species: ***Trichosphaerella decipiens*** E. Bommer et al., in Saccardo, Syll. fung. (Abellini) 9: 604 (1891)

Valetoniella Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1499 [39 repr.] (1909)

Type species: ***Valetoniella crucipila*** Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1500 [40 repr.] (1909)

Key to genera of *Niessliaceae*

1. Lichenicolous . . . . . ***Atronectria***
1. Not lichenicolous 2

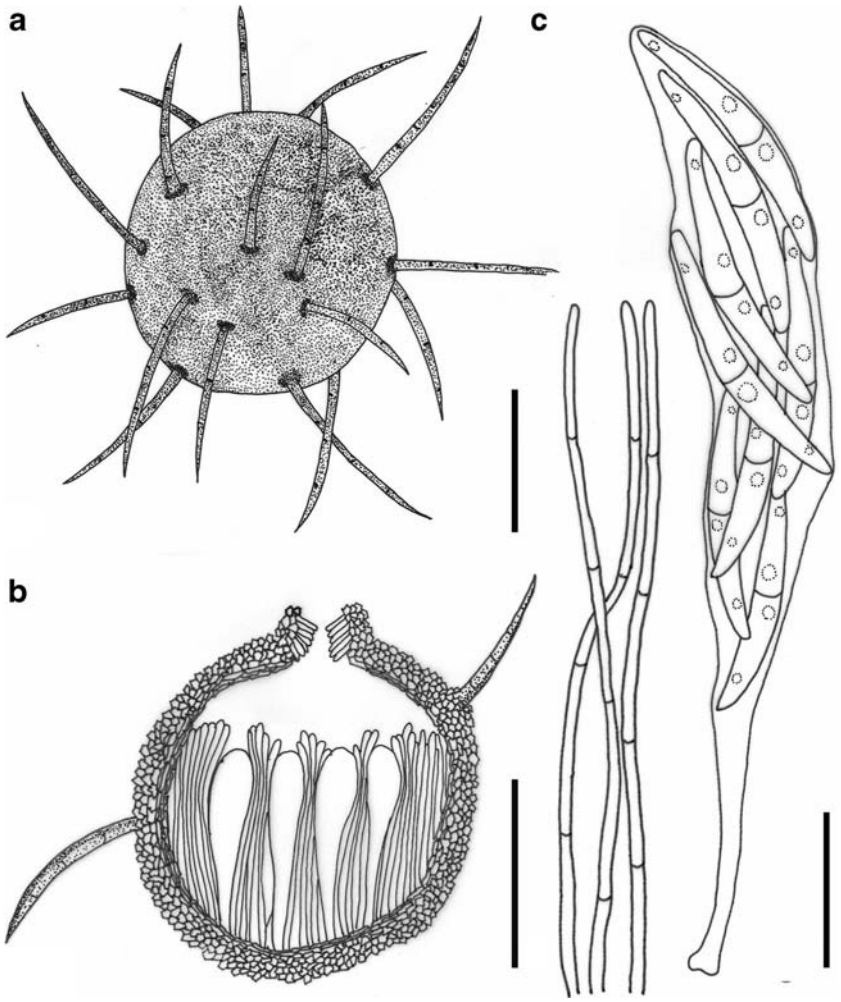
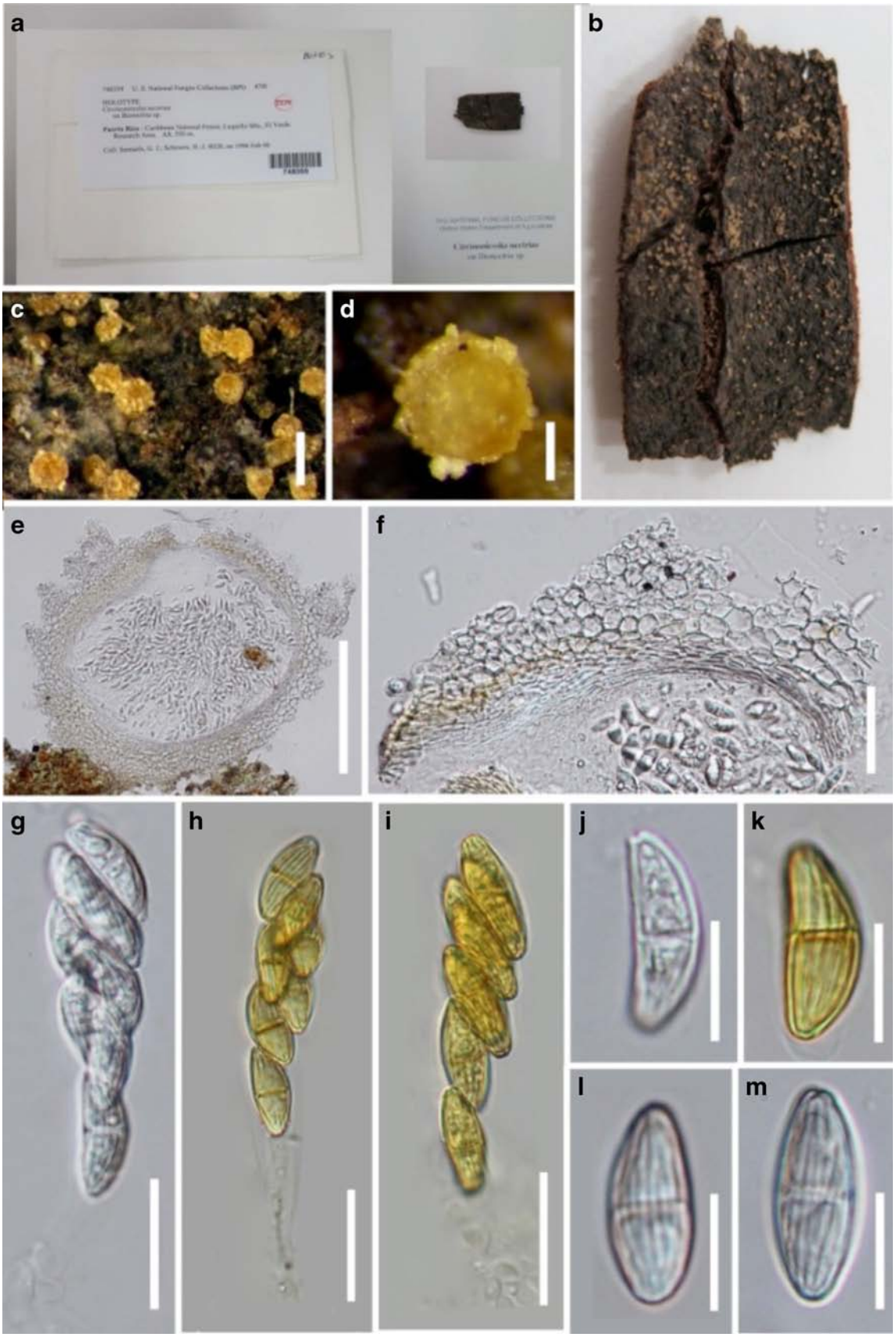


Fig. 100 *Niesslia exosporioides* (redrwn from a description by Saccardo 1882) **a** Ascoma **b** Ascoma in cross section **c** Asci. Scale bars: **a**–**b** = 100 μm, **c** = 10 μm

2. Fungicolous . . . . . ***Circinoniesslia***
2. Saprobic or parasitic on wood, leaves or stems. 3
3. Ascomata sitting on a subiculum 4
3. Ascomata sitting on the substrate 7
4. Ascomata sitting on a thick subiculum, ... 5
4. Ascomata sitting on a thin subiculum. 6
5. Bambusicolous, ascomata sitting on a black subiculum. . . . . ***Miyakeomyces***
5. Saprobic on stems, palm midribs, wood, ascomata sitting on white to brown hyphal subiculum, with hyphomycetous asexual morph . . . . . ***Trichosphaerella***
6. Ascomata sitting on the hyaline hyphal subiculum, asexual morph *Monocillium* . . . . . ***Hyaloseta***
6. Ascomata sitting on light brown hyphal subiculum, asexul morph undetermined. . . . . ***Pseudorhynchia***
7. Bambusicolous. . . . . ***Malmeomyces***
7. Saprobic or parasitic on wood, leaves and stems 8
8. Ascomata on wood submerged in freshwater habitats. . . . . ***Paraniesslia***
8. Ascomata on wood, leaves and stems in terrestrial habitats 9
9. Ascomata carbonaceous . . . . . ***Melchioria***
9. Ascomata not carbonaceous 10
10. Parasitic on leaves . . . . . ***Eucasphaeria***
10. Saprobic on wood 12
10. Saprobic on leaves 11
11. Ascomata immersed. . . . . ***Cryptoniesslia***
11. Ascomata superficial, setae elongate. . . . . ***Niesslia***
12. Ascomata erumpent, yellow, papillate orange to black. . . . . ***Myrmaeciella***
12. Ascomata superficial 13
12. Ascomata immersed, with hyphomycetous asexual morphs . . . . . ***Rosasphaeria***
13. Ascomata without setae 14
13. Ascomata with setae. 15
14. Ascomata globose, smooth or bearing conidiophores . . . . . ***Melanopsamma***
14. Ascostroma cupulate . . . . . ***Pseudonectriella***
15. Ascomata cleistothecial . . . . . ***Taiwanascus***
15. Ascomata perithecial . . . . . ***Valetoniella***

Nitschkiaceae Nannf., Nova Acta R. Soc. Scient. upsal., Ser. 4 8(no. 2): 56 (1932


a
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c
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◀ **Fig. 101** ***Circinoniesslia nectriae*** (Material examined: PUERTO RICO, Caribbean National Forest, Luquillo Mts., El Verde Research Area, alt. 350 m; *Bionectria* sp., Samuels, G. J. Schroers, H.-J. (8028), on decaying, February, 1996, BPI 748359, **holotype**) **a** Material label **b** Material **c** Ascomata **d** Ascoma **e** Vertical section of ascoma **f** Peridium **g–i** Asci **j–m** Ascospores. Note: Figures h, i and k are stained in Melzer's reagent. Scale bars: **c** = 500 μm, **d–e** = 200 μm, **f** = 50 μm, **g–i** = 20 μm, **j–m** = 10 μm

Facesoffungi number: FoF 01399

Saprobic or *parasitic* on wood, leaves or lichens, in freshwater, marine and terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, dark brown to black, gregarious, superficial to erumpent, sitting on or in a subiculum or absent, cupuliform, globose to subglobose, carbonaceous, coriaceous or membranaceous, rough, tuberculate, smooth or with short spines, with or without an ostiole, the apex collapsing when dry or shallowly cupulate when moist, periphyses inside of the ostiole or absent. *Subiculum* thin or thick, numerous or scanty, brown to dark brown, septate, branched hyphae, with spiny termination. *Peridium* thick (20–150 μm), munk pores present or absent, composed of three layers, outer layer comprising dark tissues, thin, carbonaceous; middle layer comprising dark brown to brown cells of *textura angularis*, thick, membranaceous, while the inner layer has hyaline cells of *textura prismatica*, thin, and membranaceous. *Hamathecium* with or without hyaline paraphyses, septate, simple or branched. *Asci* 4- to multi-spored, unitunicate, thin-walled, clavate to cylindrical, long or short pedicellate or sessile, blunt. *Ascospores* 2–3-seriate or irregularly arranged, hyaline or brown, fusiform, allantoid or subcylindrical, slightly curved, 0–4-aseptate, concolourous, smooth-walled, sheath and appendages present or absent, with or without guttules. **Asexual morph**: Undetermined.

Type: ***Nitschkia*** G.H. Otth ex P. Karst.

Notes: The family *Nitschkiaceae* (*Coronophorales*) was introduced by Nannfeldt (1932) based on erumpent, black, rough ascomata and clavate asci, with hyaline allantoid ascospores, and is typified by *Nitschkia fuckelii* G.H. Otth ex P. Karst. (Karsten 1873, based on *Coelosphaeria fuckelii*). Nannfeldt (1975) concluded that *Nitschkiaceae* comprised three separate groups, but the differences between them were not sufficient to place them in separate families. He accepted five genera in this family and provided a detailed morphology description. Mugambi and Huhndorf (2010) accepted twelve genera based on a multi-gene dataset and a morphological study (Lumbsch and Huhndorf 2010). The monotypic genera *Neochaetosphaerella* and *Tortulomyces* were introduced based on morphological observations (Vasilyeva et al. 2012, 2013). In our study, 14 genera are included in this family. Most taxa assigned to the family need to be evaluated at the molecular level.

Nitschkia G.H. Otth ex P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 13 (1873)

Facesoffungi number: FoF 02123; Fig. 102

Saprobic on wood in freshwater and terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, black, gregarious, superficial or erumpent, sitting on or in a subiculum or absent, globose to subglobose, carbonaceous or membranaceous, rough, with a short ostiole, the apex collapsing when dry, shallowly cupulate when moist or not collabent. *Ostiole* lined with hyaline periphyses. *Subiculum* thin or thick, numerous or scanty, brown to dark brown, septate, branched hyphae, with spiny termination. *Peridium* (20–70 μm), munk pores present, composed of three layers, outer layer comprising dark tissues, thin, carbonaceous; middle layer comprising dark brown to brown cells of *textura angularis*, thick, membranaceous; the inner layer has hyaline cells of *textura prismatica*, thin, membranaceous. *Hamathecium* comprising septate, simple paraphyses,. *Asci* 8-spored, unitunicate, clavate to cylindrical, long pedicellate, apex blunt. *Ascospores* 2–3-seriate or irregularly arranged, hyaline, allantoid or subcylindrical, slightly curved, aseptate, smooth-walled, with or without guttules. **Asexual morph**: Undetermined.

Type species: ***Nitschkia cupularis*** (Pers.) P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 81 (1873)

Notes: The taxonomy of the genus *Nitschkia* introduced by G.H. Otth ex Karsten (1873) is confused, and currently includes 65 epithets (Index Fungorum 2016). The name *Nitschkia fuckelii* was first introduced by Fuckel (1870), but Saccardo (1873) suggested *Coelosphaeria* to replace *Nitschkia*, because the spelling of "*Nitschkia*" was similar to the generic name for a diatom. Fitzpatrick (1923) reviewed the nomenclature of *Coelosphaeria* and the name was rejected. Confusion as to the type species arises because Fuckel (1870) introduced the type species *N. fuckelii* based on *Sphaeria cupularis* Fr. These two taxa, *N. fuckelii* and *N. cupularis*, differ morphologically with respect to the production of a definite pseudoparenchymatous stroma/ subiculum, respectively. Neither taxon has been sequenced, and molecular analysis is based on *Nitschhia calyculus* (Mont.) Kuntze, *N. grevillei* (Rehm) Nannf., *N. meniscoidea* Huhndorf et al. and *N. tetraspora* Nannf. (Mugambi and Huhndorf 2010).

Other genera included

Acanthonitschkea Speg., Anal. Mus. nac. B. Aires, Ser. 3 17(10): 116 (1908)

Type species: ***Acanthonitschkea argentinensis*** Speg., Anal. Mus. nac. B. Aires, Ser. 3 17(10): 116 (1908)

Biciliosporina Subram. & Sekar, Kavaka 18(1–2): 69 (1993) [1990]

Type species: ***Biciliosporina karwarensis*** Subram. & Sekar, Kavaka 18(1–2): 69 (1993) [1990]

Botryola Bat. & J.L. Bezerra, in Batista et al., Publicações Inst. Micol. Recife 431: 11 (1964)

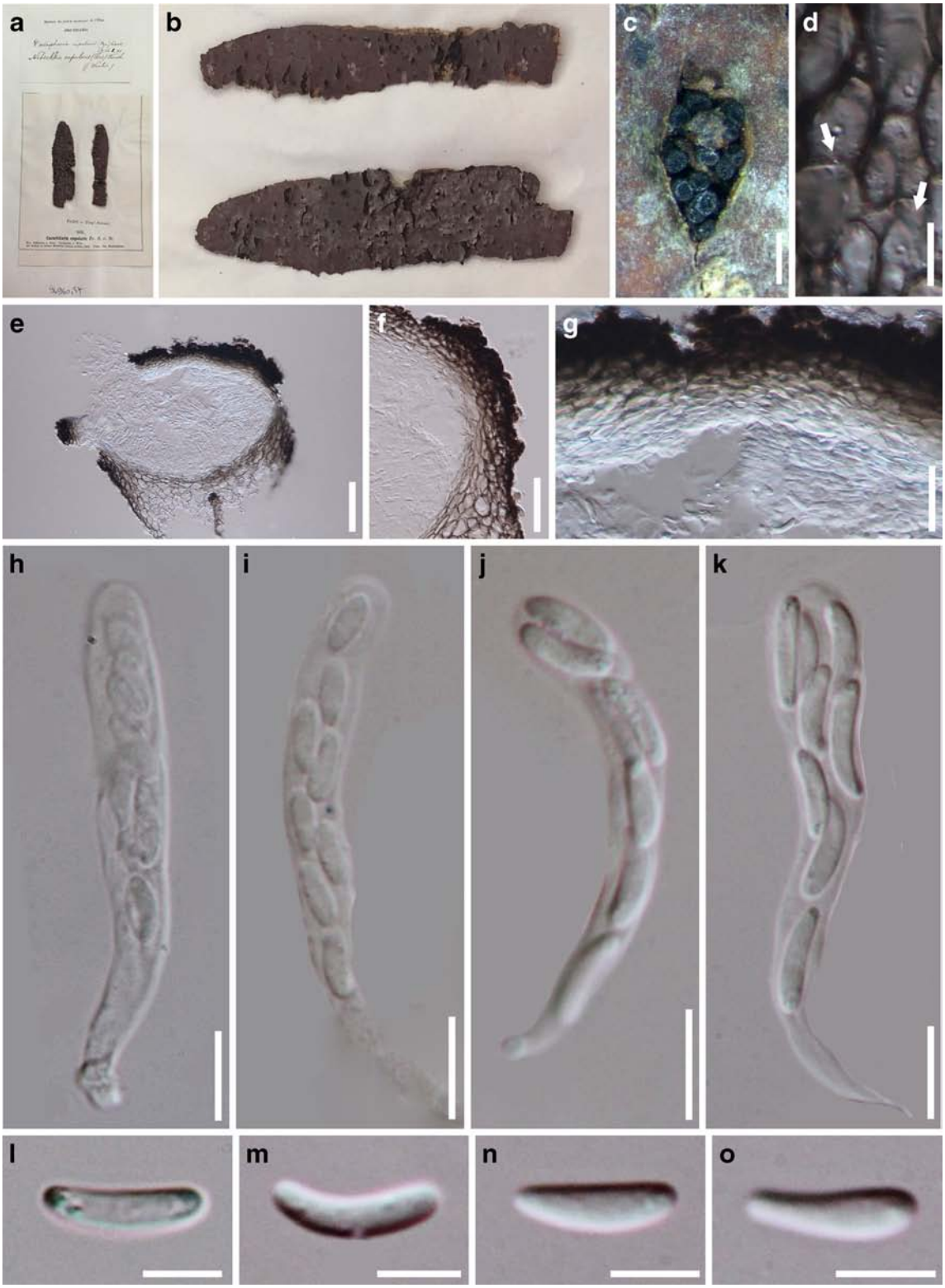


Fig. 102 ***Nitschkia cupularis*** (Material examined: on the branches of *Prunus mahaleb* L. (*Rosaceae*) and *Carpinus betulus* L. (*Betulaceae*), BR 5020096960571) **a** Material label **b** Material **c** Ascomata **d** Munk pores **e** Ascomata in cross section **f** Peridium **g** Paraphyses **h–k** Asci **l–o** Ascospores. Notes: Figs e-g. i-o are stained in KOH. Scale bars: **c** = 500 μm, **e** = 100 μm, **f** = 40 μm, **g** = 30 μm, **d. h–k** = 10 μm, **l–o** = 5 μm

Type species: ***Botryola tetrasperma*** Bat. & J.L. Bezerra, in Batista et al., Publicações Inst. Micol. Recife 431: 13 (1964)

Fracchiaea Sacc., Atti Soc. Veneto-Trent. Sci. Nat. 2: 163 (1873)

Type species: ***Fracchiaea heterogenea*** Sacc., Atti Soc. Veneto-Trent. Sci. Nat. 2: 163 (1873)

Groenhiella Jørg. Koch et al., Bot. Mar. 26(6): 265 (1983)

Type species: ***Groenhiella bivestia*** Jørg. Koch et al., Bot. Mar. 26(6): 265 (1983)

Janannfeldtia Subram. & Sekar, Kavaka 18(1–2): 69 (1993) [1990]

Type species: ***Janannfeldtia karwarensis*** Subram. & Sekar, Kavaka 18(1–2): 70 (1993) [1990]

Lasiosphaeriopsis D. Hawksw. & Sivan., in Hawksworth, Trans. Br. mycol. Soc. 74(2): 371 (1980)

Type species: ***Lasiosphaeriopsis salisburyi*** D. Hawksw. & Sivan., in Hawksworth, Trans. Br. mycol. Soc. 74(2): 373 (1980)

Loranitschkia Lar. N. Vassiljeva, Mikol. Fitopatol. 24(3): 207 (1990)

Type species: ***Loranitschkia viticola*** Lar. N. Vassiljeva [as 'Loranitschki'], Mikol. Fitopatol. 24(3): 207 (1990)

Neochaetosphaerella Lar. N. Vassiljeva et al., in Vasilyeva et al., Fungal Diversity 52(1): 192 (2012)

Type species: ***Neochaetosphaerella thaxteriospora*** Lar. N. Vassiljeva et al., in Vasilyeva et al., Fungal Diversity 52(1): 192 (2012)

Neotrotteria Sacc., Bulletino dell'orto Botanico della R. Universitá di Napoli 6: 45 (1921)

Type species: ***Neotrotteria pulchella*** Sacc., Bulletino dell'orto Botanico della R. Universitá di Napoli 6: 45 (1918)

Rhagadostoma Körb., Parerga lichenol. (Breslau) 5: 472 (1865)

Type species: ***Rhagadostoma corrugatum*** Körb., Parerga lichenol. (Breslau) 5: 473 (1865)

Rhagadostomella Etayo, Biblthca Lichenol. 84: 109 (2002)

Type species: ***Rhagadostoma corrugatum*** Körb., Parerga lichenol. (Breslau) 5: 473 (1865)

Tortulomyces Lar. N. Vassiljeva et al., Mycoscience 54(1): 110–115 (2013)

Type species: ***Tortulomyces thailandicus*** Lar. N. Vassiljeva et al., Mycoscience 54(1): 110–115 (2013)

Key to genera of *Nitschkiaceae*

1. In marine environments 2
1. In freshwater and terrestrial environments 3
2. Ascospores hyaline . . . . . ***Botryola***
2. Ascospores light brown with sheath . . . . . ***Groenhiella***
3. Lichenicolous. 4
3. Saprobic on wood 5
4. Ascomata superficial, ascospores cylindrical. . . . . ***Rhagadostomella***
4. Ascomata sub-immersed, ascospores allantoid, slightly curved . . . . . ***Rhagadostoma***
5. Ascospores brown 6
5. Ascospores hyaline 7
6. Lichenicolous, ascomata superficial . . . ***Lasiosphaeriopsis***
6. Corticolous, ascomata sub-immersed 8
7. Ascomata with setae 9
7. Ascomata without setae 11
8. Ascomata ostiolate, with spiny septate setae . . . . . ***Neochaetosphaerella***
8. Ascomata lacking ostiole, with tubercules . . . . . ***Tortulomyces***
9. Asci multi-spored. 10
9. Asci more than 8-spored . . . . . ***Acanthonitschkea***
10. Quellkörper absent . . . . . ***Fracchiaea***
10. Quellkörper present . . . . . ***Neotrotteria***
11. Ascomata immersed and erumpent through the bark 12
11. Ascomata superficial . . . . . ***Loranitschkia***
12. Quellkörper absent . . . . . ***Nitschkia***
12. Quellkörper present 13
13. Asci 8-spored, irregularly uniseriate or overlapping biseriate . . . . . ***Biciliosporina***
13. Asci more than 8-spored, not regularly arranged . . . . . ***Janannfeldtia***

Ophioceraceae Klaubauf et al., Studies in Mycology 79: 85–120 (2014).

Facesoffungi number: FoF 01254

Saprobic on wood and other plant material, commonly isolated in aquatic habitats. **Sexual morph**: *Ascomata* perithecial, solitary or in small groups, immersed or semi-immersed, dark brown to black, globose to subglobose, coriaceous, ostiolate. *Ostiole* a long neck, lined with periphyses. *Hamathecium* comprising numerous, septate, tapering, hyphae-like, thin-walled, filamentous, branched paraphyses, intermingled among asci. *Peridium* outwardly comprising small angular dark brown cells, inwardly comprising several layers of dark brown to pale brown cells of *textura angularis*. *Asci* 8-spored, unitunicate, subcylindrical to narrowly fusoid, apedicellate, with thimble-shaped, J-, apical ring. *Ascospores* fasciculate, hyaline, yellowish in mass, filiform, bluntly rounded at the apices, 3–or multi-septate. **Asexual morph**: Undetermined.

Type: ***Ophioceras*** Sacc.

Notes: The family *Ophioceraceae* was introduced as a monotypic family by Klaubauf et al. (2014) in the order *Magnaporthales* to accommodate *Ophioceras*. Previously, *Ophioceras* was placed in *Magnaporthaceae* following the phylogenetic analysis of Chen et al. (1999) and Inderbitzin and Berbee (2001). However, based on combined LSU and

RPB1 analysis, it was found that *Ophioceras* clusters separately from *Magnaporthaceae* within the order *Magnaporthales* (Thongkantha et al. 2009) and hence a new monotypic family *Ophioceraceae* was introduced to accommodate *Ophioceras* (Klaubauf et al. 2014).

Ophioceras Sacc., Syll. fung. (Abellini) 2: 358 (1883); Fig. 103

Type species: ***Ophioceras dolichostomum*** (Berk. & M.A. Curtis) Sacc., Syll. fung. (Abellini) 2: 358 (1883)

Notes: Saccardo (1883) introduced *Ophioceras* based on *O. dolichostomum* (Berk. & M.A. Curtis) Sacc., characterized by black ascomata with long necks, cylindrical asci with small, refractive, apical rings and filiform ascospores (Teng 1934; Conway and Barr 1977; Shearer et al. 1999; Tsui et al. 2001; Thongkantha et al. 2009; Klaubauf et al. 2014). *Ophioceras* species are commonly encountered on decaying woody substrates in freshwater habitats all over the world (Hyde 1992; Hyde and Goh 1998; Shearer et al. 1999; Tsui et al. 2001; Thongkantha et al. 2009). Currently 39 records of *Ophioceras* are listed in Index Fungorum (2016).

Morphologically *Ophioceras* is reminiscent of *Gaeumannomyces*, however, the two genera can be distinguished easily by the differences in their habitats. *Ophioceras* is usually associated with wood and herbaceous material in aquatic habits, while *Gaeumannomyces* species are plant pathogens (Chen et al. 1999; Klaubauf et al. 2014).

Ophiocordycipitaceae G.H. Sung et al., in Sung et al., Stud. Mycol. **57**: 35 (2007)

Facesoffungi number: FoF 01315

Parasitic on arthropods, protozoans, rotifers, nematodes, humans, animals and fungi worldwide. **Sexual morph**: *Stromata* or subiculum darkly pigmented or rarely brightly coloured, tough, fibrous, pliant to wiry, rarely fleshy, often with aperithecial apices or lateral pads. *Ascomata* superficial to completely immersed, ordinal or oblique in arrangement. *Asci* unitunicate, cylindrical, rarely fusoid to ellipsoid, usually with thickened and almost bulbous ascus apex. *Ascospores* fasciculate, usually filiform, hyaline, multi-septate, disarticulating into part-spores or non-disarticulating. **Asexual morph**: see notes.

Type: ***Ophiocordyceps*** Petch

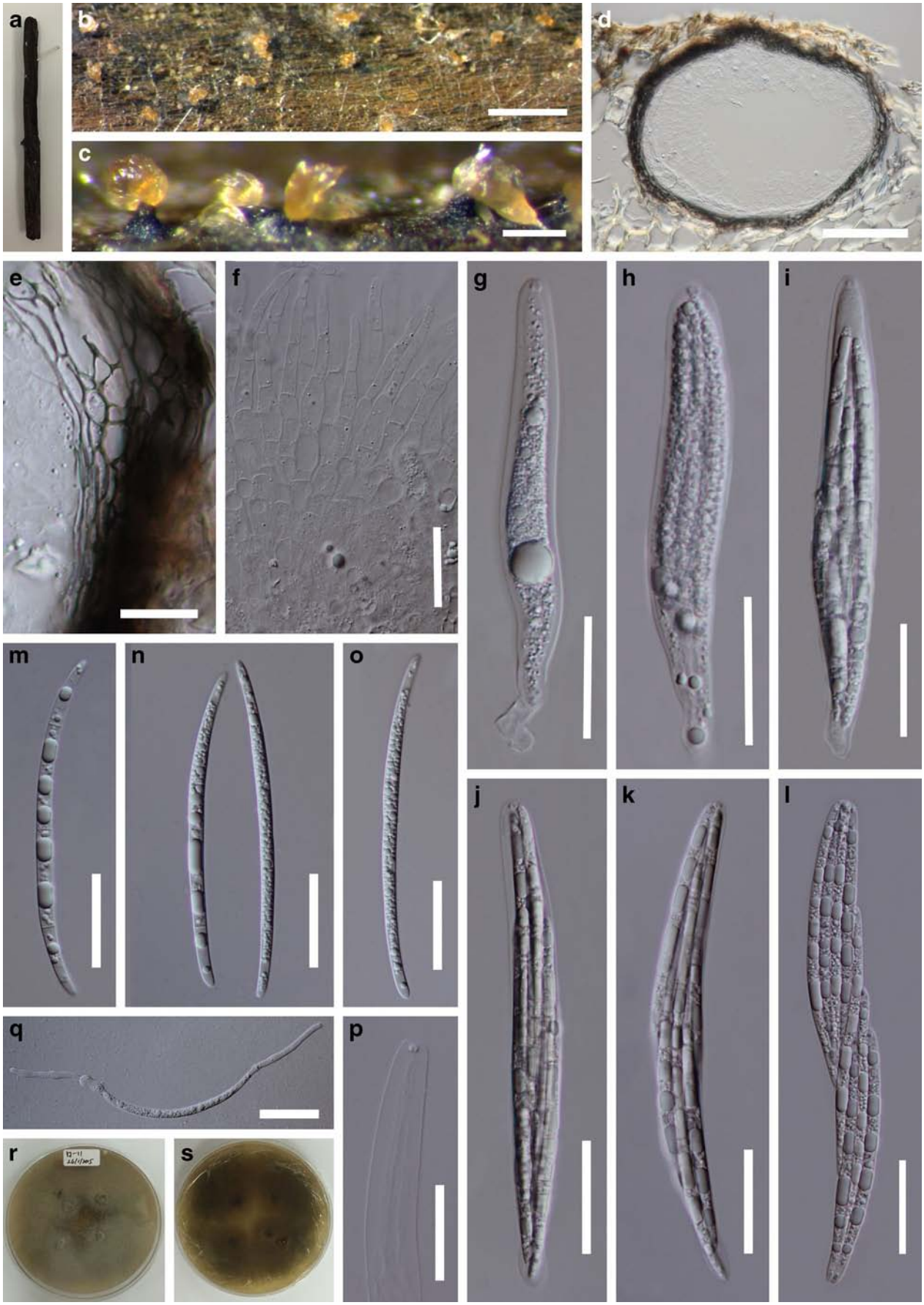
Notes: The family *Ophiocordycipitaceae* was introduced by Sung et al. (2007) based on phylogenetic analyses and later emended by Quandt et al. (2014). Quandt et al. (2014) included *Ophiocordyceps* plus six genera within *Ophiocordycipitaceae* based on morphological and phylogenetic analyses. Spatafora et al. (2015) confirmed this classification system and introduced necessary species combinations into four genera of this family, including *Drechmeria*, *Harposporium*, *Ophiocordyceps* and *Purpureocillium*. Most species in this family produce dark pigmented, tough to pliant stromata, that often possess aperithecial apices (Sung et al. 2007). The main distinguishing characters of this genus are that the ascospores do not break into part-spores at maturity and asci have thin apical caps (Petch 1931a, b). The type species is *Ophiocordyceps blattae* (Petch) Petch. This taxon was collected from Sri Lanka with only one collection and without cultural or molecular data. Asexual generic names associated with *Ophiocordyceps* include *Sorosporella* (Sorokin 1888), *Hirsutella* (Doassans and Patouillard 1892; Gams and Zare 2003), *Hymenostilbe* (Petch 1931b), *Stilbella* (Seifert 1985), *Synglioclad*ium (Petch 1932b), and *Paraisaria* (Samson and Brady 1983). Based on the morphology and sequence data, *Ophiocordyceps* was protected and other names suppressed in accordance with "one fungus one name" (Quandt et al. 2014).

Asexual morphs of the family are *Tolypocladium sensu* Gams (1971), *Chaunopycnis sensu* Gams (1980), or verticillium-like (Quandt et al. 2014). Many asexual morphs are associated with this family, some of which are restricted in their phylogenetic distribution, while others are often found in disparate lineages (Quandt et al. 2014). For example, *Verticillium* is a common asexual morph of many species in several hypocrealean families, including *Ophiocordycipitaceae*, *Cordycipitaceae* and *Clavicipitaceae* (see Zare et al. 2000; Sung et al. 2001, 2007; Gams and Zare 2001). *Ophiocordycipitaceae* are also associated with *Hymenostilbe* and *Hirsutella* asexual morphs (Kepler et al. 2013).

Tolypocladium was proposed by Quandt et al. (2014) for protection over *Elaphocordyceps* (Sung et al. 2007) and *Chaunopycnis* (Gams 1980). This genus forms a single monophyletic clade that includes truffle parasites, several insect pathogens, rotifer pathogens, mycoparasitic fungi, and general soil-inhabitants (Quandt et al. 2014). This genus is characterized by robust stipitate stroma with clavate to capitate to highly reduced stroma, comprising rhizomorphs and aggregated ascomata, which may be immersed and produced on highly reduced stromatic pads (Quandt et al. 2014). Quandt et al. (2014) list 26 new combinations within this genus.

Purpureocillium was described as a genus by Luangsa-ard et al. (2011) for the medically important *Paecilomyces lilacinus* (Thom) Samson. There are only two species in this genus: *P. lilacinum* (Thom) Samson (Luangsa-ard et al. 2011) and *P. lavendulum* (Thom) Samson (Perdomo et al. 2013a).

Fig. 103 ***Ophioceras* sp.** (Material examined: THAILAND, Chiang Rai, Tham Luang Nang Non Cave, on submerged wood, 25 November 2014, Jing Yang, YJ-11 (MFLU 15–0378) **a** Substrate **b** Colonies **c** Fruiting body **d** Section of ascoma **e** Peridium **f** Paraphyses **g–l** Asci **m–o** Ascospores **p** Apical ring of ascus **q** Germinating ascospore **r–s** Colonies on PDA (S from below). Scale bars: **b** = 500 μm, **c** = 200 μm, **d** = 100 μm, **e** = 15 μm, **f**, **j–l**, **q** = 30 μm, **g–I**, **m–p** = 25 μm


a
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According to phylogenetic analyses, the nematophagous clade separated in two clades; one containing *Harposporium* (Lohde 1874) and *Podocrella* (Seaver 1928a), and the other comprising *Drechmeria* (Gams and Jansson 1985), *Haptocillium* (Gams and Zare 2001), and *Cordyceps gunnii* (Berk.) Berk (Quandt et al. 2014). *Harposporium* was recorded as the asexual morph of *Podocrella* based on morphological and phylogenetic analyses (Chaverri et al. 2005). *Harposporium* is an older name, and the morphology of at least somewhat crescent-shaped conidia is a shared character for this clade (Quandt et al. 2014). *Harposporium* was protected over *Podocrella* as the earlier genus name. For the other clade, *Drechmeria* is an older name than *Haptocillium*. *Drechmeria* was protected as the genus name, which includes *Cordyceps gunni* (Berk.) Berk (Quandt et al. 2014).

Polycephalomyces was introduced by Kobayasi (1941), accepted as circumscribed by Seifert (1985) and emended by Kepler et al. (2013). *Polycephalomyces* is an *incertae sedis* genus currently within *Hypocreales*, as its placement has lacked support in previous phylogenetic studies (Kepler et al. 2013). Many morphological characters are shared between *Ophiocordycipitaceae* and *Polycephalomyces* as numerous species produce hirsutella-like anamorphs with conidia often borne in a slimy mass (Seifert 1985), sexual spores of *Polycephalomyces* often possess a wiry, tough, carbonaceous stipe, which is a common morphology of *Ophiocordyceps* (Kepler et al. 2013). The asexual morph includes acremonium-like, hirsutella-like and *Polycephalomyces* species (Kepler et al. 2013).

Ophiocordyceps Petch, Trans. Br. mycol. Soc.16(1): 73 (1931)

Facesoffungi number: FoF 01318; Fig. 104

Parasitic on arthropods, worldwide. **Sexual morph**: *Stromata* or *subiculum* darkly pigmented or rarely brightly coloured, tough, fibrous, pliant to wiry, rarely fleshy, often with aperithecial apices or lateral pads. *Ascomata* superficial to completely immersed, ordinal or oblique in arrangement. *Asci* cylindrical, 8-spored, rarely fusoid to ellipsoid, usually with thickened ascus apex. *Ascospores* fasciculate, hyaline usually cylindrical, multi-septate, disarticulating into part-spores or non-disarticulating.

Type species: ***Ophiocordyceps blattae*** (Petch) Petch, Trans. Br. mycol. Soc.16(1): 74 (1931)

Notes: This genus was introduced by Petch (1931a) and used by Sung et al. (2007) as the type genus of *Ophiocordycipitaceae*. Quandt et al. (2014) emended this genus based on morphological and phylogenetic analyses. According to phylogenetic analyses, the oldest name in *Ophiocordycipitaceae* clade is *Sorosporella*, a synonym of *Syngliocladium*. *Sorosporella* was suppressed (Quandt et al. 2014) while *Syngliocladium* was previously treated with respect to the second oldest name *Hirsutella* (Evans and Samson 1982). According to morphological analyses and economic value of the genus, *Ophiocordyceps* should be protected over the other names.

Other genera included

Drechmeria W. Gams & H.-B. Jansson, Mycotaxon 22(1): 36 (1985)

Type species: ***Drechmeria coniospora*** (Drechsler) W. Gams & H.-B. Jansson, Mycotaxon 22(1): 37 (1985)

Harposporium Lohde, Tagbl. Versamml. Ges. Deutsch. Naturf. 47: 206 (1874)

Type species: ***Harposporiuman guillulae*** Lohde, Tagebl. Versamm dt. naturf. Ärzte (Breslau) 47: 203–206 (1874)

Polycephalomyces Kobayasi, Sci. Rep. Tokyo Bunrika Daig., Sect. B 5: 245 (1941)

Type species: ***Polycephalomyces formosus*** Kobayasi, Sci. Rep. Tokyo Bunrika Daig., Sect. B 5: 245 (1941)

Purpureocillium Luangsa-ard et al., in Luangsa-ard et al., FEMS Microbiol. Lett. 321(2): 144 (2011)

Type species: ***Purpureocillium lilacinum*** (Thom) Luangsa-ard et al., in Luangsa-ard et al., FEMS Microbiol. Lett. 321(2): 144 (2011)

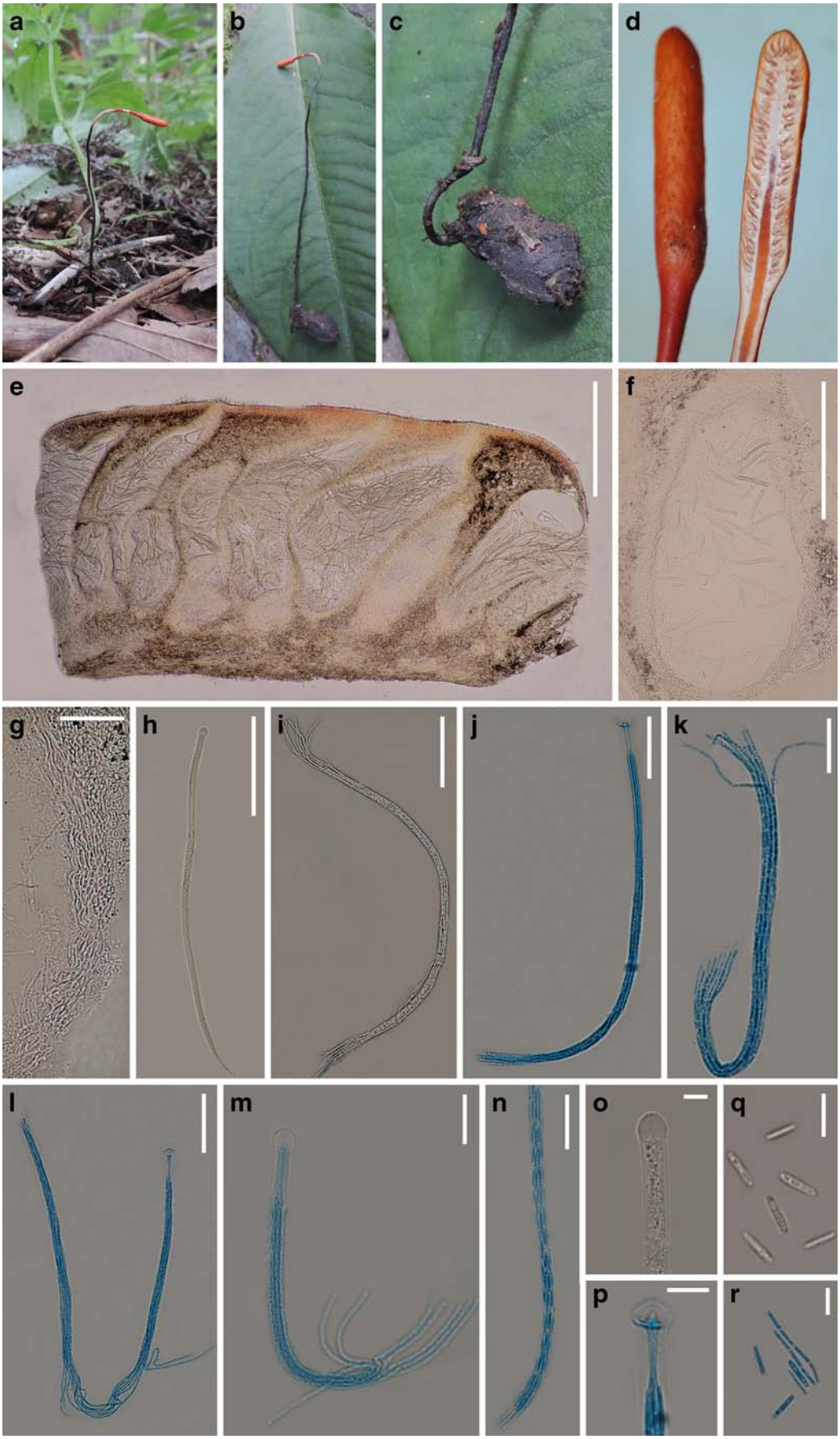
Tolypocladium W. Gams, Persoonia 6(2): 185 (1971)

Type species: ***Tolypocladiumin flatum*** W. Gams, Persoonia 6(2): 185 (1971)

Key to genera of *Ophiocordycipitaceae*

1. Sexual morph 2
1. Asexual morph. 6
2. Ascospores breaking into part spores 3
2. Ascospores not breaking into part spores . . . . . ***Ophiocordyceps***
3. Ascospores breaking into many small part spores. . . . 4
3. Ascospores breaking into two lanceolate multi-septate part spores . . . . . ***Harposporium***
4. Stromata multi-furcate, stromata apex infertile . . . . . ***Polycephalomyces***
4. Stromata with single stalk, apex fertile 5

Fig. 104 ***Ophiocordyceps nutans*** (Material examined: CHINA. Province of Jiang-Xi, on dead stinkbug. 18 June 2014, Yuan-Pin Xiao JGS 2014061810 (MFU 15-3201). **a** Stromata growing out from leaf litter **b** Overview of stromata and the host. **c** The infected host **d** Cross sections showing the complete stromata and perithecia **e**, **f** Sections of ascomata **g** Part of perithecia **h-i** Asci **n** Part of ascospore. **j-n** Asci stained in methylene blue **o** Asci with apical cap **p** Asci stained in methylene blue with apical cap **q** Part spores **r** Part spores in methylene blue. Scale Bars: **e** = 2 mm, **f**, **h–l**, **n** = 1 mm, **g** = 20 μm, **m** = 500 μm, **o–r** = 10 μm ▶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5. Stromata with perithecial apices or lateral pads . . . . . ***Ophiocordyceps***
5. Stromata with a highly reduced stromatic pad. . . . . ***Tolypocladium***
6. Conidia straight to slightly curved or ellipsoidal to fusiform, host arthropod or vertebrate . . . ***Purpureocillium***
6. Conidia crescent-shaped, helical, host protozoan. . . . . ***Drechmeria***

Ophiostomataceae Nannf., Nova Acta R. Soc. Scient. upsal., Ser. 4 8(no. 2): 30 (1932)

Facesoffungi number: FoF 01807

Saprobic or *parasitic* on woody plants, occasionally on herbaceous plants. **Sexual morph**: *Ascomata* superficial, perithecial or cleistothecial, globose to subglobose, with external hairs, pale-brown, dark-brown or black, with long ostiolar neck or sometimes lacking ostioles. *Ostiolar neck* long and slender, brown to dark brown at the base, pale-brown to hyaline at the apex, comprising parallel hyphae with pigmented cell walls, and numerous, filamentous, septate, pale-brown to hyaline ostiolar hyphae. *Peridium* pseudoparenchymatous, the outer wall layers composed of angular cells with thickened, pigmented walls, and lined by thin-walled, hyaline, cells of *textura angularis*. *Asci* 8–spored, unitunicate, thin-walled, fusiform, globose to subglobose, oblong to clavate, deliquescent. *Ascospores* bi- to multi-seriate, variable in shape, frequently asymmetrical, oval, cylindrical, ellipsoidal, reniform, or falcate, aseptate or 1-septate, hyaline or appearing yellowish in mass, some with sheath-like structure, a hyaline outer layer of wall. **Asexual morph**: Hyphomycetous. *Conidiophores* synnematous or mononematous, simple, branched, bearing a brush-like apical, branching structure, erect, hyaline or dark brown to black. *Conidiogenous cells* holoblastic phialides, some proliferating at or somewhat below the apex and giving rise to another series of denticles or conidiogenous cells. *Conidia* solitary or aggregated, fusiform, obovate to oblong, cylindrical, hyaline to pale reddish-brown, aseptate, some forming in a viscid head.

Type: ***Ophiostoma*** Syd. & P. Syd.

Notes: The family *Ophiostomataceae* was introduced by Nannfeldt (1932). Prior to 1980, this family was treated in the order *Plectascales* (Nannfeldt 1932), *Microascales* (Luttrell 1951), *Sphaeriales* (Ainsworth and Bisby 1954; von Arx 1978), or as a synonym of the *Endomycetaceae* in the *Endomycetales* (Redhead and Malloch 1977). Later, the order *Ophiostomatales*, was introduced by Benny and Kimbrough (1980) to accommodate the family *Ophiostomataceae*.

The members of this family are mostly saprobes on sapwood. These fungi are specialized with sticky spores to facilitate insect dispersal. Many bark beetles act as vectors of ophiostomatoid fungi, especially species of *Ophiostoma*, *Leptographium* and *Ceratocytiopsis* (Upadhyay 1981; Jacobs and Wingfield 2001; Zipfel et al. 2006). Many species of ophiostomatoid fungi cause sap stain or blue stain fungi on freshly cut logs and affect timber quality (Seifert 1993), and several species are important pathogens of *Protea* spp., *Pinus* spp., *Larix* spp., *Tsuga* spp. and *Pistacia* spp. (Wingfield et al. 1988; Jacobs and Wingfield 2001; Roets et al. 2013).

This family was originally described with three genera including *Ophiostoma*, *Ceratostomella* and *Endoconidiophora* (Nannfeldt 1932). Recently, De Beer et al. (2013) accepted *Ceratocystiopsis*, *Fragosphaeria*, *Graphium*, *Leptographium*, *Ophiostoma* and *Raffaelea* based on phylogenetic inference. Maharachchikumbura et al. (2015) provided an updated outline of the family *Ophiostomataceae* with 12 genera, which included sexual (*Subbaromyces*, *Klasterskya*, *Fragosphaeria*, *Ophiostoma*, *Ceratocystiopsis* and *Spumatoria*) and asexual (*Leptographium*, *Pesotum*, *Phialographium*, *Raffaelea*, *Hyalobelemnospora* and *Hyalorhinocladiella*) morph genera. In phylogenetic analysis of combined LSU, SSU, TEF and RPB2 sequence data, *Ophiostomataceae* formed a well-supported sister clade to *Ophioceraceae* (*Magnaporthales*) and *Annulatascaceae* (*Annulatascales*). It was also confirmed that *Ceratocystiopsis*, *Fragosphaeria*, *Ophiostoma* and *Raffaelea* belong in the family *Ophiostomataceae* (Maharachchikumbura et al. 2015).

Ophiostoma Syd. & P. Syd., Annls mycol. 17(1): 43 (1919)

Facesoffungi number: FoF 01808; Fig. 105

Saprobic or weak *parasites* on decaying woody substrates. **Sexual morph**: *Ascomata* superficial, perithecial, globose to subglobose, dark brown to black, with long ostiolar neck. *Ostiole* occasionally comprising two or three necks, long, becoming pale brown to hyaline at the apex, including ostiolar hyphae, hyphae pale brown to hyaline, filamentous, septate, with an outer layer of thin-walled, dark cells. *Peridium* pseudoparenchymatous, comprising hyaline to pale-brown, cells of *textura angularis*. *Asci* 8-spored, unitunicate, pear-shaped, evanescent. *Ascospores* bi- to multi-seriate, allantoidal in side view, elliptical in face view and circular in end view, surrounded by a thick, hyaline sheath, in end view apparently triangular, aseptate. **Asexual morph**: Hyphomycetous. *Conidiophores* synnematous or mononematous, erect, dark brown to black at the base, becoming light brown or subhyaline towards the apex. *Conidiogenous cells* annellidic, cylindrical, hyaline. *Conidia* unicellular, oblong or clavate to obovate, hyaline.

Type species: ***Ophiostoma pilifera*** (Fr.) C. Moreau, Revue Mycol., Paris 17 (Suppl. Colon. no. 1): 22 (1952)

Notes: The genus *Ophiostoma* was introduced by Sydow and Sydow (1919), with *Ophiostoma piliferum* (Fr.) Sydow & Sydow (1919) as the type species. De Beer et al. (2013) accepted 134 species in the genus. Some species are important tree pathogens. The best known examples are *Ophiostoma*

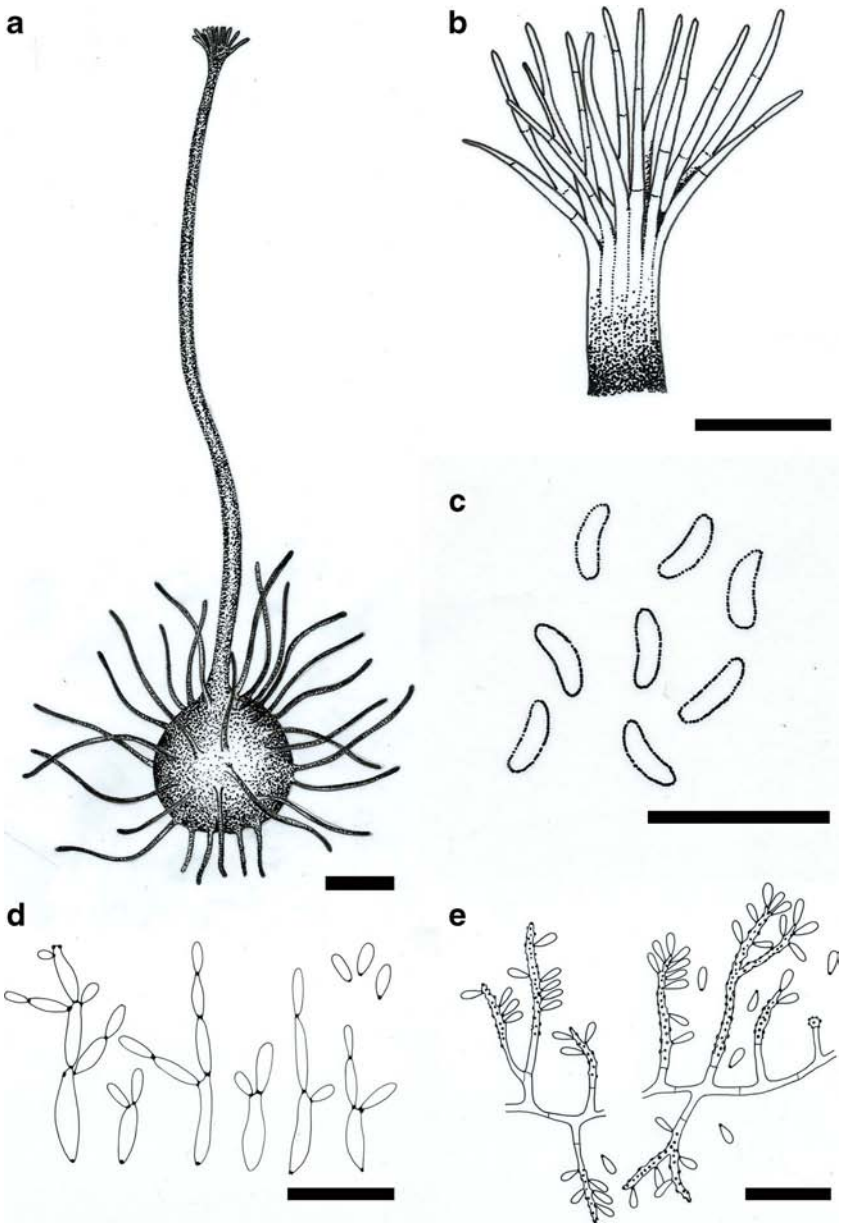


Fig. 105 ***Ophiostoma pilifera*** **a** Ascomata **b** Ostiolar region with ostiolar hyphae **c** Ascospores **d** Conidiophores and conidia of the *Raffaelea* state **e** Conidiophores and conidia of the *Hyalorhinocladiella* state (redrawn from Osorio 1985)

ulmi (Buisman) Melin & Nannf and *O. novo-ulmi* Brasier, the causal agents of Dutch elm disease, which are effectively transmitted by elm bark beetles (Webber and Gibbs 1989; Brasier 1991).

Other genera included

Ceratocystiopsis H.P. Upadhyay & W.B. Kendr., Mycologia 67(4): 799 (1975)

Type species: ***Ceratocystiopsis minuta*** (Siemaszko) H.P. Upadhyay & W.B. Kendr., Mycologia 67(4): 800 (1975)

Equicapillimyces S.S.Y. Wong et al., Veterinary Microbiology 115(2–4): 406 (2012)

Type species: ***Equicapillimyces hongkongensis*** S.S.Y. Wong et al., Veterinary Microbiology 115(2–4): 406 (2012)

Fragosphaeria Shear, Mycologia 15(3): 124 (1923)

Type species: ***Fragosphaeria purpurea*** Shear, Mycologia 15(3): 124 (1923)

Hyalobelemnospora Matsush., Matsush. Mycol. Mem. 7: 54 (1993)

Type species: ***Hyalobelemnospora amazonica*** Matsush., Matsush. Mycol. Mem. 7: 54 (1993)

Hyalorhinocladiella H.P. Upadhyay & W.B. Kendr., Mycologia 67(4): 800 (1975)

Type species: ***Hyalorhinocladiella minuta–bicolor*** (R.W. Davidson) H.P. Upadhyay & W.B. Kendr., Mycologia 67(4): 800 (1975)

Klasterskya Petr., Annls mycol. 38(2/4): 225 (1940)

Type species: ***Klasterskya acuum*** (Mouton) Petr., Annls mycol. 38(2/4): 227 (1940)

Leptographium Lagerb. & Melin, in Lagerberg et al., Svensk Skogsvårdsförening Tidskr. 25: 257 (1927)

Type species: ***Leptographium lundbergii*** Lagerb. & Melin, in Lagerberg et al., Svensk Skogsvårdsförening Tidskr. 25: 248 (1927)

Pesotum J.L. Crane & Schokn., Am. J. Bot. 60: 347 (1973)

Type species: ***Pesotum ulmi*** (M.B. Schwarz) J.L. Crane & Schokn., Am. J. Bot., Suppl. 60(4): 348 (1973)

Phialographium H.P. Upadhyay & W.B. Kendr., Mycologia 66(1): 183 (1974)

Type species: ***Phialographium sagmatosporae*** H.P. Upadhyay & W.B. Kendr., Mycologia 66(1): 183 (1974)

Raffaelea Arx & Hennebert, Mycopath. Mycol. appl. 25: 310 (1965)

Type species: ***Raffaelea ambrosiae*** Arx & Hennebert, Mycopath. Mycol. appl. 25: 310 (1965)

Spumatoria Massee & E.S. Salmon, Ann. Bot., Lond. 15: 350 (1901)

Type species: ***Spumatoria longicollis*** Massee & E.S. Salmon, Ann. Bot., Lond. 15: 350 (1901)

Subbaromyces Hesselt., Bull. Torrey bot. Club 80: 511 (1953)

Type species: ***Subbaromyces splendens*** Hesselt., Bull. Torrey bot. Club 80: 511 (1953)

Key to the sexual genera of *Ophiostomataceae*

1. Ascospores with septate 2
1. Ascospores aseptate 3
2. Ascospores 1-septate 4
2. Ascospores more than 1-septate . . . . ***Equicapillimyces***
3. Ascomata perithecial 5
3. Ascomata cleistothecial . . . . . ***Fragosphaeria***
4. Perithecium forming a disc or collar-like structure . . . . . ***Subbaromyces***
4. Perithecium not forming a disc or collar-like structure . . . . . ***Klasterskya***
5. Asci fusiform to clavate 6
5. Asci pear-shaped . . . . . ***Ophiostoma***
6. Ascospores falcate, with sheath . . . . . ***Ceratocystiopsis***
6. Ascospores obovoid, without sheath. . . . . ***Spumatoria***

Key to the asexual genera of *Ophiostomataceae*

1. Conidiophores mononematous 2
1. Conidiophores synnematous. 3
2. Conidiophores hyaline, with simple branching 4
2. Conidiophores dark, bearing a brush-like apical branching structure . . . . . ***Leptographium***
3. Conidia formed in a viscid head. . . . . ***Pesotum***
3. Conidia not formed in a viscid . . . . . ***Phialographium***
4. Conidiophores aggregated 5
4. Conidiophores single . . . . . ***Raffaelea***
5. Conidia aggregated . . . . . ***Hyalorhinocladiella***
5. Conidia solitary . . . . . ***Hyalobelemnospora***

Papulosaceae Winka & O.E. Erikss., Mycoscience 41 (2): 102 (2000)

Facesoffungi number: FoF 01284

Saprobic in freshwater or marine habitats. **Sexual morph**: *Ascomata* occurring singly, immersed or semi-immersed, black to dark brown, globose to ellipsoidal, coriaceous, ostiolate. *Necks* long, periphysate. *Peridium* thick, composed of cells of *textura angularis* or brown-walled compressed cells. *Hamathecium* comprising tapering, simple or branched, septate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical, short pedicellate, with a J-, refractive, bipartite or discoid, apical ring. *Ascospores* uniseriate to biseriate, hyaline or brown, ellipsoidal or fusiform, unicellular to 3-septate, smooth or verruculose, with or without cup-like, bipolar appendages. **Asexual morph**: Undetermined.

Type: ***Papulosa*** Kohlm. & Volkm.-Kohlm.

Notes: *Papulosaceae* is a monotypic family introduced by Winka and Eriksson (2000) based on morphology and SSU rDNA sequence data. Winka and Eriksson (2000) concluded that the exact phylogenetic position of the genus *Papulosa* could not be established, due to the small number of SSU sequences available for unitunicate pyrenomycetes at that time. *Papulosa* seemed to be closely related to *Diaporthales*, *Ophiostomatales*, *Phyllachorales* and *Sordariales* based on molecular data, thus the genus was accommodated in the subclass *Sordariomycetidae*. Phylogenetic analyses of Maharachchikumbura et al. (2015) placed *Papulosaceae* as a sister clade to *Coniochaetaceae* and the order *Annulatascales*. The genera *Brunneosporella* and *Fluminicola* are predominantly found in freshwater habitats and resemble other genera in *Annulatascaceae* with cylindrical asci and a large bipartite apical ring and were placed in family *Annulatascaceae* by Ranghoo et al. (2001); Wong et al. (1999); Zelski et al. 2011. *Brunneosporella* differs from *Fluminicola* in having brown, 1-septate, smooth ascospores, whereas *Fluminicola* has hyaline, 3-septate ascospores with cup-like, bipolar appendages. Abdel-Wahab et al. (2011) analyzed only LSU sequence data and found that *Brunneosporella* and *Fluminicola* clustered with *Papulosa amerospora* and *Cataractispora receptaculorum* W.H. Ho, K.D. Hyde & Hodgkiss. A similar clustering was seen in phylogenetic analyses carried out by Réblová et al. (2013) using LSU, SSU, *rpb-2* sequence data, wherein both *Brunneosporella* and *Fluminicola* appear in the same clade as that of *Papulosa* and *Pleurophragmium parvisporum* (Preuss) Hol.-Jech. and were marked as *Papulosaceae*. In LSU and SSU sequence analyses carried

out by Boonyuen et al. (2012), *Brunneosporella* (as *Ascobrunneispora aquatica* Ranghoo, K.D. Hyde & E.C.Y. Liew) clustered with *Papulosa*. Maharachchikumbura et al. (2015) placed *Brunneosporella* and *Fluminicola* in *Papulosaceae*. The phylogenetic tree prepared by Boonyuen et al. (2012) shows that many annulatascaceous genera, which were previously placed in *Annulatascaceae*, are scattered and do not cluster with the familial type, *Annulatascus velatispora* K.D. Hyde. These genera were placed in Sordariomycetidae *incertae sedis*. Thus a molecular phylogenetic approach is needed to resolve the position of these genera in *Annulatascaceae* and confirm the composition of *Annulatascaceae sensu stricto*.

Papulosa Kohlm. & Volkm.-Kohlm., Syst. Ascom. 11(2): 96 (1993)

Facesoffungi number: FoF 01285; Figs 106, 107

Saprobic on culms of saltmarsh plant *Juncus roemerianus* Scheele in marine habitats. **Sexual morph**: *Ascomata* occurring singly, dark brown, immersed, subglobose, ostiolate, with a long periphysate neck. *Peridium* composed of *textura angularis*. *Hamathecium* comprising tapering, simple, septate, hyaline paraphyses. *Asci* 8-spored, cylindrical, pedicellate, with a bipartite, IKI positive, apical ring. *Ascospores* uniseriate, unicellular, hyaline, ellipsoidal, verruculose, without appendages. **Asexual morph**: Undetermined.

Type species: ***Papulosa amerospora*** Kohlm. & Volkm.-Kohlm., Syst. Ascom. 11(2): 96 (1993)

Notes: The monotypic genus *Papulosa* was established by Kohlmeyer and Volkmann-Kohlmeyer (1993) and occurs on *Juncus roemerianus* in salt marshes in the USA.

Other genera included

Brunneosporella Ranghoo & K.D. Hyde, Mycol. Res. 105(5): 625 (2001)

Type species: ***Brunneosporella aquatica*** Ranghoo & K.D. Hyde, in Ranghoo et al., Mycol. Res. 105(5): 625 (2001)

Fluminicola S.W. Wong et al., Fungal Diversity Res. Ser. 2: 190 (1999)

Type species: ***Fluminicola bipolaris*** S.W. Wong et al., Fungal Diversity 2: 190 (1999)

Key to the genera of *Papulosaceae*

1. Ascospores smooth-walled, brown; asci with discoid apical ring. . . . . ***Brunneosporella***
   1. Ascospores verruculose, hyaline; asci with bipartite apical ring. 2
   2. Ascospores 1-celled, without appendages. . . ***Papulosa***
   2. Ascospores 3-septate, with cup-like, bipolar appendages. . . . . ***Fluminicola***

Pestalotiopsidaceae Maharachch. & K.D. Hyde, in Senanayake et al., Fungal Divers 73: 107 (2015)

Facesoffungi number: FoF 0666

Saprobic or *pathogenic* on plants. **Sexual morph**: *Ascomata* scattered, solitary or in small groups, immersed, apex short erumpent. *Ostiole* subglobose, papillate ostiolar canal periphysate. *Peridium* comprising several layers of dark brown to blackish, compressed cells. *Hamathecium* comprising tapering paraphyses. *Asci* 8-spored, unitunicate, cylindrical, short to long pedicellate, with a J+, or J-, apical ring. *Ascospores* uniseriate, brown, ovoid to elliptic, straight or inequilateral, 2–3-septate. **Asexual morph**: Coelomycetous. *Conidiomata* acervular or pycnidial, subglobose, globose, clavate, solitary or aggregated, dark brown to black, immersed to erumpent, unilocular or irregularly pluri-loculate. *Peridium* comprising 2–3 strata of *textura angularis*, outer layer of pale brown, thick-walled cells, becoming hyaline in the inner layer. *Conidiophores* indistinct, often reduced to conidiogenous cells, when present peripheral, hyaline, branched or unbranched, cylindrical or lageniform. *Conidiogenous cells* discrete, holoblastic, annellidic, indeterminate, integrated, cylindrical, hyaline, smooth. *Conidia* ellipsoid to clavate, or fusiform, straight or curved, 3–4-euseptate, hyaline, pale olivaceous or brown, bearing cellular, filiform or attenuated appendages.

Type: ***Pestalotiopsis*** Steyaert

Notes: *Pestalotiopsidaceae* is a recently introduced family that possesses pestalotiopsis-like asexual morphs (Senanayake et al. 2015). The other genera belonging to *Pestalotiopsidaceae* are *Ciliochorella*, *Lepteutypa*, *Monochaetia*, *Neopestalotiopsis*, *Pseudopestalotiopsis* and *Seiridium*. Previously, all these genera were assigned to *Amphisphaeriaceae*. Members of the *Pestalotiopsidaceae* are common phytopathogens that cause a variety of diseases in plants or are often isolated as saprobes or endophytes and are widely distributed throughout tropical and temperate regions (Guba 1961; Barr 1975; Nag Raj 1993; Maharachchikumbura et al. 2014). The sexual morph of *Pestalotiopsis* is *Pestalosphaeria* (Barr 1975) and *Seiridium* has a *Lepteutypa* sexual morph (Nag Raj 1985).

Pestalotiopsis Steyaert, Bull. Jard. bot. État Brux. 19: 300 (1949)

Facesoffungi number: FoF 02124; Figs 108, 109

Saprobic or *pathogenic* on plants. **Sexual morph**: *Ascomata* scattered or gregarious, immersed, subglobose to globose, with central black irregular ostioles. *Peridium* comprising 3–5 layers of brown, relatively thick-walled cells of *textura angularis*, inner cells flattened and thin-walled.

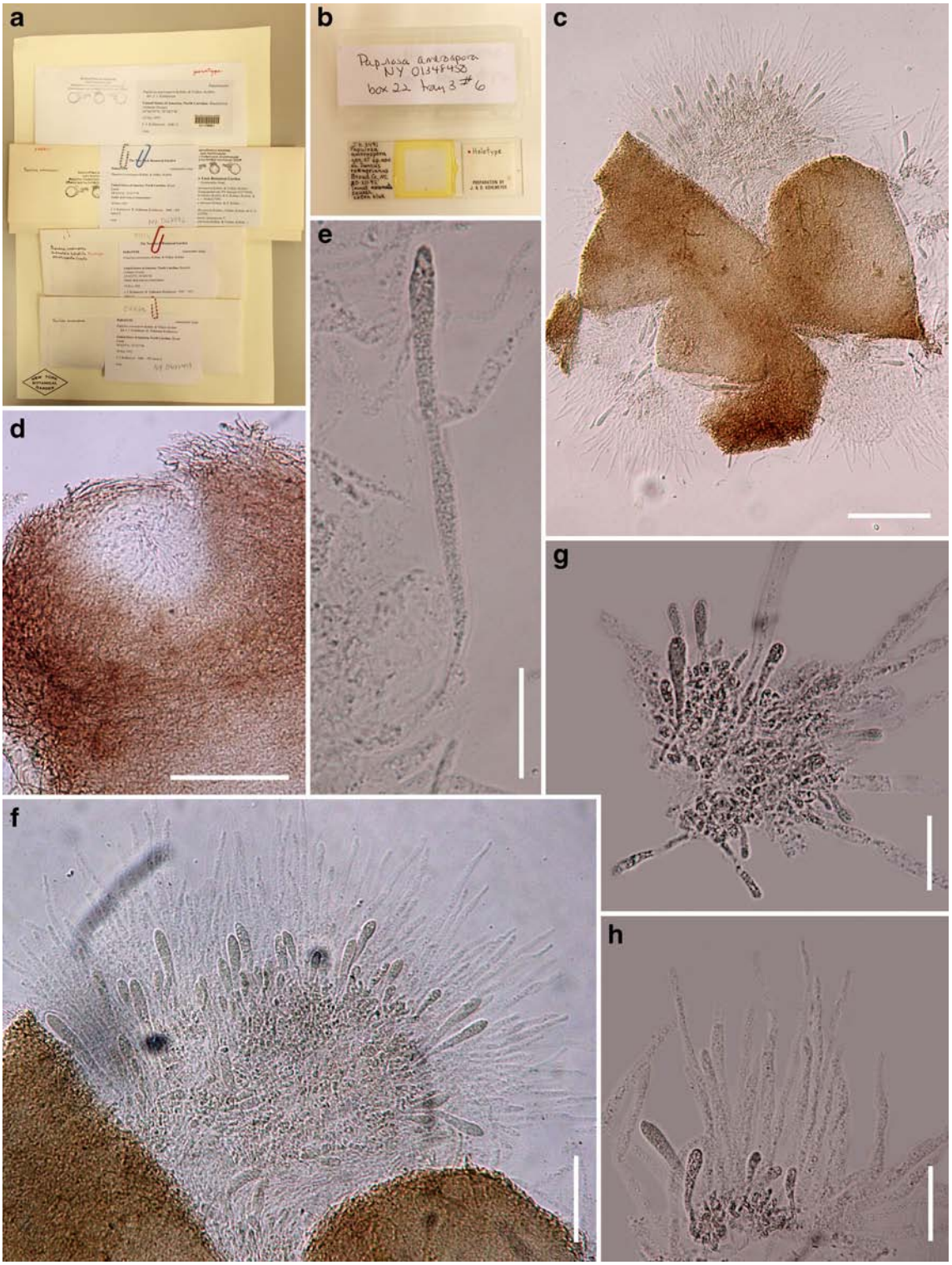


Fig. 106 ***Papulosa amerospora*** (Material examined: USA, North Carolina, Carteret County, Broad Creek, on dead standing culms of *Juncus roemerianus* Scheele (*Juncaceae*), 20 December 1992, J. Kohlmeyer 5491 (NY 01348450, **holotype**) **a–b** Herbarium packet **c** Squash mount of ascoma **d** Vertical section through ostiole **e** Immature ascus **f–h** Developing asci with paraphyses. Scale bars: **c** = 100 μm; **d**, **f** = 50 μm; **e**, **g**, **h** = 20 μm

Paraphyses with few septa, base relatively wide and tapering to free ends. *Asci* 8-spored, unitunicate, cylindrical, pedicel short, with a distinct J+, amyloid apical ring in ascus apex. *Ascospores* uniseriate, or 1-seriate in the upper part and 2-seriate at the base, oblong to ellipsoidal or fusiform, smooth or verrucose, pale yellowish brown. **Asexual morph**:

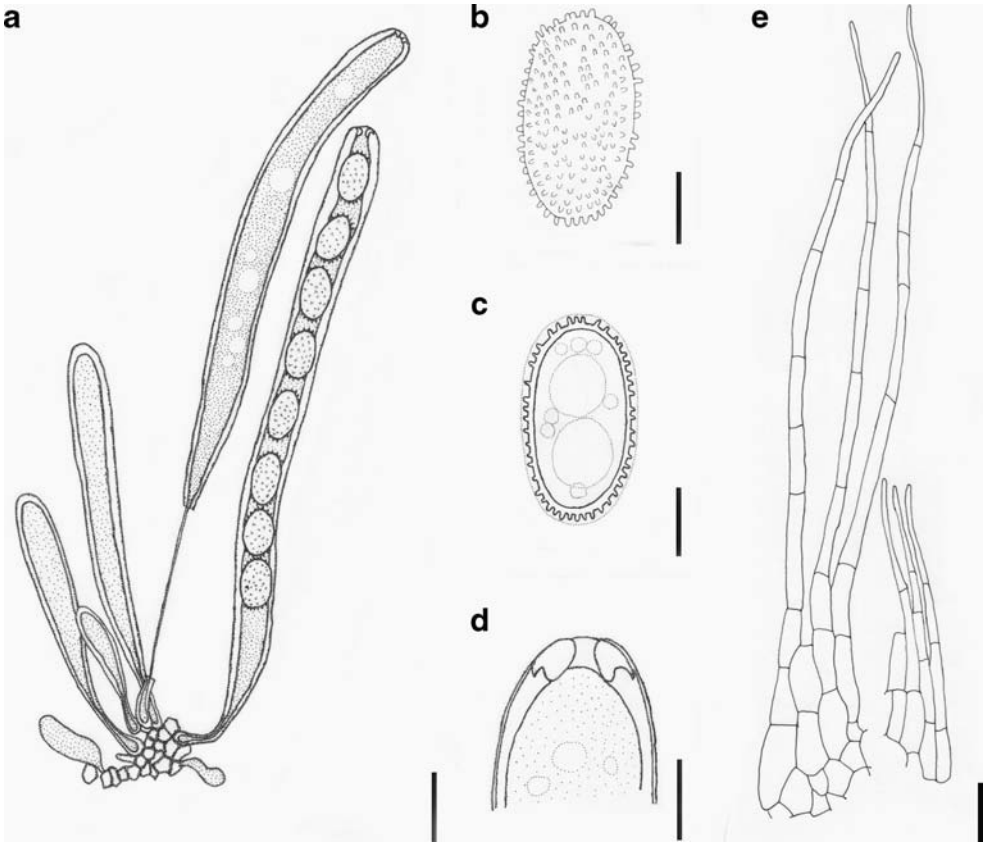


Fig. 107 ***Papulosa amerospora*** (redrawn from Kohlmeyer and Volkmann-Kohlmeyer 1993) **a** Asci at different stages of development **b**, **c** Ascospores in surface view and optical section **d** Apex of ascus, showing apical ring **e** Paraphyses (*left*) and hairs on ascomata (*right*). Scale bars: **a**, **e** = 20 μm; **b**, **c**, **d** = 5 μm

Conidiomata acervular or pycnidial, subglobose, globose, clavate, solitary or aggregated, dark brown to black, immersed to erumpent, unilocular to pluri-loculate. *Conidiophores* branded and septate, occasionally reduced to conidiogenous cells, hyaline, smooth. *Conidiogenous cells* discrete, cylindrical, ampulliform to lageniform, hyaline, smooth- and thin-walled; conidiogenesis initially holoblastic, percurrent proliferations to produce additional conidia at slightly higher levels. *Conidia* fusoid, ellipsoid, subcylindrical, straight to slightly curved, 4-septate, slightly constricted at septa; basal cell conical to cylindric with a truncate base; three median cells doliiform, concolourous, light brown to olivaceous, wall rugose to verruculose; apical cell conic to cylindrical, thin- and smooth-walled; with tubular apical appendages, one to many, filiform or attenuated, flexuous, branched or unbranched, with or without spatulate tips; basal appendage single, tubular, centric.

Type species: ***Pestalotiopsis maculans*** (Corda) Nag Raj, Mycotaxon 22(1): 47 (1985)

Notes: Based on the conidial forms, Steyaert (1949) split *Pestalotia* into three genera, namely *Pestalotia*, *Pestalotiopsis* and *Truncatella. Pestalotiopsis* was introduced for species with 5-celled conidia and *P. maculans* is regarded as the type species. The sexual morph of *Pestalotiopsis* is *Pestalosphaeria* and only 13 species are known as compared to the asexual morph (295 species names). Maharachchikumbura et al. (2011) pointed out that the common *Pestalotiopsis* name should be applied to both morphs. *Pestalotiopsis* species have often been isolated as endophytes and due to their ability to switch life-modes, many pathogens or endophytes may persist as saprobes (Zhang et al. 2012a,b; Maharachchikumbura et al. 2014).

Other genera included

Ciliochorella Syd., in Sydow & Mitter, Annls mycol. 33(1/2): 62 (1935)

Type species: ***Ciliochorella mangiferae*** Syd., Annls mycol. 33(1/2): 63 (1935)

Lepteutypa Petr., Annls mycol. 21(3/4): 276 (1923)

Type species: ***Lepteutypa fuckelii*** (Nitschke) Petr., Annls mycol. 21(3/4): 276 (1923)

Monochaetia (Sacc.) Allesch., Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1(7): 665 (1902) [1903]

Type species: ***Monochaetia monochaeta*** (Desm.) Allesch., Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1(7): 667 (1902) [1903]

Neopestalotiopsis Maharachch. et al., in Maharachchikumbura et al., Stud. Mycol. 79: 135 (2014)

Type species: ***Neopestalotiopsis protearum*** (Crous & L. Swart) Maharachch. et al., in Maharachchikumbura et al., Stud. Mycol. 79: 147 (2014)

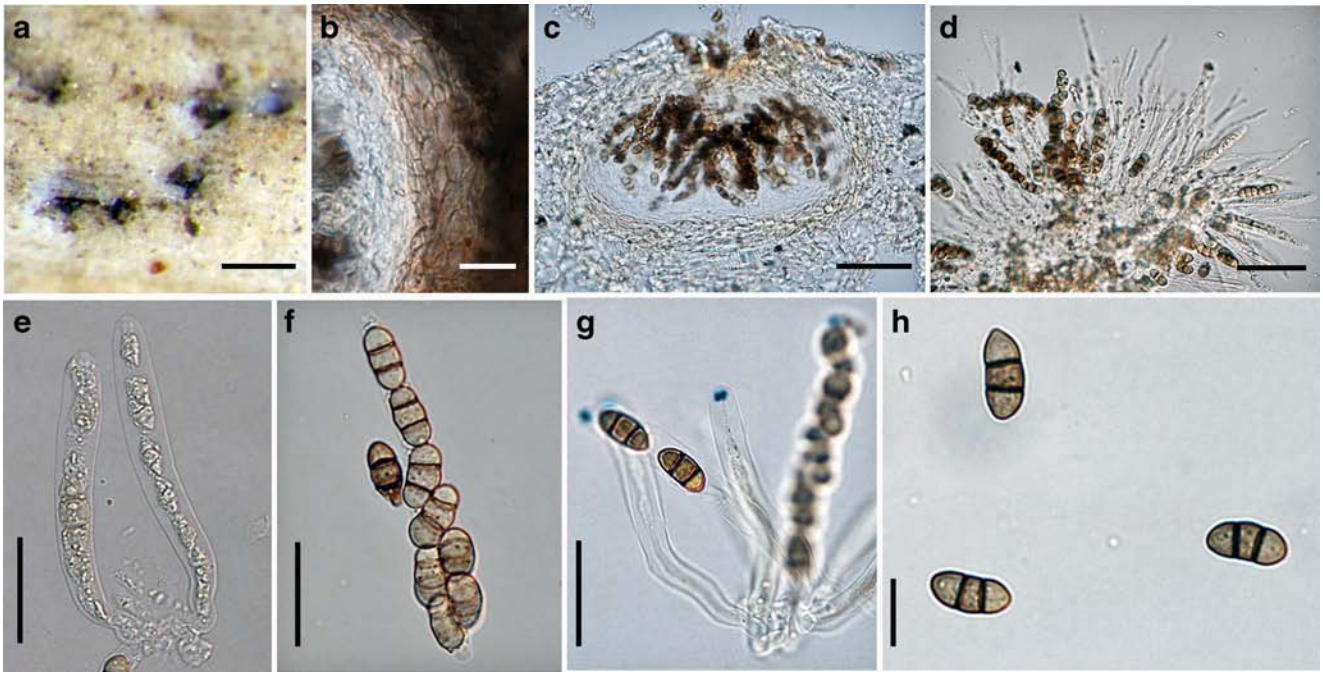


Fig. 108 ***Pestalotiopsis trachicarpicola*** **– sexual morph** (Material examined: CHINA, Yunnan Province, Kunming, Kunming Botanical Gardens, on leaf spots on living leaves of *Trachycarpus fortunei* Beccari (*Arecaceae*), March 2011, K.D. Hyde OP068 (IFRD 9026, **holotype**) **a** Conidiomata on living leaves **b** Peridium with five cell layers **c** Section of ascomata **d** Asci and paraphyses **e-f** Mature and immature unitunicate asci **g** Asci in Melzer's reagent, note the distinct J+ apical ring **h** Ascospores. Scale Bars: **a** = 200 μm, **d**, **e–g** = 20 μm, **c** = 50 μm, **h** = 10 μm

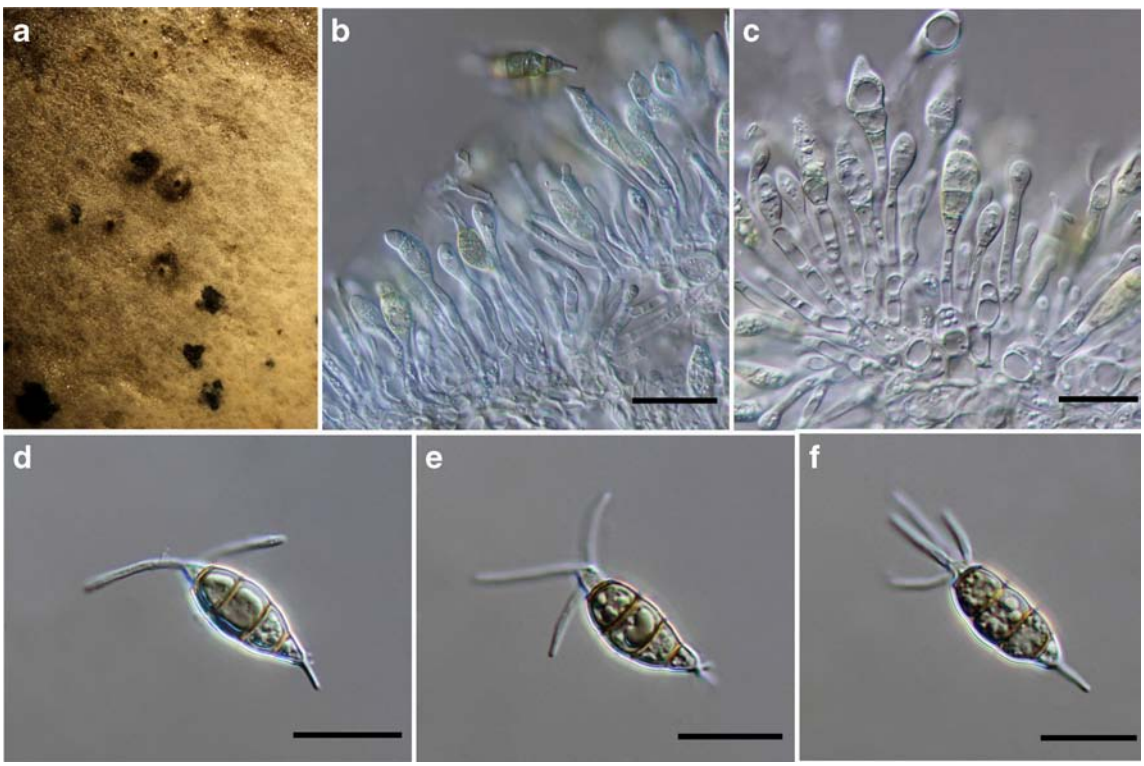


Fig. 109 ***Pestalotiopsis clavata*** **– asexual morph** (Material examined: CHINA, Yunnan Province, Kunming, Kunming Botanical Garden, living leaf of *Buxus* sp., 19 March 2002, Wenping Wu KBG26-5 (MFLUCC 12-0268, **ex-type**) **a** Conidiomata sporulating on PDA **b–c** Conidiogenous cells **d–f** Conidia. Scale bars = 20 μm

Pseudopestalotiopsis Maharachch. et al., in Maharachchikumbura et. al., Stud. Mycol. 79: 180 (2014)

Type species: ***Pseudopestalotiopsis theae*** (Sawada) Maharachch. et al. in Maharachchikumbura et al., Stud. Mycol. 79: 183 (2014)

Seiridium Nees, Syst. Pilze (Würzburg): 22 (1816) [1816–17]

Type species: ***Seiridium marginatum*** Nees, Syst. Pilze (Würzburg): 23 (1816) [1816–17]

Key to asexual genera of *Pestalotiopsidaceae*

1. Conidia 3-septate . . . . . ***Ciliochorella***
1. Conidia more than 3-septate 2
2. Conidia 4-septate 3
2. Conidia 5-septate . . . . . ***Seiridium***
3. Conidia with 1 apical appendage . . . . . ***Monochaetia***
3. Conidia with 1 to many apical appendage 4
4. Conidia concolourous 5
4. Conidia versicolourous. . . . . ***Neopestalotiopsis***
5. Conidia light concolourous . . . . . ***Pestalotiopsis***
5. Conidia dark concolourous. . . . . ***Pseudopestalotiopsis***

Phaeochoraceae K.D. Hyde et al., in Hyde et al., Syst. Ascom. 15(1–2): 118 (1997)

Facesoffungi number: FoF 01910

Saprotrophic or *biotrophic* on leaves of palms. **Sexual morph**: *Stromata* scattered as blackened regions on the host, rarely inconspicuous, usually raising the substrate surface, 1–to multi-loculate, ostiole conspicuous or not. *Ascomata* ellipsoidal to subglobose, dark brown, clustered or solitary, if solitary single ostiolate, when clustered ostiolar necks together to form a multi-ostiolate cavity. *Ostioles* conspicuous or inconspicuous. *Peridium* several layered, composed of flattened, brown to dark brown-walled cells, thinner at the base. *Interascal tissue* present only in some taxa, composed of paraphyses-like hyphae, wide, septate, tapered, thin-walled, guttulate, evanescent at maturity. *Asci* 6–8-spored, unitunicate, fusiform or saccate, very thin-walled, long or short pedicellate, usually without apical structures, deliquescing early. *Ascospores* uniseriate to biseriate, yellow to olivaceous or various shades of brown, aseptate, ellipsoidal, fusiform or cylindrical, thick-walled, sometimes with one flattened face, sometimes delicately striate, with or without appendages. **Asexual morph**: Coelomycetous. *Conidiogenous cells* narrowly conical, usually proliferating percurrently, but occasionally sympodially, periclinal thickening visible, without a collarette. *Conidia* aseptate, narrowly fusiform to bacillar, hyaline, thin-walled (Hyde et al. 1997; Hyde and Cannon 1999; Taylor and Hyde 2003).

Type: ***Phaeochora*** Höhn.

Notes: The family *Phaeochoraceae* was introduced by Hyde et al. (1997) to accommodate *Phaeochora* and two other genera (*Serenomyces*, *Cocoicola*) previously placed in the *Phyllachoraceae*. Later, *Phaeochoropsis* was also included in this family based on morphology (Hyde and Cannon 1999). Although Hyde et al. (1997) tentatively placed this family in the order *Phyllachorales*, no molecular data are available to confirm its phylogenetic placement and assign it to any order. This family is characterized by ascomata developing in a pseudostromata aseptate brown ascospores, and clavate to saccate evanescent asci Hyde et al. 1997; Hyde and Cannon 1997). The description above is a combination of characters from Hyde et al. (1997), Hyde and Cannon (1999) and Taylor and Hyde (2003).

Phaeochora Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1513 [53 repr; in clave] (1909)

Facesoffungi number: FoF 02125; Fig. 110

Saprotrophic or *biotrophic* on leaves of palms. **Sexual morph**: *Stromata* scattered as blackened regions, shiny black, conspicuous on upper and lower leaf surfaces, rarely coalescing, uniloculate to multi-loculate, composed of brown cells of *textura globosa* and crystalline granules. *Ostiole* inconspicuous. *Ascomata* oblate to subglobose, dark brown. *Peridium* several layered, composed of strongly flattened, brown-walled cells, thinner at the base. *Periphyses* and *interascal tissue* lacking. *Asci* 8-spored, unitunicate, thin-walled, saccate, short pedicellate, without an apical ring, evanescent. *Ascospores* biseriate, triseriate to multi-seriate or irregular. golden to mid-brown, aseptate, ellipsoidal to fusiform, with one flattened face, thick-walled, smooth or minutely verruculose, with globose, hyaline appendages near the apices of the flattened surface. **Asexual morph**: Coelomycetous. *Peridium* single layered, composed of brown cells of *textura angularis. Conidiogenous cells* narrowly conical, usually proliferating percurrently, occasionally sympodially, periclinal thickenings visible, without collarette. *Conidia* aseptate, narrowly fusiform to bacillar, hyaline, thin-walled.

Type species: ***Phaeochora chamaeropis*** (Cooke) Höhn. [as 'chamaeropsidis'], Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1513 [53 repr; in clave] (1909)

Notes: von Höhnel (1909) introduced the genus *Phaeochora* to accommodate *Auerswaldia chamaeropis* (Cooke) Sacc. (Syn. *Dothidea chamaeropis* Cooke). It was recognized by 'phyllachoroid' stromata embedded in the epidermis and parenchyma, and not disrupting the covering epidermal layer. Hohnel consider *A. chamaeropis* as the type and introduced another species, *A. densa* E. Bormmer & M. Rousseau to the genus. However *A. densa* was transferred to *Sphaerodothis* (Sacc. & P. Syd.) Shear by Shear (1909), but its identity remains unclear. Study by Joly (1961) only provide a short description to the *Sphaerodothis* and the host species was not recorded by the original authors, the fungaus has described simply as occurring on *Coriaceous* leaves in Costa Rica. Müller (1965) clarified the earliar name of the type

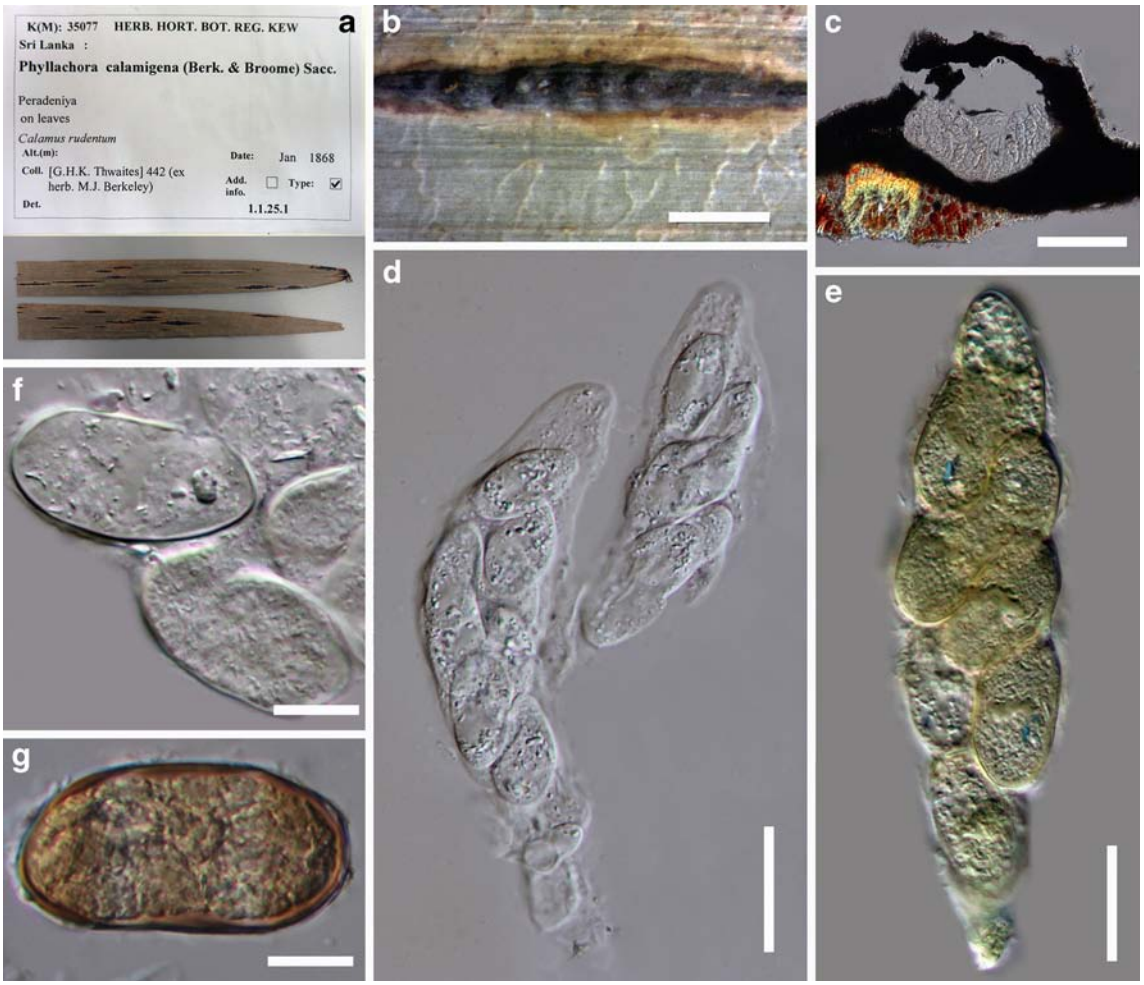


Fig. 110 ***Phaeochora calamigena*** (Material examined: SRI LANKA, Peradeniya, on leaves of *Calamus rudentum* Lour. (*Arecaceae*), G.H.K. Thwaites 442 (ex herb. M.J. Berkeley), January 1868 (K(M) 35077, **holotype**) **a** Herbarium material with label **b** Stromata on host substrate **c** Transverse section through stroma showing ascoma **d** Immature asci **e** Ascus in Melzer's reagent **f**, **g** Immature and mature ascospores. Scale bars: **b**, **c** = 200 μm, **d**, **e** = 20 μm, **f**, **g** = 10 μm

species of *Phaeochora* as *Sphaeria steinhelii* Mont. and transferred it as *Phaeochora steinhelii* Mont. E. Mull. *Phaeochora* is superficially similar to *Sphaerodothis*, and the two genera were treated as synonyms by von Arx & Müller (1954) and Joly (1961). However, the Genus *Phaeochora* is characterized by oblate to subglobose ascomata and golden to mid-brown, aseptate, ellipsoidal to fusiform, ascospores with appendages near the apices of the flattened surface (Hyde et al. 1997).

Other genera included

Cocoicola K.D. Hyde, Nova Hedwigia 60(3–4): 600 (1995)

Type species: ***Cocoicola cylindrospora*** (C. Booth & D.E. Shaw) K.D. Hyde, Nova Hedwigia 60(3–4): 600 (1995)

Phaeochoropsis K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 30 (1999)

Type species: ***Phaeochoropsis neowashingtoniae*** (Shear) K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 33 (1999)

Serenomyces Petr., Sydowia 6(1–4): 296 (1952)

Type species: ***Serenomyces shearii*** Petr., Sydowia 6(1–4): 296 (1952)

Key to the genera of *Phaeochoraceae*

1. Ascospores asymmetrical 2
   1. Ascospores symmetrical 3
   2. Ascospores, striate, surrounded by mucilage when young, without polar appendages . . . ***Phaeochoropsis***
2. Ascospores smooth or verrucose, not surrounded by mucilage, with polar appendages . . . . . ***Phaeochora***
3. Ascospores light brown . . . . . ***Serenomyces***
3. Ascospores yellow or olivaceous . . . . . ***Cocoicola***

Phlogicylindriaceae Senan. & K.D. Hyde, in Senanayake et al., Fungal Diversity 73: 35 (2015)

Facesoffunginumber: FoF 00681

Saprobic on leaves, twigs and branches, presently known only from dicotyledons. **Sexual morph**: *Pseudostroma* scattered, solitary, immersed, black, thick around papilla, thinner towards the base. *Ascomata* forming under pseudostroma, scattered, solitary, globose, coriaceous, brown to black, ostiolate, papillate. *Papilla* short, narrow. *Peridium* comprising outer, brown to light brown, thick-walled cells of *textura angularis* and inner, hyaline, thin-walled cells of *textura angularis*. *Hamathecium* comprising septate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical, short pedicellate, rounded at apex, with J+ discoid subapical ring. *Ascospores* overlapping uniseriate, hyaline, fusiform, rounded at ends, equally 1-septate, slightly constricted at septa. **Asexual morph**: Coelomycetous. *Conidiomata* slimy, erect tufts of hyaline conidial masses, synnematous, indeterminate, turning brown with age. *Conidiophores* consisting of an intricate network of brown, smooth, branched cells. *Conidiogenous cells* hyaline, annellidic, smooth, becoming pale brown with age, ampulliform with elongated necks, with percurrent proliferations. *Conidia* formed apically, hyaline, cylindrical with obtusely rounded apex, aseptate to 1-septate.

Type: ***Phlogicylindrium*** Crous et al.

Notes: The family *Phlogicylindriaceae* was introduced by Senanayake et al. (2015) to accommodate the genus *Phlogicylindrium* Crous et al. (Summerell et al. 2006) and *Ciferriascosea* Senan. et al. The type species, *Phlogicylindrium eucalypti* Crous et al. has no known sexual morph and was reported occurring in association with a *Mycosphaerella* species causing lesions on living leaves of *Eucalyptus*. *Phlogicylindrium* has unique characteritics that include slimy conidiomata, with erect tufts of hyaline conidial masses, and hyaline, unicellular to 1-septate, cylindrical conidia, with obtusely rounded apices (Summerell et al. 2006). The genus *Ciferriascosea*, which had sexual characteristics, showed a close affinity to the species of *Phlogicylindrium* based on their phylogeny, and was placed in this family by Senanayake et al. (2015). The genus comprises two species, the type *C. rectamurum* Senan. et al. (illustrated) and *C. fluctamurum* Senan. et al., both of which occured on *Spartium junceum*, in Italy. The description and illustration provided of the asexual morph, is based on Summerell et al. (2006).

Phlogicylindrium Crous et al., in Summerell et al., Fungal Diversity 23: 340 (2006); Fig. 111

Type species: ***Phlogicylindrium eucalypti*** Crous et al., in Summerell et al., Fungal Diversity 23: 340 (2006)

Notes: The genus comprises three species, the type *P. eucalypti* Crous, Summerb. & Summerell, *P. eucalyptorum* Crous and P. *uniforme* Crous & Summerell all occuring on species of *Eucalyptus*, from Australia (Farr and Rossman 2016; Index Fungorum 2016).

Other genera included

Ciferriascosea Senan.et al., in Senanayake et al., Fungal Divers 73: 35 (2015); Fig. 112

Type species: ***Ciferriascosea rectamurum*** Senan. et al., in Senanayake et al., Fungal Diversity 73: 107 (2015)

Phyllachoraceae Theiss. & P. Syd., Annls mycol. 13(3/4): 168 (1915)

Facesoffungi number: FoF 01329

Parasitic on plants in terrestrial and rarely aquatic habitats. **Sexual morph**: Leaf spots on host black, abundant, scattered, raised, mostly rounded to oblong or elongated, sometimes parallel with leaf venation, surrounded by light brown necrotic region. *Ascomata* flattened, globose, with thin walls, lying in leaf tissues or in a stroma and maturing in living leaves, ostiolate, ostiolar canal conical, wide, lacking periphyses. *Peridium* clypeate, thickest adjacent to ostiolar canal, composed of a deeply melanized, brown-black, amorphous layer of host cuticle and epidermal cells, often merging with a lighter pigmented region of brownish, distorted parenchyma cells infiltrated with fungal hyphae, beneath the clypeus. Lower and lateral peridium composed of two layers; an outer region comprising several layers of dark brown, flattened, thin-walled fungal cells, which merge inwardly with several layers of hyaline, flattened, thin-walled fungal cells. Lateral peridium fuses outwardly with an irregular, narrow region of distorted host parenchyma infiltrated by fungal cells. The basal peridium merges outwardly with either a narrow zone of infiltrated and distorted host parenchyma and occasionally lower epidermal cells, or integrates directly with a lower clypeus, similar in construction to that basal peridium. *Paraphyses* numerous, persistent, filiform, branched or unbranched, septate, slightly longer than asci. *Asci* 8-spored, persistent, cylindrical to fusiform, short pedicellate, with walls uniform in thickness, not especially thickened at apex, apical ring often present rarely absent, J-, or J+ *Ascospores* 1–3 seriate, fusiform to narrowly oval, usually hyaline, aseptate or rarely septate, often with a mucilaginous sheath, with or without an attenuated base, sometimes with pad like appendages. **Asexual morph**: Coelomycetous, with conidia in locules within a stroma, spermatial or disseminative. *Conidiomata* similar to ascomata, immersed, subcuticular, strongly raising the host surface, occasionally pycnidial, occupying the region between the cuticle and epidermis, ostiolate. *Conidiogenous cells* arising from the basal and lateral walls, cylindrical, phialidic, aseptate, hyaline, forming conidia singly at the apex. *Conidia* hyaline, filiform, aseptate.

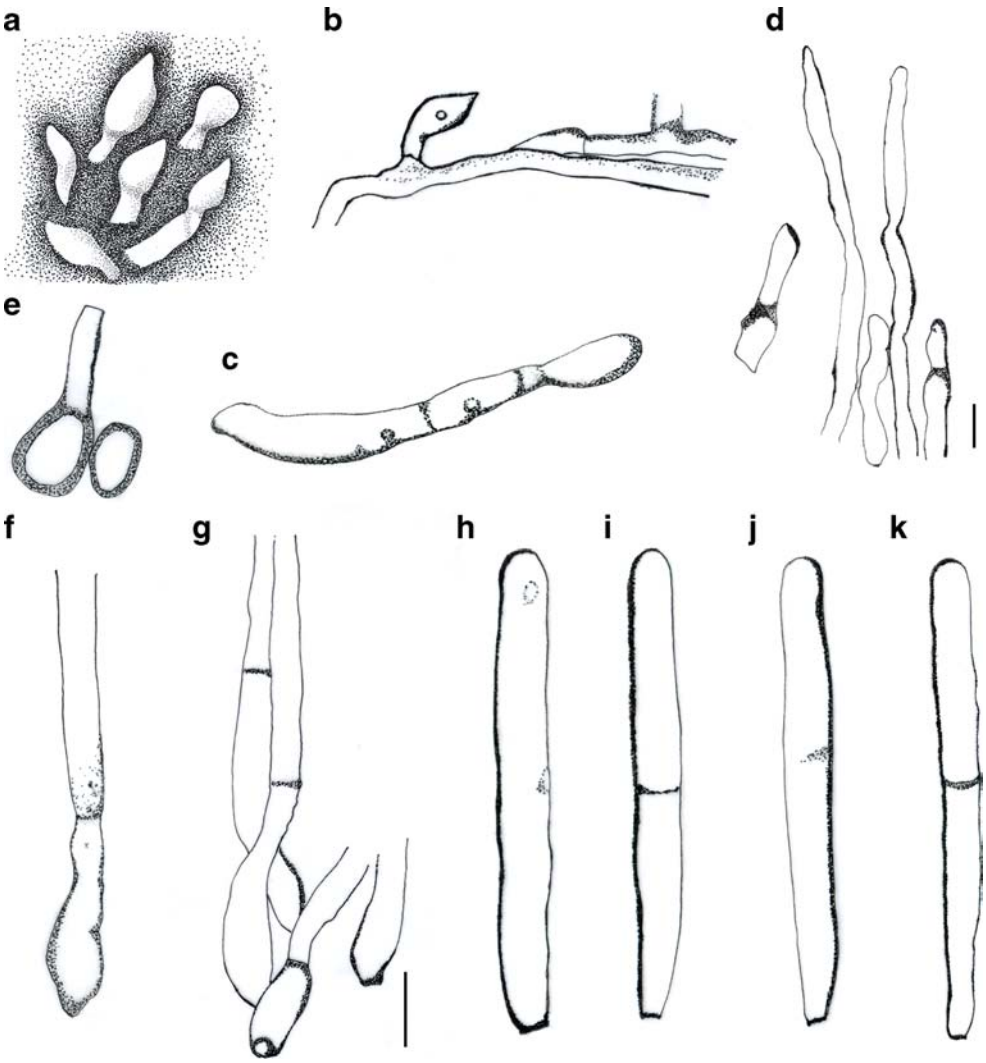


Fig. 111 ***Phlogicylindrium eucalypti*** (CBS H-19749, redrawn from Summerell et al. 2006). **a** Colony sporulating on MEA **b–d** Conidiophores and conidiogenous cells **e–g** Conidiogenous cells **h–k** Conidia. Scale bars: **d**, **g** = 20 μm

Type: ***Phyllachora*** Nitschke

Notes: *Phyllachoraceae* was introduced by Theissen and Sydow (1915) and has been included in several orders, including *Dothideales* (Horst 1990), *Sphaeriales* (Nannfeldt 1932; Miller 1949; Müller and von Arx 1962; Wehmeyer 1975), *Xylariales* (Luttrell 1951; Barr 1990), *Glomerellales* (Chadefaud 1960; Locquin 1984), *Phyllachorales* (Barr 1976a, b, 1983), *Polystigmatales* (Eriksson 1982; Hawksworth et al. 1983), and *Diaporthales* (Cannon 1988). Members of *Phyllachoraceae* are characterised by ascohymenial development with paraphyses, thin-walled asci, which may have an apical ring, that does not stain blue in iodine (J-) and ascospores that are often hyaline and 1-celled (Cannon 1991). Asexual morphs are coelomycetes, spermatial or disseminative (Hawksworth et al. 1995). Munk (1957) and Barr (1990) had a different concept of the family, including genera with J+, apical rings, in the ascus. The number of genera recognized within the family varies according to the authority. Hawksworth (1985) recognized 23 genera of *Phyllachoraceae*, whereas Barr (1990), who provided a key to genera of *Phyllachoraceae*, included only 12 genera. Eriksson and Hawksworth (1993) recognized 39 genera and Hawksworth et al. (1995) accepted 42 genera. In a recent study based on available molecular data, Maharachchikumbura et al. (2015) listed 58 genera in the family *Phyllachoraceae*.

Phyllachora Nitschke ex Fuckel, Jb. nassau. Ver. Naturk. 23–24: 216 (Fuckel 1870) [1869–70]

Facesoffungi number: FoF 02126; Fig. 113

Parasitic on plants. **Sexual morph**: Leaf spots on host black, abundant, scattered, raised, mostly rounded to oblong or elongated, sometimes parallel with leaf venation, surrounded by light brown necrotic region. *Ascomata* flattened, globose, with thin walls, lying in leaf tissues or in a stroma and maturing in living leaves, ostiolate and sometimes with a clypeus formed by the lateral proliferation of ostiolar hyphae. *Peridium* clypeate, thickest adjacent to ostiolar canal, composed of a deeply melanized, brown-black, amorphous layer of host cuticle and epidermal cells, often merging with

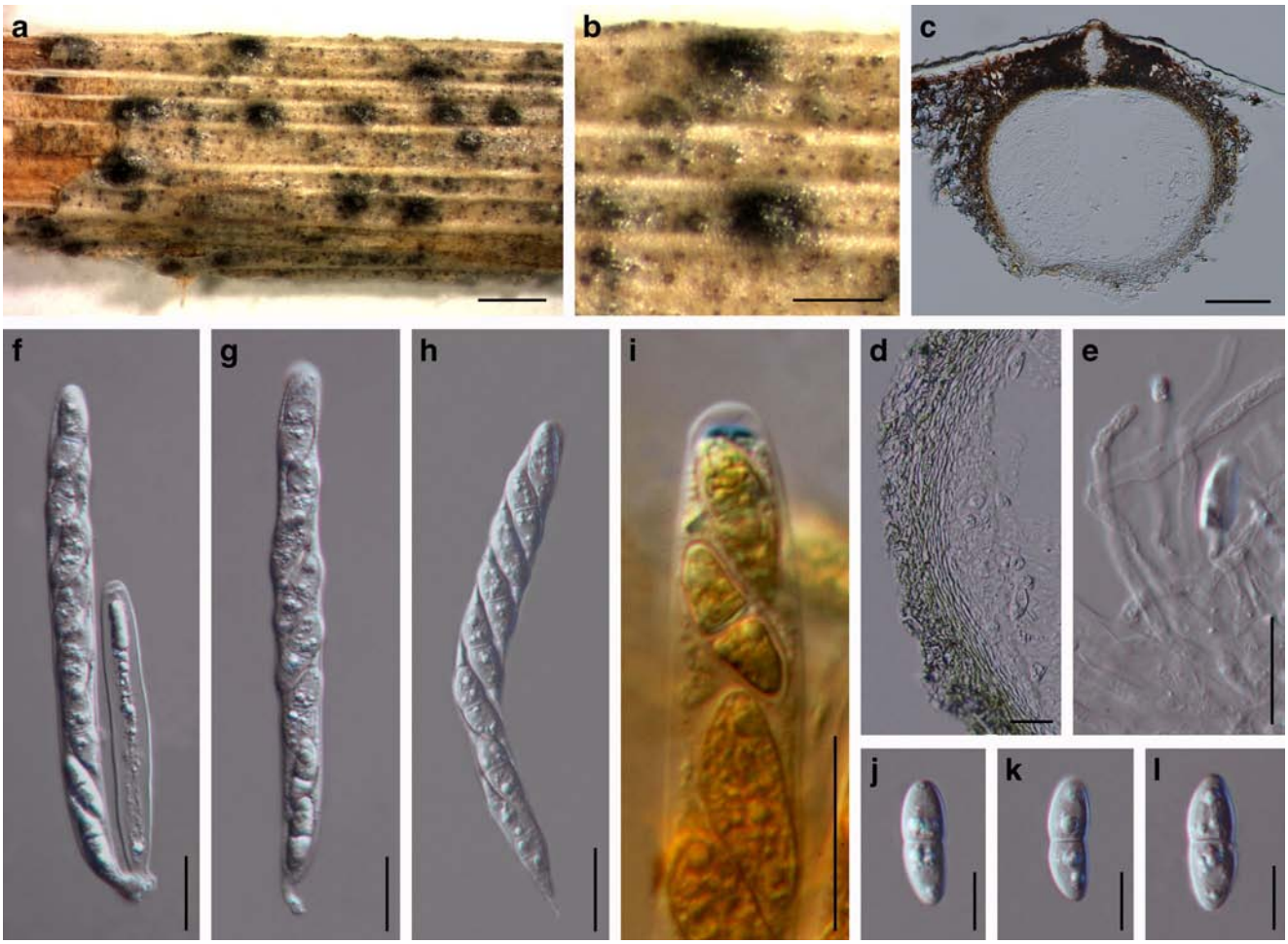
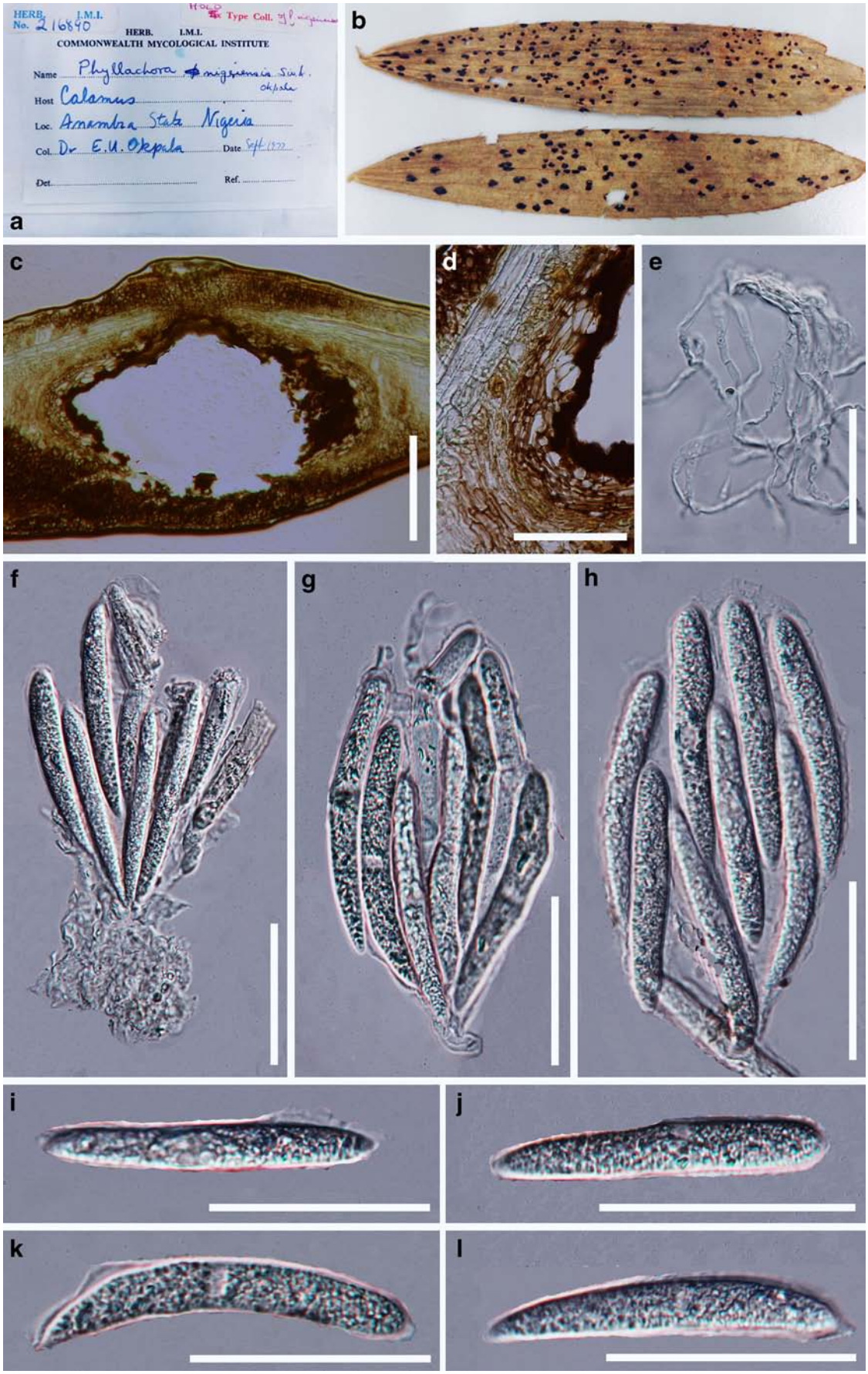


Fig. 112 *Ciferriascosea rectamurum* (Material examined: ITALY, Province of Forlì-Cesena, Santa Sofia, Castellaccio di Corniolino, on branches of *Spartium junceum* L. (*Fabaceae*), 29 December 2012, Erio Camporesi, IT 986, MFLU 15-0726). **a**, **b** Ascomata on host **c** Section of ascoma **d** Peridium **e** Paraphyses **f–h** Asci with ascospores **j–l** Ascospores. Scale bars: **a**, **b** = 1 mm, **c**, = 100 μm, **d** = 20 μm, **e–h** = 50 μm, **j–l** = 25 μm, **i** = 20 μm

a lighter pigmented region of brownish, distorted parenchyma cells infiltrated with fungal hyphae, beneath the clypeus. Lower and lateral peridium composed of two layers; an outer region comprising several layers of dark brown, flattened, thin-walled fungal cells, which merge inwardly with several layers of hyaline, flattened, thin-walled fungal cells. Lateral peridium fuses outwardly with an irregular, narrow region of distorted host parenchyma infiltrated by fungal cells. The basal peridium merges outwardly with either a narrow zone of infiltrated and distorted host parenchyma and occasionally lower epidermal cells, or integrates directly with a lower clypeus, similar in construction to that of basal peridium. *Paraphyses* numerous, persistent, filiform, branched, slightly longer than asci. *Asci* 8-spored, persistent, cylindrical to fusiform, short pedicellate, with walls fairly uniform in thickness, not specially thickened at apex, apical ring often present rarely absent, J-, or J+. *Ascospores* 1–3 seriate, fusiform to narrowly oval, hyaline, with or without attenuated base, sometimes with pad like appendages. **Asexual morph**: Coelomycetous, with conidia in locules within a stroma. *Conidiomata* similar to ascomata, immersed, subcuticular, strongly raising the host surface, occasionally pycnidial, occupying the region between the cuticle and epidermis, ostiolate. *Conidiophores* cylindrical, hyaline, thin-walled, formed directly from the strongly contorted cells of the lower wall *Conidiogenous cells* arising from the basal and lateral walls, cylindrical, phialidic, aseptate, hyaline, forming conidia singly at the apex. *Conidia* hyaline, clavate, aseptate.

Type species: ***Phyllachora graminis*** (Pers.) Fuckel, Jb. nassau. Ver. Naturk. 23–24: 216 (1870) [1869–70]

Notes: *Phyllachora* is a large genus with about 1500 species currently recognized (Index Fungorum 2016). This large number of species is a result of naming species on the basis of host association (Cannon 1988). There have been several morphological studies of *Phyllachora* on various groups of host plants. For example, *Phyllachora* species causing leaf tar spot diseases on *Leguminosae* (Cannon 1991), on *Duranta* spp. in the tropics (Hanlin and Tortolero 1991), small scabby


HERB. I.M.I. No. 216840
Type Coll. of P. nigrisemia
HERB. I.M.I.
COMMONWEALTH MYCOLOGICAL INSTITUTE
Name Phyllachora nigrisemia Sivan. Okpala
Host Calamus
Loc. Amambra State Nigeria
Col. Dr E.U. Okpala Date Sept 1977
Det. Ref.
a
b
c
d
e
f
g
h
i
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k
l

◀ **Fig. 113** ***Phyllachora nigeriensis*** (Material examined: AFRICA, West Tropical Africa, Nigeria, on leaf surface of *Calamus* sp., 1977 September, E.U. Okpala, IMI 216890, **holotype**) **a** Herbarium specimen **b** Ascomata on host **c** Section through ascoma **d** Peridium **e** Paraphyses f-i Asci j-m Ascospores. Scale bars: **c**, **d** = 100 μm, **e–m** = 50 μm

leafspots or "lixa-pequena" on coconut palms in Brazil (Subileau et al. 1993), and leaf-spots on grasses and sedges in northern regions (Seaver 1928b), on plants of family *Asclepiadaceae*, tar spots on grasses in Australia (Sivanesan and Shivas 2002). *Phyllachora* retains its uniqueness from most other members of the family by the development of ascomata embedded between a clypeus and epidermis (Cannon 1991). However, differences in depth of ascomata can be influenced by the consistency of the host tissue (Cannon 1991), therefore, this is not a reliable character on which to distinguish genera.

Other genera included

Acerviclypeatus Hanlin, Mycotaxon 37: 380 (1990)

Type species: ***Acerviclypeatus poriformans*** Hanlin, Mycotaxon 37: 381 (1990)

Apiosphaeria Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1218 [62 repr.] (1909)

Type species: ***Apiosphaeria guaranitica*** (Speg.) Höhn**.** [as 'guarantica'], Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1218 [62 repr.] (1909)

Ascovaginospora Fallah et al., Mycologia 89(5): 813 (1997)

Type species: ***Ascovaginospora stellipala*** Fallah et al., Mycologia 89(5): 813 (1997)

Brobdingnagia K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 47 (1999)

Type species: ***Brobdingnagia nigeriensis*** (Sivan. & Okpala) K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 47 (1999)

Camarotella Theiss. & Syd., Annls mycol. 13(3/4): 370 (1915)

Type species: ***Camarotella astrocaryae*** (Rehm) Theiss. & Syd., Annls mycol. 13(3/4): 370 (1915)

Coccodiella Hara, Bot. Mag., Tokyo 25: 224 (1910)

Type species: ***Coccodiella arundinariae*** Hara, Bot. Mag., Tokyo 24: 224 (1910)

Cyclodomus Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1527 [67 repr.] (1909)

Type species: ***Cyclodomus umbellulariae*** Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1528 [2 repr.] (1909)

Deshpandiella Kamat & Ullasa, in Ullasa & Rao, Bull. Torrey bot. Club 100: 41 (1973)

Type species: ***Deshpandiella jambolana*** (T.S. Ramakr. et al.) Kamat & Ullasa, in Ullasa & Rao, Bull. Torrey bot. Club 100: 42 (1973)

Diachora Müll. Arg., Jb. wiss. Bot. 25: 623 (1893)
= *Diachorella* Höhn., Hedwigia 60: 192 (1918).

Type species: ***Diachora onobrychidis*** (DC.) Jul. Müll. [as 'onobrychis'], Jb. wiss. Bot. 25: 693 (1893)

Diatractium Syd. & P. Syd., Annls mycol. 18(4/6): 183 (1921) [1920]

Type species: ***Diatractium cordiae*** (F. Stevens) Syd. & P. Syd., Annls mycol. 18(4/6): 183 (1921) [1920]

Erikssonia Penz. & Sacc., Malpighia 11(11–12): 526 (1898) [1897]

Type species: ***Erikssonia pulchella*** Penz. & Sacc., Malpighia 11(11–12): 526 (1898) [1897]

Fremitomyces P.F. Cannon & H.C. Evans, Mycol. Res. 103(5): 585 (1999)

Type species: ***Fremitomyces punctatus*** P.F. Cannon & H.C. Evans, Mycol. Res. 103(5): 587 (1999)

Geminispora Pat., in Patouillard & Lagerheim, Bull. Soc. mycol. Fr. 9: 151 (1893)

Type species: ***Geminispora mimosae*** Pat., in Patouillard & Lagerheim, Bull. Soc. mycol. Fr. 9: 151 (1893)

Gibellina Pass., in Roumeguère, Revue mycol., Toulouse 8: 177 (1886)

Type species: ***Gibellina cerealis*** (Pass.) Pass., Revue mycol., Toulouse 8: 177 (1886)

Imazekia Tak. Kobay. & Y. Kawabe, Japanese Journal of Tropical Agriculture 36(3): 201 (1992)

Type species: ***Imazekia ryukyuensis*** Tak. Kobay. & Y. Kawabe, Japanese Journal of Tropical Agriculture 36(3): 201 (1992)

Isothea Fr., Summa veg. Scand., Section Post. (Stockholm): 421 (1849)

Type species: ***Isothea rhytismoides*** (Bab.) Fr., Summa veg. Scand., Section Post. (Stockholm): 421 (1849)

Lichenochora Hafellner, Nova Hedwigia 48(3–4): 358 (1989)

Type species: ***Lichenochora thallina*** (Cooke) Hafellner, Nova Hedwigia 48(3–4): 363 (1989)

Lindauella Rehm, Hedwigia 39: 82 (1900)

Type species: ***Lindauella pyrenocarpoidea*** Rehm, Hedwigia 39: 82 (1900)

Linochora Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 119: 638 [22 repr.] (1910)

Type species: ***Linochora leptospermi*** (Cooke) Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 119: 639 [23 repr.] (1910)

Lohwagia Petr., Bot. Arch. 43: 205 (1942) [1941]

Type species: ***Lohwagia intermedia*** (Speg.) Petr., Bot. Arch. 43: 205 (1942) [1941]

Maculatifrondes K.D. Hyde [as 'Maculatifrondis'], Mycol. Res. 100(12): 1509 (1996)

Type species: ***Maculatifrondes aequatoriensis*** K.D. Hyde, in Hyde et al., Mycol. Res. 100(12): 1509 (1996)

Malthomyces K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 69 (1999)

Type species: ***Malthomyces calamigena*** (Berk. & Broome) K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 70 (1999)

Muelleromyces Kamat & Anahosur, in Anahosur, Experientia 24: 849 (1968)

Type species: ***Muelleromyces indicus*** Kamat & Anahosur, Experientia 24: 849 (1968)

Mycohypallage B. Sutton, Mycol. Pap. 88: 4 (1963)

Type species: ***Mycohypallage congesta*** (Berk. & Broome) B. Sutton, Mycol. Pap. 88: 5 (1963)

Neoflageoletia J. Reid & C. Booth, Can. J. Bot.44: 450 (1966)

Type species: ***Neoflageoletia bambusina*** (Syd.) J. Reid & C. Booth 1966

Ophiodothis (Berk. & M.A. Curtis) Sacc., Syll. fung. (Abellini) 2: 652 (1883)

Type species: ***Ophiodothis vorax*** (Berk. & M.A. Curtis) Sacc., Syll. fung. (Abellini) 2: 652 (1883)

Ophiodothella Henn., Hedwigia 43: 258 (1904)

Type species: ***Ophiodothella atromaculans*** (Henn.) Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 119: 940 [64 repr.] (1910)

Orphnodactylis Malloch & A. Mallik, Can. J. Bot.76(7): 1267 (1998)

Type species: ***Orphnodactylis kalmiae*** Malloch & A. Mallik, Can. J. Bot. 76(7): 1267 (1998)

Oswaldina Rangel, Archivos da Escola Superior de Agricultura e Medicina Veterinaria, Nictheroy, Rio de Janeiro 5: 37 (1921)

Type species: ***Oswaldina icarahyensis*** Rangel, Archivos da Escola Superior de Agricultura e Medicina Veterinaria, Nictheroy, Rio de Janeiro 5: 37 (1921)

Oxodeora K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 75 (1999)

Type species: ***Oxodeora petrakii*** (Cif.) K.D. Hyde & P.F. Cannon, Mycol. Pap. 175: 75 (1999)

Parberya C.A. Pearce & K.D. Hyde, Fungal Diversity 6: 90 (2001)

Type species: ***Parberya kosciuskoa*** C.A. Pearce & K.D. Hyde, Fungal Diversity 6: 91 (2001)

Petrakiella Syd., Annls mycol. 22(1/2): 230 (1924)

Type species: ***Petrakiella insignis*** Syd., Annls mycol. 22(1/2): 230 (1924)

Phaeochorella Theiss. & Syd., Annls mycol. 13(3/4): 405 (1915)

Type species: ***Phaeochorella parinarii*** (Henn.) Theiss. & Syd., Annls mycol. 13(3/4): 405 (1915)

Phycomelaina Kohlm., Phytopath. Z. 63: 350 (1968)

Type species: ***Phycomelaina laminariae*** (Rostr.) Kohlm., Phytopath. Z. 63: 350 (1968)

Phylleutypa Petr., Annls mycol. 32(5/6): 429 (1934)

Type species: ***Phylleutypa dioscoreae*** (Wakef.) Petr., Annls mycol. 32(5/6): 429 (1934)

Phyllocrea Höhn., Annls mycol. 16(1/2): 38 (1918)

Type species: ***Phyllocrea quitensis*** (Pat.) Höhn., Annls mycol. 16(1/2): 38 (1918)

Polystigma DC., in de Candolle & Lamarck, Fl. franç., Edn 3 (Paris) 6: 164 (1815)

= *Polystigmina* Sacc., Syll. fung. (Abellini) 3: 622 (1884)

Type species: ***Polystigma rubrum*** (Pers.) DC., in de Candolle & Lamarck, Fl. franç., Edn 3 (Paris) 6: 164 (1815)

Pseudothiella Petr., Hedwigia 68(5): 257 (1928)

Type species: ***Pseudothiella hirtellae*** (Henn.) Petr., Hedwigia 68(5): 257 (1928)

Pseudothiopsella Petr., Hedwigia 68(5): 259 (1928)

Type species: ***Pseudothiopsella hirtellae*** Petr., Hedwigia 68(5): 259 (1928)

Pterosporidium W.H. Ho & K.D. Hyde, Can. J. Bot.74(11): 1826 (1996)

Type species: ***Pterosporidium rhizophorae*** (Vizioli) W.H. Ho & K.D. Hyde, Can. J. Bot. 74(11): 1828 (1996)

Rehmiodothis Theiss. & Syd., Annls mycol. 12(2): 192 (1914)

Type species: ***Rehmiodothis osbeckiae*** (Berk. & Broome) Theiss. & Syd., Annls mycol. 12(2): 192 (1914)

Retroa P.F. Cannon, Mycol. Pap. 163: 201 (1991)

Type species: ***Retroa dimorphandrae*** (F. Stevens) P.F. Cannon, Mycol. Pap. 163: 202 (1991)

Rhodosticta Woron., Izv. Imp. St.-Peterburgsk. Bot. Sada 11: 13 (1911)

Type species: ***Rhodosticta caraganae*** Woron., Consp. System. Corticiac. (Tartu) 11: 13 (1911

Rikatlia P.F. Cannon, Syst. Ascom. 11(2): 83 (1993)

Type species: ***Rikatlia lungusaensis*** (Henn.) P.F. Cannon, Syst. Ascom. 11(2): 84 (1993)

Schizochora Syd. & P. Syd., Annls mycol. 11(3): 265 (1913)

Type species: ***Schizochora elmeri*** Syd. & P. Syd., Annls mycol. 11(3): 265 (1913)

Sphaerodothella C.A. Pearce & K.D. Hyde, Fungal Diversity 6: 85 (2001)

Type species: ***Sphaerodothella danthoniae*** (McAlpine) C.A. Pearce & K.D. Hyde, Fungal Diversity 6: 86 (2001)

Sphaerodothis (Sacc. & P. Syd.) Shear, Mycologia 1(4): 162 (1909)

Type species: ***Sphaerodothis arengae*** (Racib.) Shear ex Theiss. & Syd., Annls mycol. 13(5/6): 577 (1915)

Stigmatula (Sacc.) Syd. & P. Syd., Bull. Herb. Boissier, 2 sér. 1: 77 (1901)

Type species: ***Stigmatula sutherlandiae*** (Kalchbr. & Cooke) Syd. & P. Syd., Bull. Herb. Boissier, 2 sér. 1: 78 (1901)

Stigmochora Theiss. & Syd., Annls mycol. 12(3): 272 (1914)

Type species: ***Stigmochora controversa*** (Starbäck) Theiss. & Syd., Annls mycol. 12(3): 272 (1914)

Stromaster (Pat.) Höhn., in Weese, Mitt. bot. Inst. tech. Hochsch. Wien 7(3): 93 (1930)

Type species: ***Stromaster tuberculatus*** (Pat.) Höhn., in Weese, Mitt. bot. Inst. tech. Hochsch. Wien 7(3): 93 (1930)

Telimena Racib., Parasit. Alg. Pilze Java's (Jakarta) 1: 18 (1900)

Type species: ***Telimena erythrinae*** Racib., Parasit. Alg. Pilze Java's (Jakarta) 1: 18 (1900)

Telimenella Petr., in Rechinger et al., Annln K. K. naturh. Hofmus. Wien 50: 468 (1940) [1939]

Type species: ***Telimenella persica*** Petr., Annln K. K. naturh. Hofmus. Wien 50: 469 (1940) [1939]

Telimenochora Sivan., Trans. Br. mycol. Soc. 88(4): 474 (1987)

Type species: ***Telimenochora abortiva*** (F. Stevens) Sivan., Trans. Br. mycol. Soc. 88(4): 474 (1987)

Trabutia Sacc. & Roum., Revue mycol., Toulouse 3(no. 9): 27 (1881)

Type species: ***Trabutia quercina*** (F. Rudolphi ex Fr.) Sacc. & Roum., Revue mycol., Toulouse 3(no. 9): 27 (1881)

Tribulatia Joanne E. Taylor et al., in Taylor & K.D.Hyde, Fungal Divers. Res. Ser. 12: 189 (2003)

Type species: ***Tribulatia appendicospora*** Joanne E. Taylor et al., in Taylor & Hyde, Fungal Diversity Res. Ser. 12: 191 (2003)

Uropolystigma Maubl., Bull. Soc. mycol. Fr. 36: 36 (1920)

Type species: ***Uropolystigma atrotestaceum*** Maubl., Bull. Soc. mycol. Fr. 36: 36 (1920)

Vitreostroma P.F. Cannon, Mycol. Pap. 163: 206 (1991)

Type species: ***Vitreostroma desmodii*** (Henn.) P.F. Cannon, Mycol. Pap. 163: 207 (1991)

Zimmermanniella Henn., Hedwigia 41: 142 (1902)

Type species: ***Zimmermanniella trispora*** Henn., Hedwigia 41: 142 (1902)

Key to genera of *Phyllachoraceae*

1. Ascomycete 2
1. Coelomycete 35
2. Ascospores aseptate 3
2. Ascospores 1- multi-septate 9
3. Ascospores hyaline 4
3. Ascospores pigmented 28
4. Ascospores with appendages and/or sheaths 5
4. Ascospores without appendages or sheaths. 26
5. Ascospores with appendages and sheath . . . . . ***Apiosphaeria***
5. Ascospores without appendages but, with sheaths . . . 6
6. Ascospores flattened on one side, with a narrow oblong longitudinal depression in the middle . . ***Sphaerodothis***
6. Ascospores not as above 7
7. Paraphyses persistent . . . . . ***Ascovaginospora***
7. Paraphyses absent 8
8. Apical ring absent . . . . . ***Maculatifrondes***
8. Apical ring conspicuous, not amyloid. . . . . ***Trabutia***
9. Ascospores mostly filiform . . . . . ***Ophiodothis***
9. Ascospores cylindrical, obovoid or fusiform. 10
10. Paraphyses present 11
10. Paraphyses absent 14
11. Ascospores pigmented 12
11. Ascospores hyaline. 19
12. Immature ascospores hyaline, becoming brown when mature 13
12. Ascospores brown at all stages. . . . . ***Deshpandiella***
13. Ascomata flask-shaped, with black, protruding beaks . . . . . ***Gibellina***
13. Ascomata globose without a beak . . . ***Telimenochora***
14. Ascomata with well-developed clypeus 15
14. Ascomata with poorly developed clypeus or without clypeus 17
15. Asci readily gelatinizing at maturity, with thick apical canal . . . . . ***Muelleromyces***
15. Asci cylindric-clavate at maturity 16
16. Asci bulbous at immature stage . . . . . ***Phycomelaina***
16. Asci not as above. . . . . ***Stigmochora*, *Rehmiodothis***
17. Ascospores apiosporous . . . . . ***Imazekia***
17. Ascospores non-apiosporous 18
18. Ascospores hyaline . . . . . ***Phyllocrea***
18. Ascospores pigmented . . . . . ***Malthomyces***
19. Paraphyses branched 20
19. Paraphyses unbranched 23
20. Persistent periphysoids present 22
20. Periphysoids absent 21
21. Stroma pseudostromatic, ... ***Phyllachora***
21. Stroma eustromatic. . . . . ***Coccodiella***
22. Ascospores asymmetrically 3-septate, often constricted in the middle . . . . . ***Telimena***
22. Ascospores 2-septate, not constricted at the septa. . . . . ***Telimenella***
23. Ascospores with appendages . . . . . ***Schizochora***
23. Ascospores without appendages. 24
24. Ascomata with well-developed clypeus . . . . . ***Diatractium***
24. Ascomata with poorly developed clypeus or without clypeus 25
25. Ascospores 3-septate . . . . . ***Petrakiella***
25. Ascospores uni septate . . . . . ***Rikatlia***
26. Ascospores ovoid to globose or cylindrical-ellipsoid to ellipsoid or fusiform. 27
26. Ascospores filiform . . . . . ***Linochora*, *Ophiodothella***
27. Paraphyses inconspicuous 28

27. Paraphyses well-developed. 29
28. Ascomata usually clearly distinguishable from the surface even in old colonies, from the surface usually strongly domed, ostiole inconspicuous . . . . . ***Isothea***
28. Ascomata immersed in host mesophyll between vascular bundles, often occupying the entire leaf thickness, globose to irregularly shaped, occasionally almost stellate, with a central to slightly off-centre, ostiolate with conical ostiolar canal. . . . . ***Sphaerodothella***
29. Ascomata with well-developed clypeus . . . . . ***Brobdingnagia***
29. Ascomata with poorly develop/without clypeus . . . 30
30. Leaf spots cream buff to deep olive buff. . ***Erikssonia***
30. Leaf spots dark grey or brown to black 31
31. Ascomata flask shaped. 32
31. Ascomata globose to sub-globose. 33
32. Paraphyses filamentous, septate, disintegrating at maturity to form a dense amorphous matrix . . . . . ***Orphnodactylis***
32. Paraphyses longer than the asci, thin-walled, slightly tapered. . . . . ***Fremitomyces***
33. Ascomata embedded in a stroma 34
33. Ascomata not embedded in a stroma . . . . ***Lindauella***
34. Stromata unilocular . . . . . ***Camarotella***
34. Stromata bi- to multi-loculate. 35
35. Stromata epiphyllous . . . . . ***Lohwagia***, ***Polystigma***, ***Phylleutypa***, ***Pseudothiella***, ***Retroa***, ***Rhodosticta***, ***Vitreostroma***
35. Stromata hypophyllous. . . . . ***Zimmermanniella***
36. Present only one type of conidia. 37
36. Present macro and micro conidia . . . . ***Phaeochorella***
37. Conidia with appendages 40
37. Conidia without appendages. 38
38. Conidiophores present 39
38. Conidiophores absent. . . . . ***Cyclodomus***
39. Conidiogenous cells slender, tapering towards the apex . . . . . ***Acerviclypeatus***
39. Conidiogenous cells lageniform to cylindrical . . . . . ***Oswaldina***
40. Conidia with apical and basal appendages . . . . . ***Mycohypallage***
40. Conidia with an apical appendage . . ***Pseudothiopsella***

Note: Some of genera are kept together under one character and some genera are not included in the tree due to lack of data to further separate them.

Pisorisporiaceae Réblová & J. Fourn., Persoonia 34: 43 (2015).

Facesoffungi number: FoF 01286

Saprobic on submerged, woody substrates, in freshwater habitats. **Sexual morph**: *Ascomata* perithecial, astromatic, solitary or occurring in small groups, subhyaline to pale brown to black, immersed to superficial, papillate or with a long, hyaline or black, upright or obliquely lying neck, ostiolate, periphysate. *Peridium* leathery to fragile, comprising two layers, partly carbonaceous in the outer layers. *Hamathecium* comprising abundant, persistent, cylindrical, septate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical-clavate, pedicellate, persistently attached to the ascogenous hyphae at maturity, with a pronounced J+, or J-, apical ring. *Ascospores* overlapping uniseriate to biseriate, hyaline, fusiform, cylindrical to cymbiform, transversely multi-septate, lacking a mucilaginous sheath or appendages, with or without guttules. **Asexual morph**: Undetermined.

Type genus: ***Pisorisporium*** Réblová & J. Fourn.

Notes: The family *Pisorisporiaceae* was introduced by Réblová et al. (2015) based on morphology and analysis of combined LSU, SSU and RPB2 sequence data and presently includes the genera *Achroceratosphaeria* and *Pisorisporium*. *Pisorisporiaceae* shows a sister relationship with the orders *Koralionastetales* and *Lulworthiales*, but is weakly supported by Bayesian and maximum likelihood analyses. Although currently placed in Hypocreomycetidae, Réblová et al. (2015) suggested it represents a new lineage of aquatic fungi and that the three orders might represent a novel sub-class. The taxa in this family are found in Europe and Asia. Réblová et al. (2010) introduced the genus *Achroceratosphaeria* based on analysis of combined LSU and SSU sequence data. *Achroceratosphaeria* formed a sister clade to *Lulworthiales* and *Koralionastetales*, both orders being predominantly marine. In Réblová et al. (2015), *Achroceratosphaeria* lies as a sister clade to *Pisorisporium* in the family *Pisorisporiaceae*. *Achroceratosphaeria* has hyaline to pale brown ascomata, membranous ascomata, and asci with J- apical ring as compared to black, carbonaceous ascomata with J+ apical ring in *Pisorisporium*.

Pisorisporium Réblová & J. Fourn., Persoonia 34: 45 (2015)

Facesoffungi number: FoF 02127; Fig. 114

Saprobic on submerged wood in freshwater habitats. *Ascomata* immersed, gradually becoming superficial, solitary or in groups, glabrous, subglobose to conical, with short periphysate neck. *Peridium* carbonaceous, 2-layered. *Hamathecium* comprising of persistent, hyaline, septate paraphyses. *Asci* unitunicate, 8-spored, cylindrical-clavate, short-stipitate, with a pronounced thimble-shaped J+ apical ring. *Ascospores* fusiform, cylindrical to cymbiform, sometimes falcate, hyaline, transversely multi-septate, smooth-walled, with numerous guttules. **Asexual morph**: Undetermined.

Type species: ***Pisorisporium cymbiforme*** Réblová & J. Fourn., Persoonia 34: 45 (2015)

Other genus included

Achroceratosphaeria Réblová, et al., Fungal Diversity 43: 79 (2010)

Type species: ***Achroceratosphaeria potamia*** Réblová et al., Fungal Diversity 43: 79 (2010)

Key to genera of *Pisorisporiaceae*

1. Ascomata hyaline, membranous; apical ring J- ……***Achroceratosphaeria***
1. Ascomata black, carbonaceous; apical ring J+ ……***Pisorisporium***

Plectosphaerellaceae W. Gams et al., Nova Hedwigia 85(3–4): 476 (2007)

Facesoffungi number: FoF 01334

Saprobic on dead plant material, in soil or *pathogenic* on plants causing root and collar rots. **Sexual morph**: *Ascomata* perithecial or cleistothecial, superficial, dark brown, subglobose to pyriform or globose, with elongate neck. *Peridium* multi-layered, composed of dark brown cells of *textura angularis*. *Paraphyses* conspicuous in young ascomata or absent. *Asci* 8-spored, unitunicate, clavate or saccate, without an apical ring. *Ascospores* irregularly arranged, hyaline or pale brown, fusiform or ellipsoidal or ovoid, 1-celled or 2-celled, wall asperulate or smooth. **Asexual morph**: Hyphomycetous. *Conidiophores* vegetative hyphae, hyaline or centrally pale brown or pale olivaceous. *Conidiophores cells* phialidic, hyaline, some become orange-brown or olivaceous-brown, partly melanized or single. *Conidia* aggregated in slimy heads, hyaline to pale olive, shapes variable, ranging from subglobose to oval or cylindrical, slightly curved, or fusiform with pointed ends, 1–2-celled, smooth-walled (Description based on Uecker 1993 and Zare et al. 2007)

Type: ***Plectosphaerella*** Kleb.

Notes: The family *Plectosphaerellaceae* was introduced by Zare et al. (2007), typified by *Plectosphaerella* (Kirk et al. 2008; Zare et al. 2007). In a phylogenetic analysis based on combined LSU SSU and RPB2 sequence data, Réblová et al. (2011) included *Stachylidium* in the family *Plectosphaerellaceae*. Based on analysis of ITS and GAPDH sequence data, Cannon et al. (2012b) reported that *Lectera* belongs in the family *Plectosphaerellaceae* rather than the order *Hypocreales*. Grum-Grzhimaylo et al. (2013) introduced *Sodiomyces* as the second holomorphic, alkaliphilic genus within the *Plectosphaerellaceae* based on a multi-locus phylogeny (ITS, LSU, SSU, RPB2 and TEF). Grum-Grzhimaylo et al. (2016) established a new genus *Chordomyces* with a single species *Chordomyces antarcticum* Bilanenko et al. in the *Plectosphaerellaceae*. Currently, nine genera are recognized in the *Plectosphaerellaceae* including two holomorphic genera *viz*. *Plectosphaerella* and *Sodiomyces*. Only the asexual morphs are known for the remaining genera *viz*. *Acrostalagmus*, *Chordomyces*, *Gibellulopsis*, *Lectera*, *Musicillium*, *Stachylidium* and *Verticillium* (Kirk et al. 2008; Zare et al. 2007; Réblová et al. 2011; Cannon et al. 2012a; Wijayawardene et al. 2012; Grum-Grzhimaylo et al. 2013; Hirooka et al. 2014; Maharachchikumbura et al. 2015; Grum-Grzhimaylo et al. 2016). The family is referred to the order *Glomerellales*.

Plectosphaerella Kleb., Phytopath. Z. 1: 43 (1929)

Facesoffungi number: FoF 01335, Figs 114, 115, 116

Saprobic on dead plant material, in soil or *pathogenic* on plants causing root and collar rots. **Sexual morph**: *Ascomata* perithecial, superficial, pale brown or dark brown, subglobose to pyriform, thin-walled, with elongated neck. *Peridium* multi-layered, composed of dark brown cells of *textura angularis*. *Paraphyses* conspicuous in young stages or absent. *Asci* 8-spored, unitunicate, clavate, without an apical ring, J⁻. *Ascospores* irregularly arranged, hyaline, fusiform, both ends rounded, 1–2-celled, wall asperulate. **Asexual morph**: Hyphomycetous. *Conidiophores* vegetative hyphae, hyaline or centrally pale brown or pale olivaceous, solitary, sometimes branched, apical or lateral with verticillate or single conidiogenous. *Conidiophores cells* phialidic, determinate, discrete, hyaline, thin-walled, smooth. *Conidia* aggregated in slimy heads, hyaline, bilaterally symmetric, oblong-ellipsoidal, slightly curved, 0–1-celled, smooth-walled.

Type species: ***Plectosphaerella cucumeris*** Kleb., Phytopath. Z. 1: 43 (1929)

Notes: *Plectosphaerella cucumerina* (Lindfors) W. Gams is a holomorphic fungus (Zare et al. 2007; Carlucci et al. 2012; Arzanlou et al. 2013a, b). The sexual morph *Plectosphaerella* was described first by Klebahn in 1929 (Palm et al. 1995). Elbakyan (1970) considered *P. cucumeris* conspecific with *Venturia cucumerina* Lindf. (Carlucci et al. 2012). It was regarded as a member of the *Hypocreales*, until Uecker (1993) suggested to place it in *Sordariaceae* (Uecker 1993; Palm et al. 1995; Liu et al. 2013; Arzanlou et al. 2013a, b; Carlucci et al. 2012). Palm et al. (1995) firstly linked *Plectosphaerella* to the hyphomycetous genus *Plectosporium*. Zare et al. (2007) introduced a new family *Plectosphaerellaceae* based on *Plectosphaerella*. *Plectosphaerella* has been suggested as the accepted generic name because it was published earlier than *Plectosporium* (Carlucci et al. 2012). *Plectosphaerella*

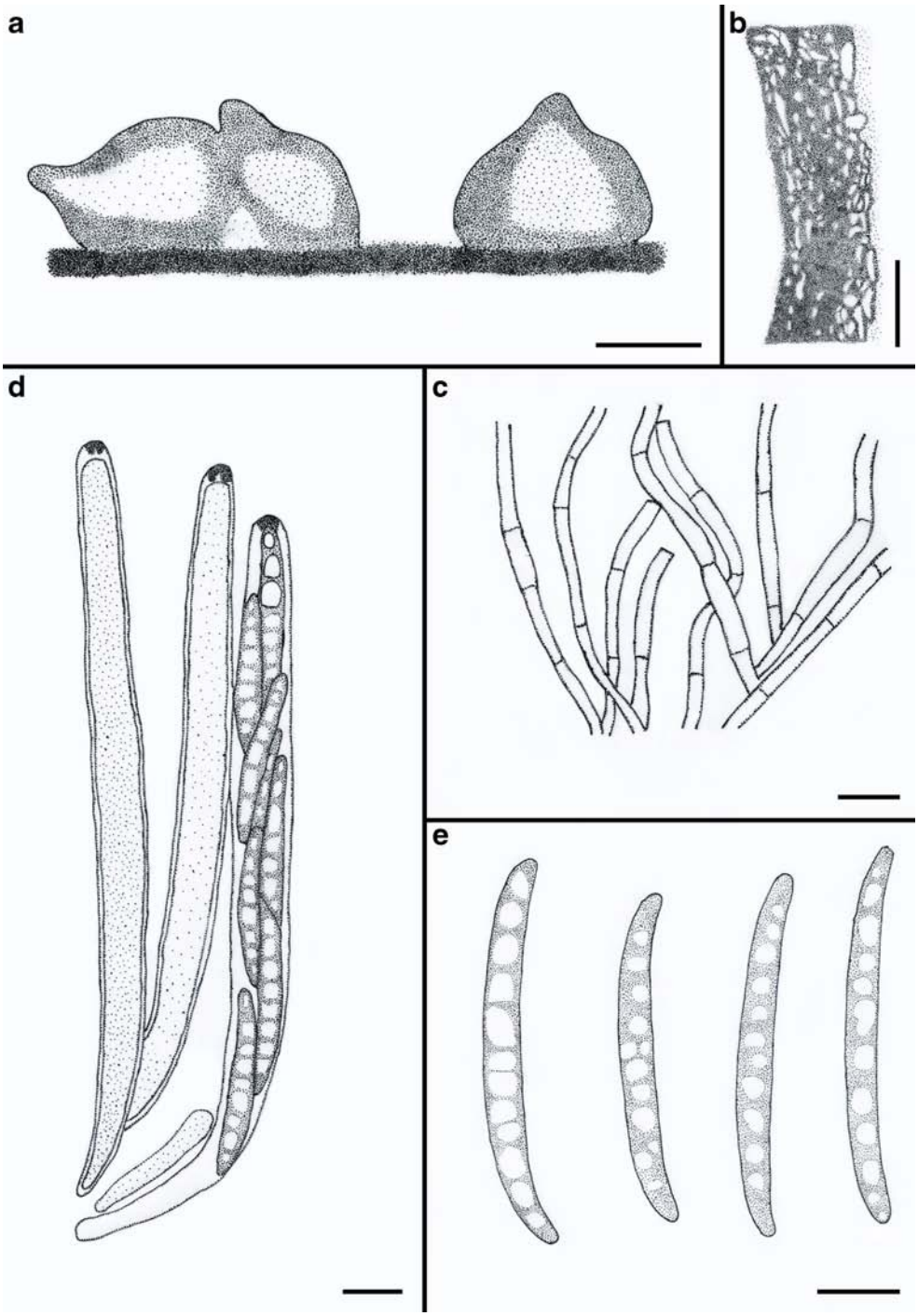


Fig. 114 ***Pisorisporium cymbiforme*** (redrawn from Réblová et al. 2015) **a** Ascomata **b** Peridium **c** Paraphyses **d** Asci **e** Ascospores. Scale bars: **a** = 200 μm, **b** = 20 μm, **c**–**e** = 10 μm

is characterized by off-white to pale yellow, or pale gray-brown colonies, 1–2-celled, ellipsoidal conidia and determinate phialides (Carlucci et al. 2012).

Other genera included

Acrostalagmus Corda, Icon. fung. (Prague) 2: 15 (1838)

Type species: ***Acrostalagmus cinnabarinus*** Corda, Icon. fung. (Prague) 2: 15 (1838)

Chordomyces E.N. Bilanenko et al., Fungal Diversity 76: 31 (2015)

Type species: ***Chordomyces antarcticum*** E.N. Bilanenko et al., Fungal Diversity 76: 31 (2015)

Gibellulopsis Bat. & H. Maia, Anais Soc. Biol. Pernambuco 16(1): 153 (1959)

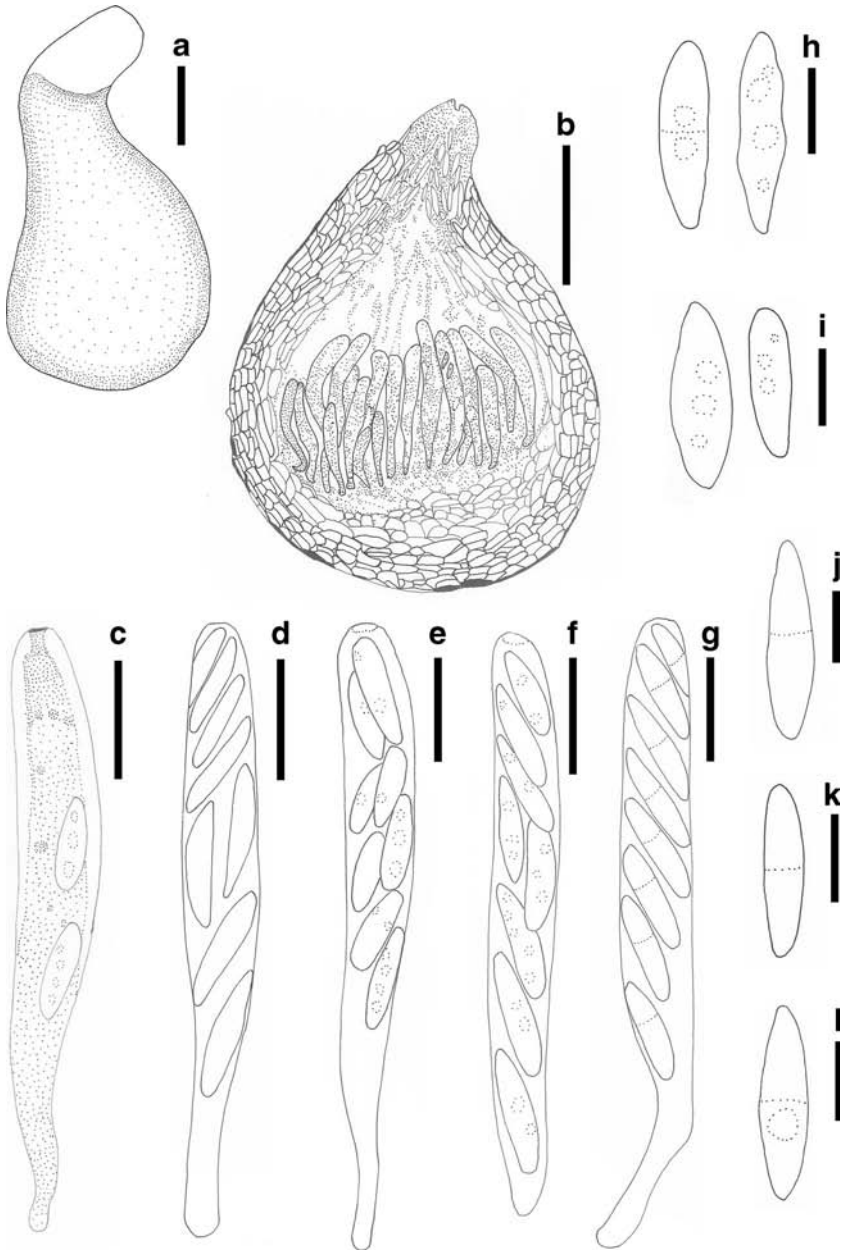


Fig. 115 ***Plectosphaerella cucumeris*** (redrawn from the Uecker 1993) **a** Ascomata **b** Section of ascomata **c-g** Asci **h-l** Ascospores. Scale bars: **a**, **b** = 50 μm, **c–g** = 10 μm, **h–l** = 5 μm

Type species: ***Gibellulopsis piscis*** Bat. & H. Maia, Anais Soc. Biol. Pernambuco 16(1): 154 (1959)

Lectera P.F. Cannon, in Cannon et al., MycoKeys 3: 28 (2012)

Type species: ***Lectera colletotrichoides*** (J.E. Chilton) P.F. Cannon, in Cannon et al., MycoKeys 3: 28 (2012)

Musicillium Zare & W. Gams, in Zare et al., Nova Hedwigia 85(3–4): 482 (2007)

Type species: ***Musicillium theobromae*** (Turconi) Zare & W. Gams, Nova Hedwigia 85(3–4): 482 (2007)

Sodiomyces A.A. Grum-Grzhimaylo et al., Persoonia, Mol. Phyl. Evol. Fungi 31: 154 (2013)

Type species: ***Sodiomyces alkalinus*** (Bilanenko & M. Ivanova) A.A. Grum-Grzhimaylo et al., Persoonia, Mol. Phyl. Evol. Fungi 31: 157 (2013)

Stachylidium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 15 (1809)

Type species: ***Stachylidium bicolor*** Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 15 (1809)

Verticillium Nees, Syst. Pilze (Würzburg): 57 (1816) [1816–17]

Type species: ***Verticillium dahliae*** Kleb., Mykol. Zentbl. 3: 66 (1913)

Key to genera of *Plectosphaerellaceae*

1. Ascomycete 2
1. Hyphomycete. 3

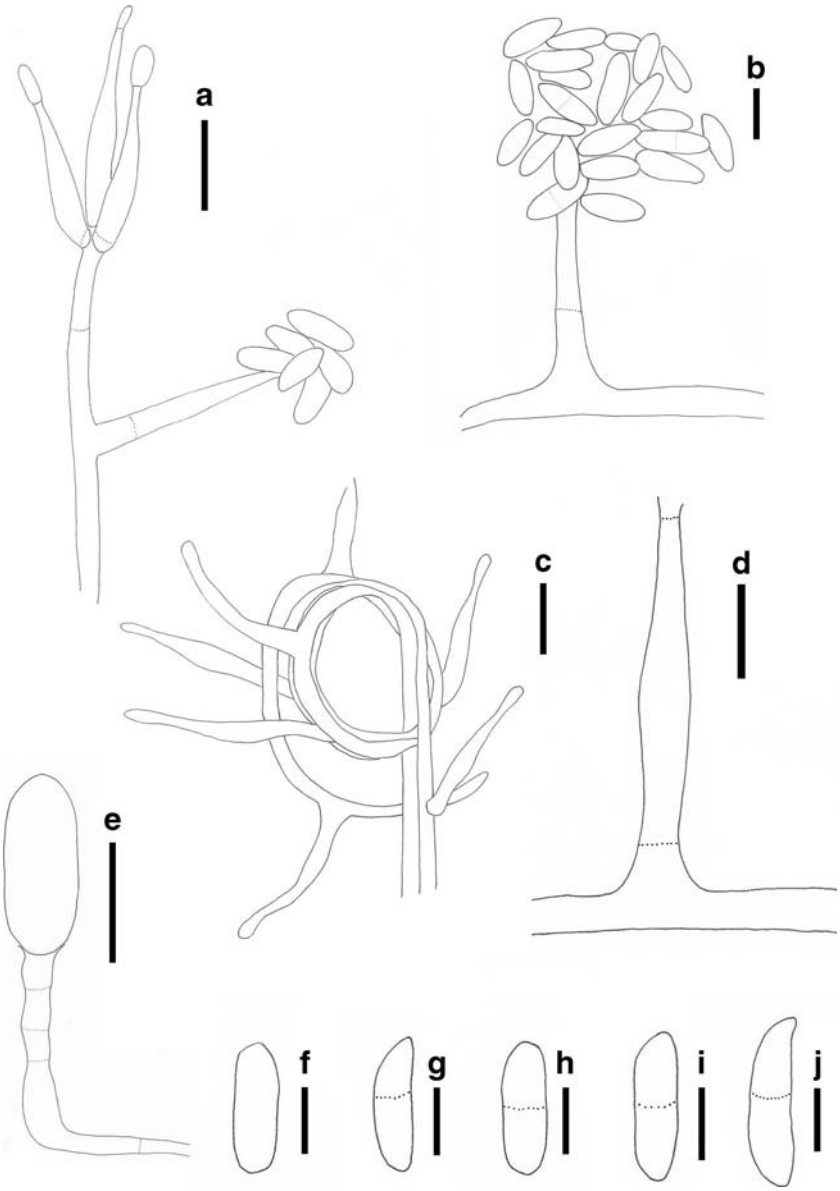


Fig. 116 ***Plectosphaerella cucumeris*** (redrawn from Carlucci et al. 2012, Pascoe et al. 1984 and Palm et al. 1995) **a** Conidiophore **b**, **d** Phialides **c** Hyphal coil with phialides **e-j** Conidia. Scale bars: **a**, c = 10 μm, **b**, **d–j** = 5 μm

2. Ascomata perithecial . . . . . ***Plectosphaerella***
2. Ascomata cleistothecial . . . . . ***Sodiomyces***
3. Conidiophores basitonously verticillate 4
3. Conidiophores dichotomous or multi-branched verticillate. 5
4. Conidiogenous cell narrowly ellipsoidal . . . . . ***Stachylidium***
4. Conidiogenous cell tapering towards the apex. . . . . ***Sodiomyces***
5. Conidiogenous cell cylindrical . . . . . ***Lectera***
5. Conidiogenous cell phialidic 6
6. Conidiogenous 4–5 whorled branches at a node, separate with warty tips . . . . . ***Acrostalagmus***
6. Conidiogenous tapering to the apex 7
7. Phialides, tapering to the apex with collarette 8
7. Phialides, tapering to the apex without collarette . . . . . ***Verticillium***
8. Collarette with a sinuous apex, conidia bilaterally symmetric, appear slightly curved in side view. . . . . ***Plectosphaerella***
8. Collarettes inconspicuous, conidia ellipsoidal to cylindrical. 9
9. Phialides, in whorl of 3–6, slender aculeate and hardly tapering towards the tip . . . . . ***Musicillium***
9. Phialides, in whorl of 1–3 10
10. Phialides 28–30 μm, often proliferating sympodially, tapering from 2.5–3 μm near the base to 0.8–1 μm at the tip . . . . . ***Chordomyces***
10. Phialides 23–50 μm, aculeate, tapering from 1–2 μm near the base to 0.5–1 μm at the apex . . ***Gibellulopsis***

Pleurostomataceae Réblová et al., Stud. Mycol. 50: 540 (2004)

Facesoffungi number: FoF 01136

Saprobic on wood in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, black, gregarious or scattered, immersed to superficial, globose to subglobose, coriaceous, smooth, without setae, papillate. *Peridium* thick (30–100 μm), composed of two to four layers, outer layer comprising of brown cells of *textura intricata* or *epidermoidea*, thick, coriaceous; inner layer comprising of hyaline cells of *textura prismatica* or *angularis*, thin, membranaceous; sometimes middle layers comprised of two types of cells, forming thin-walled and brown cells of *textura epidermoidea* to in the outer part, merging with thin-walled and dark brown cells of *textura angularis* in the inner part, thick, coriaceous. *Hamathecium* composed of numerous, hyaline, filamentous paraphyses or paraphyses absent, with hyaline spicate ascogenous hyphae in clusters. *Asci* multi-spored, unitunicate, reniform to oblong, with short pedicel or sessile, apical ring lacking. *Ascospores* crowded, hyaline, oblong to allantoid, curved, aseptate, smooth-walled. **Asexual morph**: Hyphomycetous. *Mycelium* composed of branched, septate, hyaline or brown hyphae. *Conidiophores* single, from aerial or submerged hyphae, hyaline, straight or flexuous, aseptate to 2-septate, tuberculate or smooth. *Conidiogenous cells* monophialidic or polyphialidic, cylindrical, hyaline, smooth-walled. *Conidia* aggregated in round, hyaline, aseptate, oblong to allantoid, curved or straight, smooth, with or without guttules.

Type: ***Pleurostoma*** Tul. & C. Tul.

Notes: The monotypic family *Pleurostomataceae* was introduced by Réblová (2004). It was placed in *Calosphaeriales* based on allantoid ascospores, ascogenous hyphae and other characteristics similar to *Calosphaeriaceae*, as well as SSU nrDNA and LSU nrDNA sequence data, based on *Pleurostoma ootheca* (Berk. & M.A. Curtis) M.E. Barr (Réblová et al. 2004). Berlese (1900) introduced *Neoarcangelia* via *N. ootheca* (Berk. & M.A. Curtis) Berl., based on upright papillae on the ascomata, but Barr (1985) maintained there were insufficient features to separate the species from *Pleurostoma candollei* Tul. & C. Tul. *Neoarcangelia* was accepted as the synonym of *Pleurostoma* (von Höhnel 1918; Barr 1985). Shear (1937) reexamined *Sphaeria ootheca*, the synonym of *P. ootheca* from Virginia, and decided that the species was similar with *P. candollei*. However, *P. ootheca* was included as the second species, and *Pleurostomophora* was accepted as the asexual morph of *Pleurostoma* based on morphological and phylogenetic analyses (Réblová et al. 2004; Vijaykrishna et al. 2004; Najwa et al. 2012).

Pleurostoma Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 247 (1863); Figs 117, 118

= *Pleurostomophora* Vijaykr.et al.

Type species: ***Pleurostoma candollei*** Tul. & C. Tul. [as 'candollii'], Select. fung. carpol. (Paris) 2: 247 (1863)

Notes: Tulasne and Tulasne (1863a) introduced the type species, *Pleurostoma candollei*. Maharachchikumbura et al. (2015), based on a multi-gene dataset, showed that *Pleurostoma* and *Pleurostomophora* formed a highly supported clade in the *Pleurostomataceae*.

Pseudomassariaceae Senanayake et al., in Senanayake et al., Fungal Diversity 73: 132 (2015)

Facesoffungi number: FoF 00843

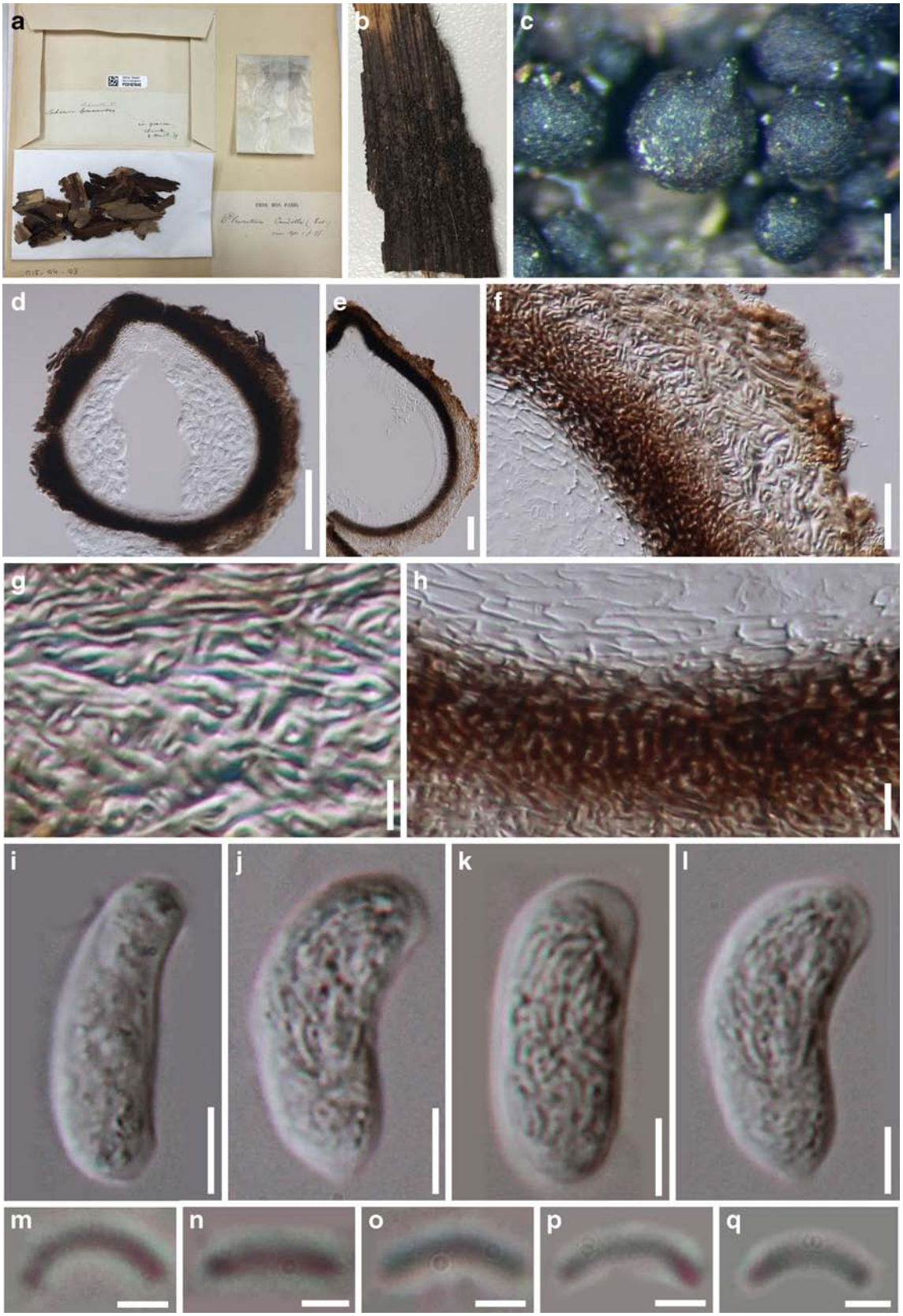
Saprobic on recently dead twigs attached to the trees, appearing as black dots, below small raised areas of bark, opening through long fissures. **Sexual morph**: *Ascomata* perithecial, scattered, solitary or aggregated, immersed, depressed globose to ellipsoid, coriaceous, black, ostiolate, papillate. *Ostiolar papilla* short, cylindrical, wide at the apex, periphysate. *Peridium* comprising strongly compressed, narrow, light to medium brown, thin-walled cells of *textura angularis*. *Hamathecium* comprising numerous, apically narrow, basally wide, hyaline paraphyses. *Asci* 8-spored, unitunicate, clavate to fusoid, short pedicellate, apically rounded, with J+, or J– apical ring. *Ascospores* biseriate or partially uniseriate, hyaline, broadly ellipsoid, oblong or narrowly clavate, mostly apiosporous, with a rounded to subconical, small, lower cell or equally uniseptate, straight or curved, thick-walled, smooth-walled. **Asexual morph**: Hyphomycetous, *Setae* erect, dark brown, straight to flexuous, arising from superficial hyphae, branched at base, subcylindrical, tapering to obtuse apex, 3–7-septate, basal cell slightly swollen. *Conidiophores* subcylindrical to setiform, with radially lobed basal cells, pale brown, smooth, arising from superficial mycelium, straight to flexuous, 1–10-septate. *Conidiogenous cells* terminal or lateral, polyblastic, subcylindrical to somewhat clavate, pale brown, smooth, with 1–4 denticulate loci. *Conidia* lageniform, distal end free, truncate, rostrate at proximal end, pale brown, with a subhyaline transverse band at equatorial zone, smooth, guttulate, aseptate.

Type: ***Pseudomassaria*** Jacz.

Notes: Single gene sequence analyses of ITS and LSU regions by Jaklitsch and Voglmayr (2012) indicate a separate taxonomic clade grouping for *Pseudomassaria* and *Leiosphaerella*. However, they did not formally establish this family. *Leiosphaerella* also shows molecular and morphological similarities with *Pseudomassaria* (Jaklitsch and Voglmayr 2012). *Pseudomassariaceae* was introduced by Senanayake et al. (2015) to accommodate *Pseudomassaria* and *Leiosphaerella*. This family is typified by *Pseudomassaria* Jacz.

Pseudomassaria Jacz., Bull. Herb. Boissier 2: 663 (1894)

Facesoffungi number: FoF 00843; Fig. 119


a
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q

◀ **Fig. 117** ***Pleurostoma candollei*** (Material examined: FRANCE, Chaville, on dead wood of *Quercus* sp., 8 March 1859, PC PC0167640)**. a** Material label **b** Herbarium material **c** Ascomata **d-e** Ascoma cross section **f** Peridium **g** Outer layer cross section **h** Middle and inner layers cross section **i-l** Asci **m-q** Ascospores. Notes: Figs f-q soaked in 3 % KOH. Scale bars: **c** = 200 μm, **d–e** = 100 μm, **f** = 20 μm, **g–h** = 10 μm, **i–l** = 5 μm, **m–q** = 1 μm

Saprobic on dead twigs attached to trees, appearing as black dots, below small bumps on the bark. **Sexual morph**: *Ascomata* perithecial, scattered, solitary or aggregated, immersed, depressed globose, coriaceous, black, ostiolate, papillate. *Ostiolar papilla* short, cylindrical, wide at the apex, even with the bark surface, periphysate. *Peridium* comprising narrow, compressed, light brown, thin-walled, cells of *textura angularis* at the base and thick-walled, light brown to hyaline, isodiametric cells around the ostiole. *Hamathecium* comprising numerous, apically narrow, basally wide, hyaline paraphyses. *Asci* 8-spored, unitunicate, clavate to fusoid, short pedicellate, apically rounded, with a J+ or J– apical ring. *Ascospores* biseriate or partially uniseriate, hyaline, broadly ellipsoid, oblong or narrowly clavate, apiosporous with a rounded to subconical small lower cell, straight or curved, thick-walled, smooth-walled. **Asexual morph**: Hyphomycetous, *Setae* erect, dark brown, straight to flexuous, arising from superficial hyphae, branched at base, subcylindrical, tapering to obtuse apex, 3–7-septate, basal cell slightly swollen. *Conidiophores* subcylindrical to setiform, with radially lobed basal cells, pale brown, smooth, arising from superficial mycelium, straight to flexuous, 1–10-septate. *Conidiogenous cells* terminal or lateral, polyblastic, subcylindrical to somewhat clavate, pale brown, smooth, with 1–4 denticulate loci. *Conidia* pale brown, lageniform to rhomboid, distal end free, proximal end rostrate, with a subhyaline transverse band at equatorial zone, smooth-walled, guttulate, aseptate.

Type species: ***Pseudomassaria chondrospora*** (Ces.) Jacz., Bull. Herb. Boissier 2: 663 (1894)

Notes: *Pseudomassaria* was introduced by Jaczewski (1894) to place *Sphaeria chondrospora*. This genus was assigned to the family *Hyponectriaceae* and introduced a new species *P. huwerae* (Hyde et al. 1998). This was followed by Lumbsch and Huhndorf (2010) and Maharachchikumbura et al. (2015). Combined gene analysis by Senanayake et al. (2015), shows the taxonomic placement of *Pseudomassaria* as different from *Hyponectriaceae*. This result confirms the taxonomic placement suggested by Jaklitsch and Voglmayr (2012).

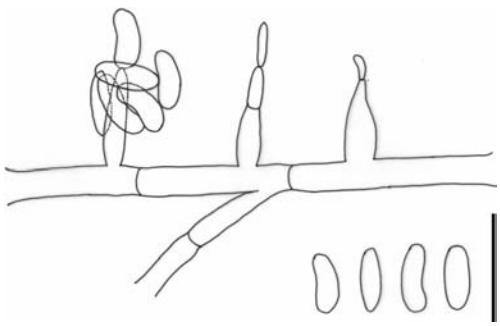

Fig. 118 ***Pleurostomophora*** **anamorph of** ***Pleurostroma ootheca*** (From Vijaykrishna et al. 2004)**.** Conidiogenous cells and conidia. Scale bars = 10 μm

Other genus included

Leiosphaerella Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 579 (1919)

Type species: ***Leiosphaerella praeclara*** (Rehm) Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 128: 579 (1919)

Key to genera of *Pseudomassariaceae*

1. Ascospores apiosporous . . . . . ***Pseudomassaria***
   1. Ascospores elongate, bicelled. . . . . ***Leiosphaerella***

Pseudoplagiostomataceae Cheew. et al. [as 'Pseudoplagiostomaceae'], in Cheewangkoon et al., Fungal Diversity 44: 95 (2010)

Facesoffungi number: FoF 01403

Pathogen on leaves, forming spots. **Sexual morph**: *Ascomata* solitary, scattered, immersed, slanted to horizontal on host tissue, globose or elliptical, black, coriaceous, papillate, ostiolate. *Papilla* short, internally covered with hyaline, filamentous, periphyses. *Peridium* comprising a few layers of thick-walled, brown cells of *textura angularis. Hamathecium* lacking paraphyses. *Asci* 8-spored, unitunicate, cylindrical, sessile, with J-, subapical ring. *Ascospores* overlapping uniseriate to biseriate, hyaline, fusiform to ellipsoid, 1-septate, with terminal, elongate, hyaline appendages. **Asexual morph**: Coelomycetous. *Conidiomata* acervular or pycnidial, brown. *Peridium* comprising small, brown cells of *textura angularis. Conidiophores* absent. *Conidiogenous cells* cylindrical to ampulliform, enteroblastic, percurrently proliferating with periclinal thickening and collarette. *Conidia* holoblastic, hyaline to brown, ellipsoid, unicellular, subglobose to broadly-allantoid, with obtuse apex and a flat protruding scar at the base.

Type: ***Pseudoplagiostoma*** Cheew. et al.

Notes: The family *Pseudoplagiostomataceae* was introduced by Cheewangkoon et al. (2010) to accommodate the type species, *P. eucalypti* Cheew.et al. and two other new species (*P. oldii* Cheew. et al. and *P. variabile* Cheew. et al.) isolated from *Eucalyptus* leaf spots. This monotypic family comprises foliar pathogens and has been recorded only from

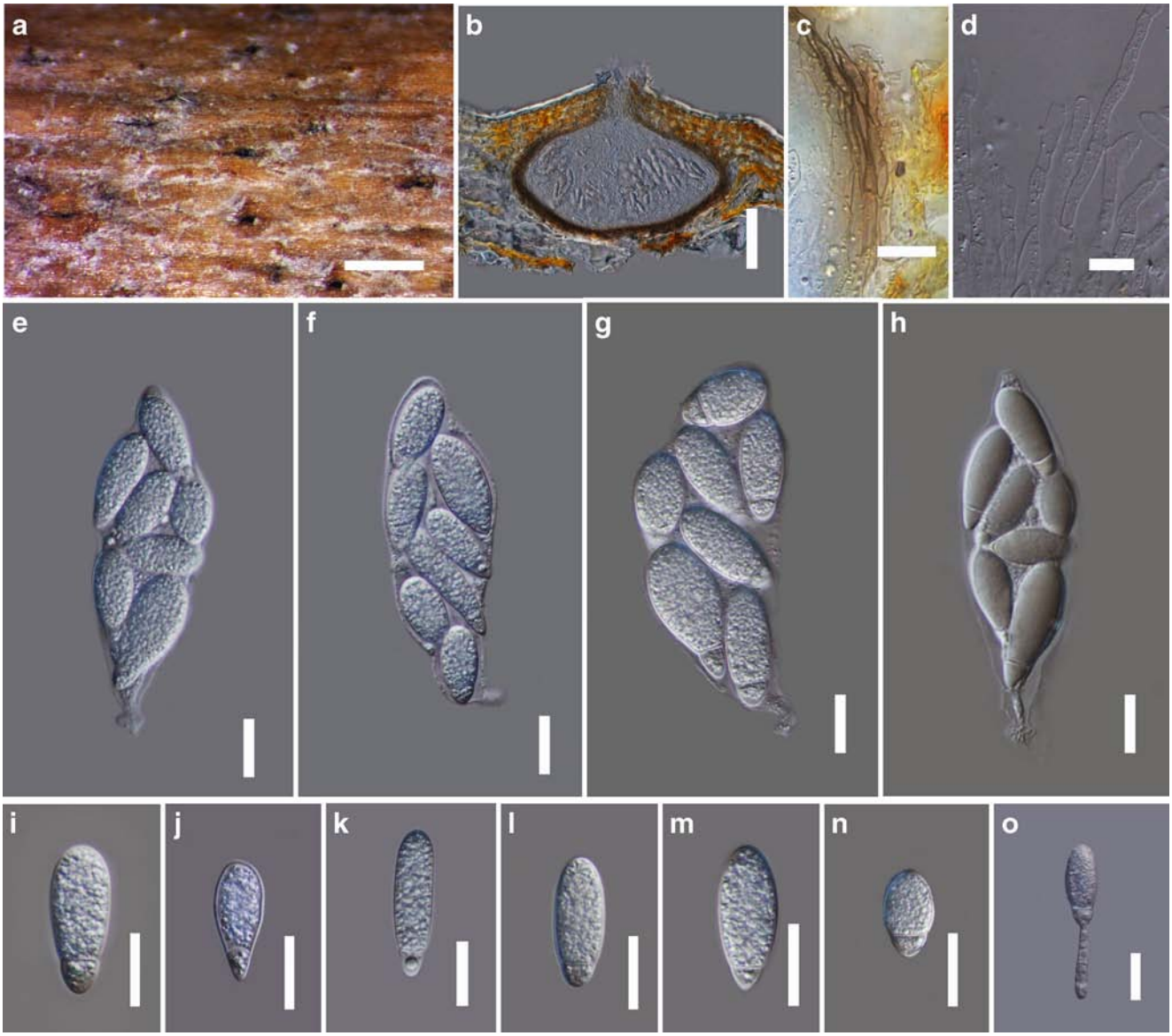

Fig. 119 *Pseudomassaria chondrospora* (Material examined: ITALY, Province of Forlì-Cesena, Premilcuore, Fiumicello, on branch of *Tilia cordata* Mill. (*Tiliaceae*), 24 April 2013, Erio Camporesi, IT 1200 MFLU 15-0729, **reference specimen**). **a** Appearance of ascomata on host substrate **b** Cross section of ascoma **c** Peridium. **d** Paraphyses **e–h** Asci **i–o** Ascospores. Scale bars: **a** = 500 μm, **b** = 100 μm, **c**, **e–p** = 10 μm

Eucalyptus. Ascospore morphology, in particular, is distinct and morphologically this family differs from other families in the order in having astromatic, slanted to horizontal, globose ascomata with an aparaphysate hamathecium and ascospores with terminal, elongate, hyaline appendages. A maximum parsimony analysis of LSU sequence data of the order *Diaporthales*, showed the distinct placement of *Pseudoplagiostomaceae* (Cheewangkoon et al. 2010).

Pseudoplagiostoma Cheew. et al., in Cheewangkoon et al., Fungal Diversity 44: 96 (2010)

Facesoffungi number: FoF 02128; Fig. 120

Pathogenic on leaves, forming spots. **Sexual morph**: *Ascomata* perithecial, immersed in host tissues, slanted to horizontal, globose to elliptical, coriaceous, brown to black, papillate, ostiolate. *Papilla* erumpent, internal wall lined by hyaline periphyses. *Peridium* comprising a few layers of thick-walled, brown cells of *textura angularis*. *Hamathecium* lacking paraphyses. *Asci* 8-spored, unitunicate, subcylindrical to long obovoid, sessile, apex blunt, with wedge-shaped, J-, subapical ring. *Ascospores* overlapping uniseriate to biseriate, hyaline, fusiform to ellipsoid, tapering towards the rounded ends, 1-septate, with terminal, elongate, hyaline appendages. **Asexual morph**: Coelomycetous. *Conidiomata* acervular to pycnidial, subcuticular to subepidermal. *Peridium* comprising small, brown cells of *textura angularis*. *Conidiophores* absent. *Conidiogenous cells* cylindrical to ampulliform, enteroblastic,

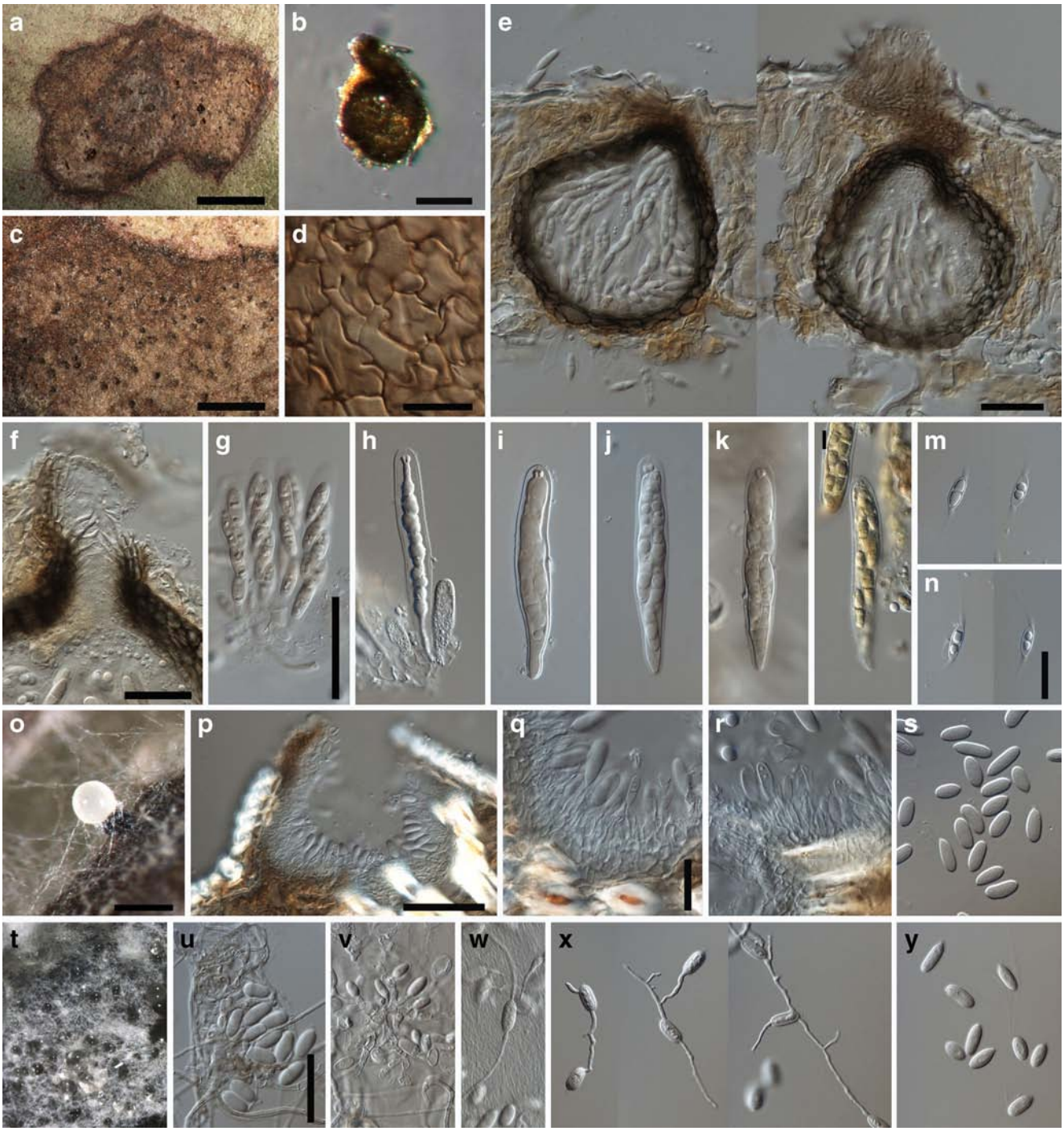

Fig. 120 ***Pseudoplagiostoma eucalypti*** (Material examined: VENEZUELA, on living leaves of *Eucalyptus urophylla* S. T. Blake (*Myrtaceae*), October 2006, M.J. Wingfield, CBS H-20303, **holotype**). **a** Leaf spot **b**, **c** Ascomata **d** Ascomatal wall **e** Cross section though ascomata **f** Ostiole **g** Asci **h**, **i** Young asci **j** Mature ascus **k**, **l** Asci strained in Melzer's reagent, showing non-amyloid subapical ring **m**, **n** Ascospores **o** Conidiomata **p** Cross section though conidiomata **q**, **r** Conidia attached to conidiogenous cells with percurrent proliferation **s** Conidia **t** Colony on MEA **u**, **v** Conidia and conidiogenous cells **w**, **y** Microcyclic conidiation. Scale bars: **a** = 5 mm, **b** = 1 mm, **c**, **e** = 50 μm, **d** = 5 μm, **f–j** = 30 μm, **k**, **s–u** = 20 μm, **o** = 200 μm, **p** = 70 μm, **q–s**, **w–y** = 15 μm

proliferating with periclinal thickening. *Conidia* holoblastic, hyaline to brown, ellipsoid, unicellular, with obtuse apex and a flat protruding scar at the base.

Type species: ***Pseudoplagiostoma eucalypti*** Cheew.et al., in Cheewangkoon et al., Fungal Diversity 44: 98 (2010)

Notes: The genus *Pseudoplagiostoma* was introduced to accommodate a distinct foliar pathogen from *Eucalyptus* that has astromatic, slanted to horizontal, globose perithecia without paraphyses, ascospores with terminal, elongate, hyaline appendages and a cryptosporiopsis-like asexual morph. The generic type of *Cryptosporiopsis*, *C. nigra* (*Dermateaceae*, *Helotiales*) is not closely related and *Cryptosporiopsis eucalypti* falls within *Diaporthales* in the phylogenetic analyses. Hence *Pseudoplagiostoma* was introduced to accommodate this taxon. Combined gene analysis of ITS and TUB gene sequence data resolved the species within *Pseudoplagiostoma* (Cheewangkoon et al. 2010).

Pseudovalsaceae M.E. Barr, Mycol. Mem. 7: 151 (1978)

Facesoffungi number: FoF 01404

Saprobic on dead wood. **Sexual morph**: *Stromata* solitary, erumpent, comprising pseudoparenchymatous cells. *Ectostromatic disc* well or poorly developed, brown to black, comprising small cells of *textura prismatica. Ascomata* perithecial, immersed, aggregated, globose to subglobose, coriaceous, brown to black, papillate, ostiolate. *Papilla* upright, central, broad, sometimes converging. *Peridium* comprising outer, thick-walled, brown cells of *textura angularis* and inner, thick-walled, hyaline, compressed cells of *textura angularis. Hamathecium* comprising broad, cellular, septate paraphyses. *Asci* 8-spored, unitunicate, ellipsoid to cylindrical, thin-walled, pedicellate, apex rounded with a J-, apical ring. *Ascospores* overlapping uniseriate to biseriate, initially hyaline, brown at maturity, ellipsoid, fusoid or elongate, one to several septate, often distoseptate, end cells light brown or hyaline, straight or curved. **Asexual morph**: Coelomycetous. *Conidiomata* acervular, solitary, erumpent through the outer periderm layers of host or immersed, scattered, surface tissues above slightly domed. *Conidiomatal wall* composed of thin-walled, vertically arranged dark brown cells of *textura angularis. Conidiophores* branched at the base or not, cylindrical to globose, septate or aseptate, hyaline or hyaline at the top, pale brown at the base. *Conidiogenous cells* formed from the apical cells of the conidiophores, hyaline, annellidic, cylindrical, sometimes with setulose apical appendages. *Conidia* hyaline to dark brown, curved, globose, broadly fusiform to cylindrical or clavate, smooth-walled, unicellular to distoseptate, with 4–6 septa, sometimes the apical and basal cell darker than other cells with hyaline apex in apical cell or hyaline, apical apiculus.

Type: ***Coryneum*** Nees

Notes: The family *Pseudovalsaceae* was introduced by Barr (1978) to include diaporthalean taxa having upright, erumpent ascomata with central necks. However, many genera previously included in *Pseudovalsaceae* have been placed in other families (Castlebury et al. 2002) and the only genus remaining in the family *Pseudovalsaceae* was *Coryneum*. This genus is based on the type species *C. lanciformis* (Fr.) Voglmayr & Jaklitsch. *Coryneum* species are reported to be the asexual morphs of *Pseudovalsa* (Rossman et al. 2015). *Coryneum* species commonly occur on temperate hardwood trees. Maharachchikumbura et al. (2015) also listed *Apoharknessia* Crous & S.J. Lee under *Pseudovalsaceae*.

Coryneum Nees, Syst. Pilze (Würzburg): 34 (1816) [1816–17]

= *Murogenella* Goos & E.F. Morris, Mycologia 57(5): 776 (1965)

= *Pseudovalsa* Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 206 (1863)

Facesoffungi number: FoF 02129; Figs 121, 122

Saprobic or rarely *pathogenic* on dead wood. **Sexual morph**: *Stromata* solitary, erumpent, comprising pseudoparenchymatous cells. *Ectostromatic disc* well or poorly developed, brown to black, comprising small cells of *textura prismatica. Ascomata* perithecial, immersed, aggregated, globose to subglobose, coriaceous, brown to black, papillate, ostiolate. *Papilla* upright, central, broad, sometimes converging. *Peridium* comprising outer, thick-walled, brown cells of *textura angularis* and inner, thick-walled, hyaline, compressed cells of *textura angularis. Hamathecium* comprising broad, cellular, septate paraphyses. *Asci* 8–spored, unitunicate, ellipsoid to cylindrical, thin-walled, pedicellate, apex rounded, with J-, apical ring. *Ascospores* overlapping uniseriate to biseriate, initially hyaline, brown at maturity, ellipsoid, fusoid or elongate, one to several septate, often distoseptate, end cells light brown or hyaline, straight or curved. **Asexual morph**: *Conidiomata* acervular, solitary, erumpent through the outer periderm layers of host, scattered, surface tissues above slightly domed. *Conidiomatal wall* comprising thin-walled, vertically arranged, dark brown, cells of *textura angularis. Conidiophores* branched at the base, cylindrical, septate, hyaline at the apex, pale brown at the base. *Conidiogenous cells* formed from the apical cell of the conidiophore, hyaline, annellidic, cylindrical. *Conidia* dark brown, curved, broadly fusiform to cylindrical or clavate, smooth-walled, distoseptate with 4–6 septa, the apical and basal cell darker than other cells, apical cell hyaline.

Type species: ***Coryneum umbonatum*** Nees, Syst. Pilze (Würzburg): 34 (1816) [1816–17]

Basionym: *Sphaeria lanciformis* Fr., Observ. Mycol. (Havniae) 2: 324 (1818)

Notes: *Coryneum* was introduced and typified by *C. umbonatum* Nees. Type species of *Coryneum*, *C. umbonatum* has been linked to the type species of *Pseudovalsa*, *P. lanciformis* (Rossman et al. 2015) and *Coryneum* (1816) has been conserved over *Pseudovalsa* (1863) giving priority to the older name (Rossman et al. 2015). Both sexual and asexual morphs of *Coryneum*

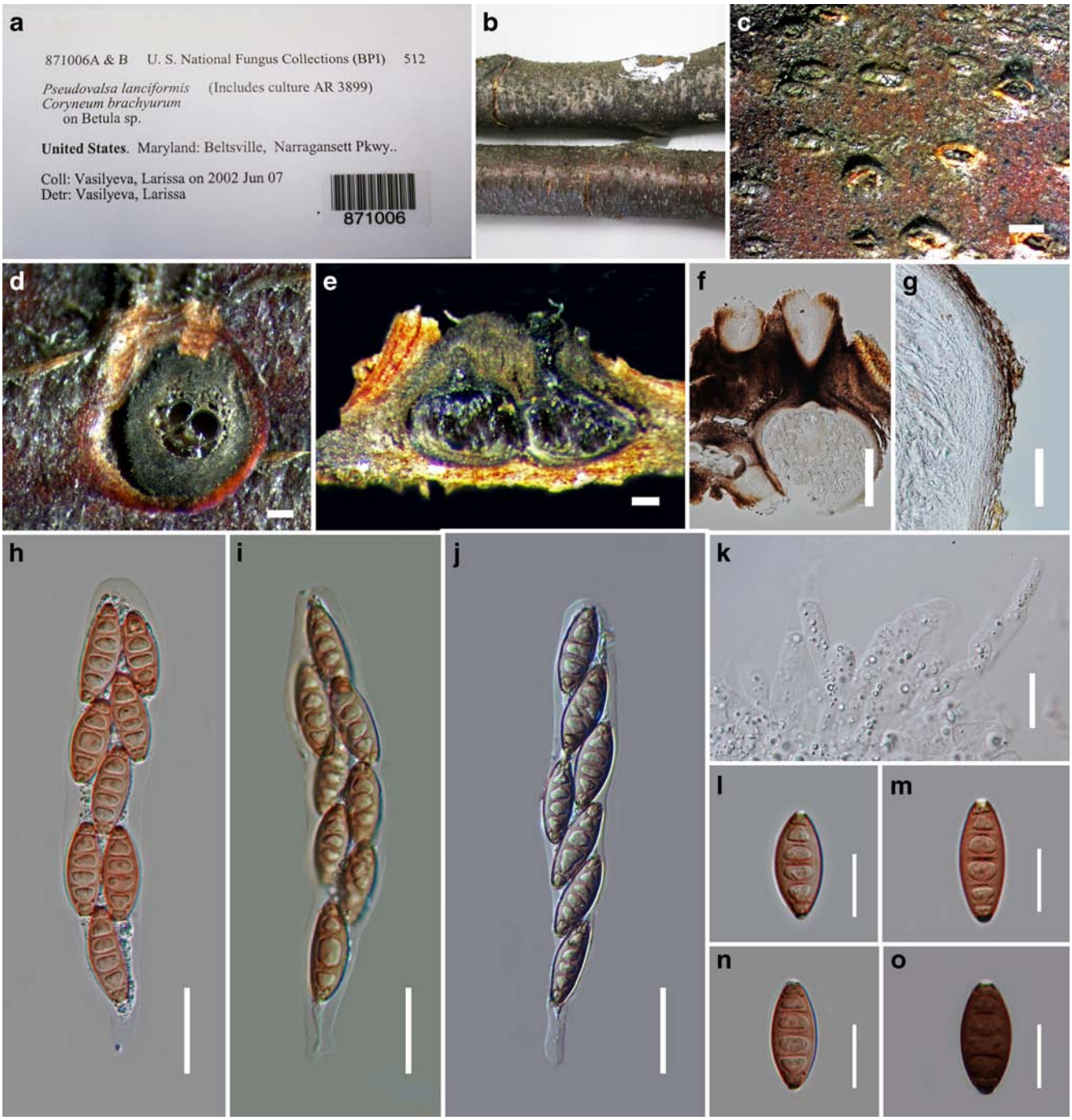

Fig. 121 ***Coryneum lanciformis*** **- sexual morph** (Material examined: USA, Maryland, Beltsville, Narragansett Parkway, on stem of *Betula* sp., 7 June 2002, L. Vasilyeva BPI 871006A) **a** Herbarium packet **b** Herbarium specimen **c** Stromata on substrate **d** Transverse section of stroma **e** Longitudinal section of stroma **f** Longitudinal section of ascoma **g** Peridium **h–j** Asci **k** Paraphyses **l-o** Ascospores. Scale bars: **c** = 1 mm, **d** = 200 μm, **e**, **f** = 100 μm, **g** = 20 μm, **h–j** = 20 μm, **k–o** = 10 μm

cause plant disease, such as Coryneum-blight on leaves, twigs and buds of cherry, stone fruits, peach and apricot. Index Fungorum (2016) lists 41 epithets under *Pseudovalsa* within the family *Pseudovalsaceae* and 159 epithets are listed under *Coryneum* (Index Fungorum 2016).

Other genus included

Apoharknessia Crous & S.J. Lee, Stud. Mycol. 50(1): 239 (2004)

Type species: ***Apoharknessia insueta*** (B. Sutton) Crous & S.J. Lee, in Lee et al., Stud. Mycol. 50(1): 240 (2004)

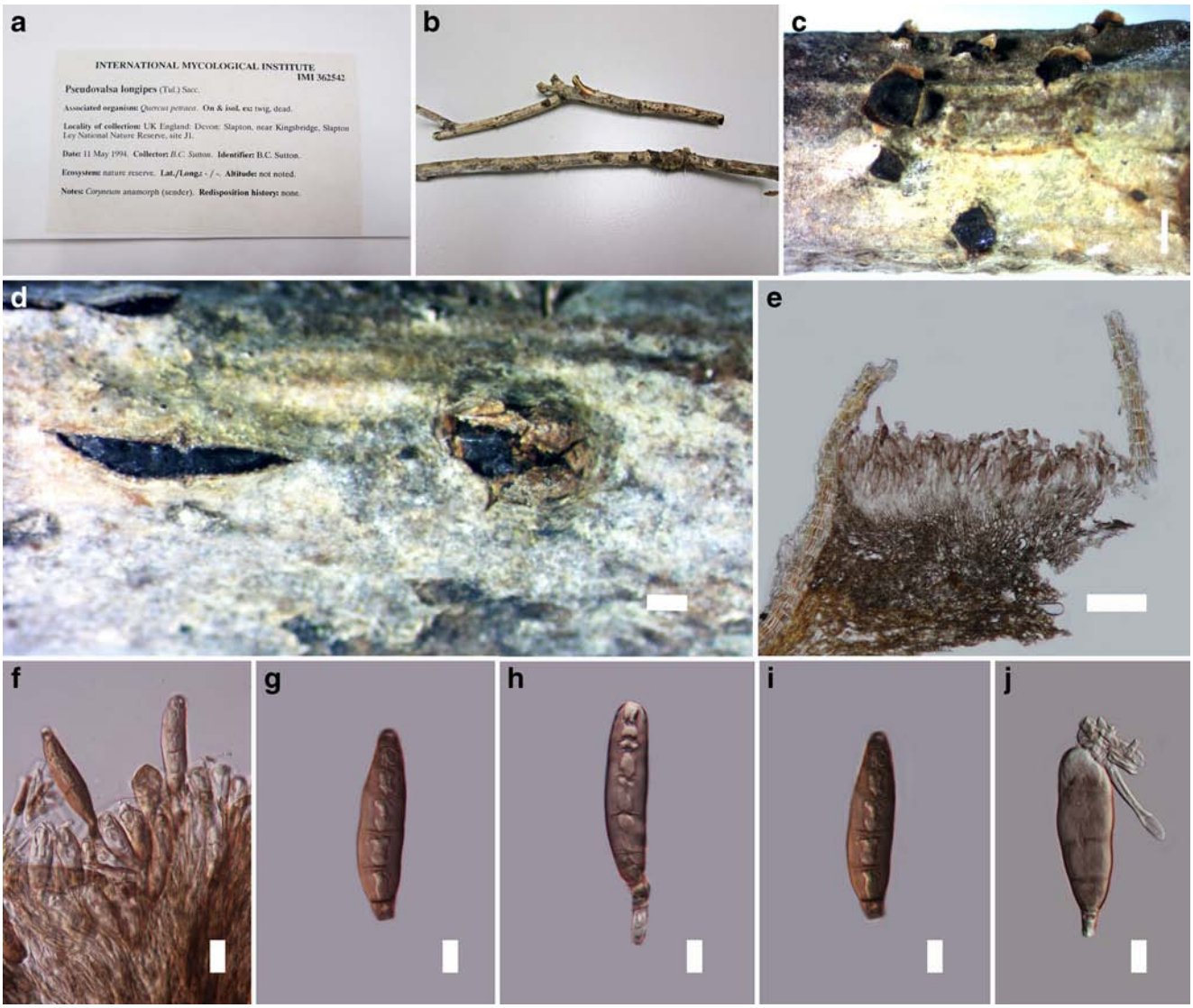

Fig. 122 ***Coryneum longipes*** **- asexual morph** (UK England, Devon, Slapton, near Kingsbridge, Slapton Ley National Nature Reserve, site J1, on twigs of *Quercus petraea* (Mattuschka) Liebl. (*Fagaceae*), 11 May 1994, B.C. Sutton, IMI 362542) **a**, **b** Herbarium packet **c**, **d** Conidiomata on substrate **e** Cross section of conidioma **f** Conidia attached to conidiophores **g-i** Conidia. Scale bars: **c** = 1 mm, **d** = 500 μm, **e** = 100 μm, **f–j** = 10 μm

Key to genera of *Pseudovalsaceae*

1. Conidiomata immersed and globose, unicellular conidia with a hyaline, apical apiculus . . . . . ***Apoharknessia***
   1. Conidiomata erumpent and broadly fusiform to cylindrical or clavate conidia, with 4–6 distosepta, apical cell hyaline . . . . . ***Coryneum***

Pyriculariaceae Klaubauf et al., Studies in Mycology 79: 85–120 (2014)

Facesoffungi number: FoF 01801

Pathogenic or *saprobic* on various plant hosts, commonly on monocotyledons. **Sexual morph**: *Ascomata* perithecial, immersed in plant tissue, solitary, scattered or gregarious, black, surface smooth, coriaceous, brittle, with long cylindrical necks, covered in setae. *Peridium* comprising of several layers of brown *textura angularis*. *Hamathecium* comprising septate, hyaline, paraphyses intermingled among asci. *Asci* 8-spored, unitunicate, subcylindrical, short pedicellate, with a large, J+, apical ring. *Ascospores* ellipsoid to obclavate, fusiform, often with median cells pigmented, with 3–septa, pale-brown, lacking a sheath. **Asexual morph**: Hyphomycetous. *Conidiophores* solitary or in fascicles, subcylindrical, erect, olivaceous, pale brown or brown, in some genera branched (*Pseudopyricularia* and *Xenopyricularia*) or

unbranched (*Bambusicularia*, *Barretomyces*, *Deightoniella*, *Macgarvieomyces*, *Neocordana*, *Neopyricularia*, *Proxipyricularia* and *Pyricularia*). *Conidiogenous cells* integrated, pigmented, denticulate. *Conidia* hyaline to brown, 1–5-transversely septate, some genera (*Neopyricularia*, *Proxipyricularia* and *Pyricularia*) have apical mucoid appendages.

Type: ***Pyricularia*** Sacc.

Notes: The family *Pyriculariaceae* was introduced by Klaubauf et al. (2014), as a sister family to the *Ophioceraceae*, based on morphological and phylogenetic analyses. All member of this family cause diseases on monocotyledons plants. Klaubauf et al. (2014) accepted nine genera, of which seven were new genera (*Bambusicularia*, *Barretomyces*, *Macgarvieomyces*, *Neopyricularia*, *Proxipyricularia*, *Pseudopyricularia* and *Xenopyricularia*) into *Pyriculariaceae* based on morphology and molecular analysis of the combined ACT, ITS and RPB1 genes (Klaubauf et al. 2014).

Klaubauf et al. (2014) re-evaluated generic and species concepts within *Pyriculariaceae*, and novelties was proposed based on morphological and phylogenetic data. The taxonomic relationships among magnaporthe-like or pyricularia-like species were clarified using phylogenetic analyses of isolates representing a wide range of host plants by using partial DNA sequences of multiple genes (LSU, ITS, RPB1, Actin and Calmodulin).

Pyricularia Sacc., Michelia 2(no. 6): 20 (1880)

Faces of fungi number: FoF 01802; Fig. 123

Pathogenic on plants **Sexual morph**: *Ascomata* perithecial, immersed in host tissue, solitary and gregarious, subsphaerical, brown to black, with long neck protruding above host surface. *Peridium* comprising several layers of *textura angularis*. *Paraphyses* intermingled among asci, unbranched, septate. *Asci* 8-spored, unitunicate, subcylindrical to clavate, short-stipitate, with prominent, with a large, J+, apical ring. *Ascospores* bi- to multi-seriate, hyaline, fusiform, curved, with rounded ends, transversely 3-septate, slightly constricted at septa, guttulate, smooth-walled. **Asexual morph**: Hyphomycetous, *Conidiophores* solitary or in fascicles, hyaline to pale brown, sub cylindrical, smooth, rarely branched, with sympodial proliferation. *Conidiogenous* cells terminal and intercalary, pale brown, with denticulate conidiogenous loci and rhexolytic secession. *Conidia* solitary, pyriform to obclavate, 2-septate, narrowed toward tip, rounded at the base, hyaline to pale brown, with a distinct basal hilum, sometimes with marginal frill

Type species: ***Pyricularia grisea*** Sacc., Michelia 2(no. 6): 20 (1880)

Notes: The genus *Pyricularia* was established by Saccardo (1880) with *Pyricularia grisea* Sacc. (synonym: *Magnaporthe grisea*) as the type species. The name of the type genus *Pyricularia*, refers to the pyriform shape of the conidia, which is a specific character of this genus (Bussaban et al. 2005). Klaubauf et al. (2014) synonymized *M. grisea* under *P. grisea*, by clarify the taxonomic relationships among species that are magnaporthe- or pyricularia-like using molecular phylogeny (LSU, ITS, RPB1, Actin and Calmodulin).

This genus includes species that are pathogenic on a wide range of monocotyledonous plants (Klaubauf et al. 2014), and of these *P. oryzae* Cavara (1892) (synonym: *Magnaporthe oryzae*) is responsible for the foliar disease of wheat and millet as well as the cause of the major rice blast disease, which is highly destructive and causes up to 30 % yield loss worldwide (Skamnioti and Gurr 2009). *Pyricularia grisea* is responsible for a foliar disease of *Digitaria* (Klaubauf et al. 2014).

Other genera included

Bambusicularia Klaubauf et al., Stud. Mycol. 79: 104 (2014)

Type species: ***Bambusicularia brunnea*** Klaubauf et al. Stud. Mycol. 79: 104 (2014)

Barretomyces Klaubauf et al., Stud. Mycol. 79: 104 (2014)

Type species: ***Barretomyces calatheae*** (D.J. Soares et al.) Klaubauf et al., Stud. Mycol. 79: 104 (2014)

Deightoniella S. Hughes, Mycol. Pap. 48: 27 (1952)

Type species: ***Deightoniella africana*** S. Hughes, Mycol. Pap. 48: 27 (1952)

Macgarvieomyces Klaubauf et al., Stud. Mycol. 79: 106 (2014)

Type species: ***Macgarvieomyces borealis*** (de Hoog & Oorschot) Klaubauf et al., Stud. Mycol. 79: 107 (2014)

Neocordana Hern.-Restr. & Crous, in Hernández-Restrepo et al., Phytotaxa 205(4): 233 (2015)

Type species: ***Neocordana musae*** (Zimm.) M. Hern.-Rest. & Crous, in Hernández-Restrepo et al., Phytotaxa 205(4): 234 (2015)

Neopyricularia Klaubauf et al., Stud. Mycol. 79: 108 (2014)

Type species: ***Neopyricularia commelinicola*** (M.J. Park & H.D. Shin) Klaubauf et al., Stud. Mycol. 79: 108 (2014)

Proxipyricularia Klaubauf et al., Stud. Mycol. 79: 109 (2014)

Type species: ***Proxipyricularia zingiberis*** (Y. Nisik.) Klaubauf et al., Stud. Mycol. 79: 109 (2014)

Pseudopyricularia Klaubauf et al., Stud. Mycol. 79: 109 (2014)

Type species: ***Pseudopyricularia kyllingae*** Klaubauf et al., Stud. Mycol. 79: 109 (2014)

Xenopyricularia Klaubauf et al., Stud. Mycol. 79: 116 (2014)

Type species: ***Xenopyricularia zizaniicola*** (Hashioka) Klaubauf et al., Stud. Mycol. 79: 116 (2014)

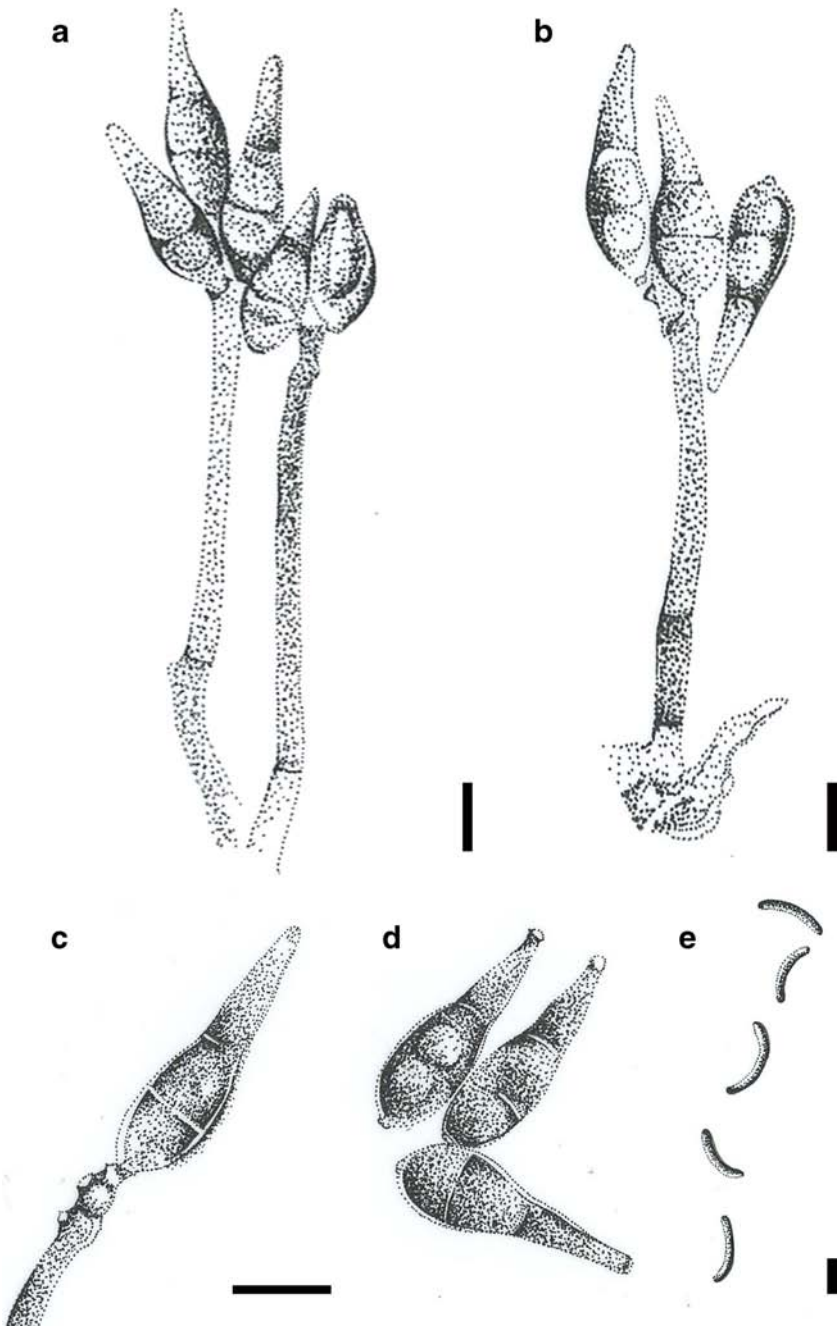

Fig. 123 *Pyricularia grisea* **a**, **b**, **c** Conidiophores and conidia **d** Conidia with apical marginal frill, which is a remnant of the apical mucoid cap. **e** Microconidia. Scale bars: **a**–**e** = 10 μm (redrawn from Klaubauf et al. 2014)

Key to genera of *Pyriculariaceae*

1. Conidiophores branched 2
1. Conidiophores unbranched 3
2. Conidia obclavate, finely roughened . . . . . ***Pseudopyricularia***
2. Conidia obovoid, narrowed toward apex . . . . . ***Xenopyricularia***
3. Conidia with 2(−5)-septa 4
3. Conidia with 1-septa 5
4. Conidia 4(−5)-septate . . . . . ***Barretomyces***
4. Conidia 2-septate 6
5. Conidia pale brown 7
5. Conidia hyaline (narrowly obclavate) . . . . . ***Macgarvieomyces***
6. Conidia ellipsoid to obclavate, finely roughened . . . . . ***Bambusicularia***
6. Conidia pyriform to obclavate, narrowed toward tip, rounded at the base 8
7. Conidia ellipsoid, thin-walled . . . . . ***Deightoniella***
7. Conidia obclavate, thick-walled . . . . . ***Neocordana***
8. Conidiogenous loci slightly darkened . . ***Neopyricularia***
8. Conidiogenous loci not darkened 9
9. Conidiophores olivaceous to brown . . ***Proxipyricularia***

9. Conidiophores pale brown to yellow . . . . . ***Pyricularia***

Reticulascaceae Réblová & W. Gams, in Réblová et al., Stud. Mycol. 68(1): 180 (2011)

Facesoffungi number: FoF 01311

Saprobic on terrestrial tree branches, wood and bark. **Sexual morph**: *Stromata* minute, sometimes present. *Ascomata* superficial, gregarious to solitary, brown to black, subglobose to conical, base flattened, slightly verruculose, glabrous with minute papilla, ostiole periphysate. *Peridium* 26–39 μm wide, fragile, 2-layered, the whole wall heavily sclerotized in the upper part, poorly developed towards the rim, absent at the base. *Hamathecium* composed of copious, 1–2 μm wide, filiform, sparsely septate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical to clavate, short-pedicellate, apex truncate to broadly rounded, with inamyloid, apical ring. *Ascospores* uni to bi-seriate, hyaline or dark brown, septate, mostly 2-celled, with a delayed formation of the 2 additional septa, smooth-walled, ellipsoidal to fusiform, sometimes with end pores. **Asexual morph**: Hyphomycetous. *Cylindrotrichum*: *Setae* straight, cylindrical, septate, dark brown, paler towards the apex. *Conidiophores* macronematous, mononematous, solitary, erect, unbranched, 2-layered. *Conidiogenous cells* monophialidic, collarette hyaline to subhyaline, disappearing early. *Conidia* cylindrical, rounded at the apex, 1-septate, not constricted at the septum, smooth-walled, hyaline. *Kylindria*: *Conidiophores* setiform, solitary, erect, sometimes curved, branched, gregarious, scattered, septate, thick-walled, dark brown, becoming paler towards the apex, smooth-walled. *Conidia* blastic-phialidic, 1-several-septate, oblong-ellipsoid, apex rounded, tapering towards the truncate base, hyaline, smooth-walled. *Sporoschismopsis*: *Conidiophores* erect, straight to slightly flexuous, un-branched, brown, septate, thick-walled, terminating in a cylindrical to slightly flask-shaped monophialide, collarette funnel-shaped, which encloses not more than one conidium. *Conidia* clavate, cuneiform, obovate, pyriform to subcylindrical-clavate, distal end bluntly rounded, basal end truncate, septate, uniformly brown or with paler distal and/or basal cells, sometimes the septa are obscured by a darker band, without or with conspicuous pores at the septa.

Type: ***Cylindrotrichum*** Bonord., Handb. Allgem. mykol. (Stuttgart): 88 (1851)

Notes: The family *Reticulascaceae* was introduced to accommodate two holomorphic genera *Reticulascus* and *Porosphaerellopsis* Samuels & E. Müll., supported by analysis of combined ITS, LSU, SSU and RPB2 sequence data. Even though the characters and ontogeny of these genera differ, the centrum and interthecial tissues are quite similar (Réblová et al. 2011). The asexual dematiaceous hyphomycete genera *Cylindrotrichum*, *Kylindria* and *Sporoschismopsis* are linked with the family (Réblová et al. 2011; Maharachchikumbura et al. 2015). The sexual-asexual link between *Porosphaerellopsis* and *Sporoschismopsis* has been established by Réblová (2014) who synonymized the sexual genus *Porosphaerellopsis* under the asexual genus *Sporoschismopsis*. The link between *Reticulascus* and *Cylindrotrichum* has also been established by Réblová and Gams (1999) and Maharachchikumbura et al. (2015) recommended the use of *Cylindrotrichum* over *Reticulascus*, which is followed in this paper.

Kylindria has oblong, longer, wider, 1-several-sepatate, often asymmetrical conidia that are in contrast to *Cylindrotrichum* that has cylindrical, narrower, 1-septate, symmetrical conidia. Therefore, we follow Réblová (2012) and keep these two genera separate, even though very Little information is available on the genus *Kylindria*.

Cylindrotrichum Bonord., Handb. Allgem. mykol. (Stuttgart): 88 (1851) Fig. 124, 125

Synonym: *Reticulascus* Réblová & W. Gams, in Réblová et al. Stud. Mycol. 68(1): 180 (2011)

Type species: ***Cylindrotrichum oligospermum*** (Corda) Bonord., Handb. Allgem. mykol. (Stuttgart): 88 (1851)

Notes: The genus *Reticulascus* was introduced by Réblová et al. (2011) for the two holomorphic species, namely *R. tulasneorum* Réblová & W. Gams with the asexual morph *Cylindrotrichum oligospermum* (Corda) Bonord and *Reticulascus clavatus* Réblová & J. Fourn. with the asexual morph *Cylindrotrichum clavatum* W. Gams. The asexual morph of *Reticulascus* generally resembles the dematiaceous, phialidic hyphomycete, linked with *Chaetosphaeria*, but differs in having cylindrical, 1–septate conidia (Réblová et al. 2004; Réblová et al. 2011). *Cylindrotrichum hennebertii* W. Gams & Hol.-Jech. was synonymized under *C. oligospermum* due to their identical ITS sequences (Réblová et al. 2011). *Reticulascus tulasneorum* produces minute, black, astromatic ascomata, growing on decaying wood. *Reticulascus clavatus* is common on submerged wood. It differs from *Reticulascus tulasneorum* and its asexual morph by having verruculose, mature ascospores and in the absence of setae among the conidiophores. Physical separation of the conidiogenous cells and setae makes *Cylindrotrichum setosum* Seifert unique in the genus. Microconidia have also been reported only from *C. setosum*. Maharachchikumbura et al. (2015) recommended that *Cylindrotrichum* and *Reticulascus* should be treated as congeneric and as the *Cylindrotrichum* is the older name, *Reticulascus* should be synonymized under this genus, which is followed in this paper.

Other genus included

Kylindria DiCosmo, S.M. Berch & W.B. Kendr., Mycologia 75(6): 970 (1983)

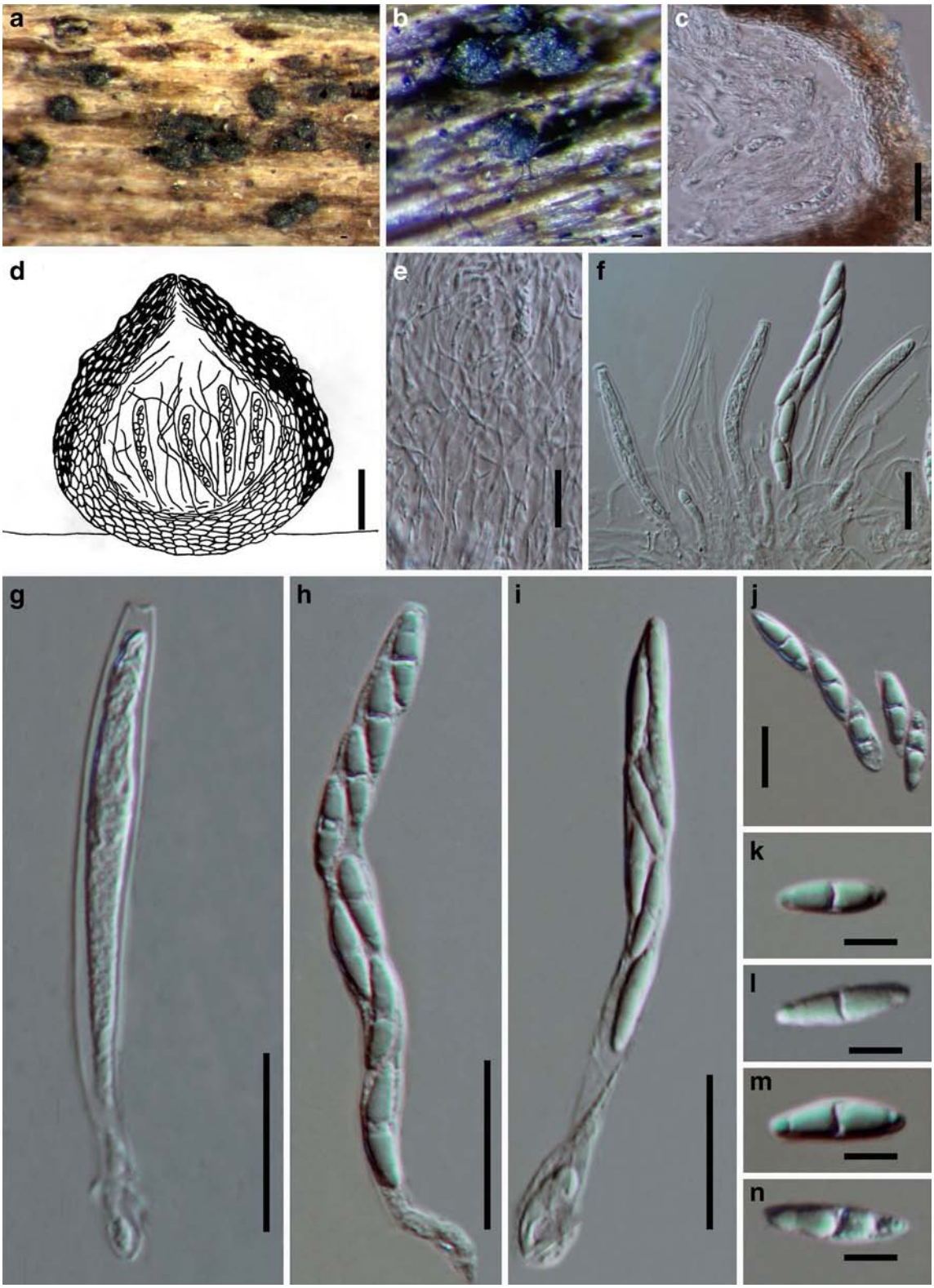

Fig. 124 ***Reticulascus tulasneorum*** (CZECH REPUBLIC, Southwestern Bohemia, Javornická, Hornatina Mts, Strašín, near Sušice, on dead branch of *Sambucus nigra* L. (*Adoxaceae*), 21 October 1997, M. Svrček, (PRM 842978, **holotype**), Median, longitudinal section of ascomata of *Reticulascus tulasneorum* redrawn from Réblová and Gams (1999) **a** Ascomata on the host **b** Ascomata with conidiophores of the asexual morph on the host **c** Cells of peridium **d** Median, longitudinal section of ascomata with sclerotized lateral wall **e** Interthecial filaments **f** Asci with ascospores **g** Immature hyaline ascus **h–i** Matured, hyaline asci **j–n** Hyaline 1–4 septate ascospores. Scale bars: **a–b** = 100 μm, **c–d** = 50 μm, **g–I** = 25 μm, **e–f**, **j–n** = 10 μm

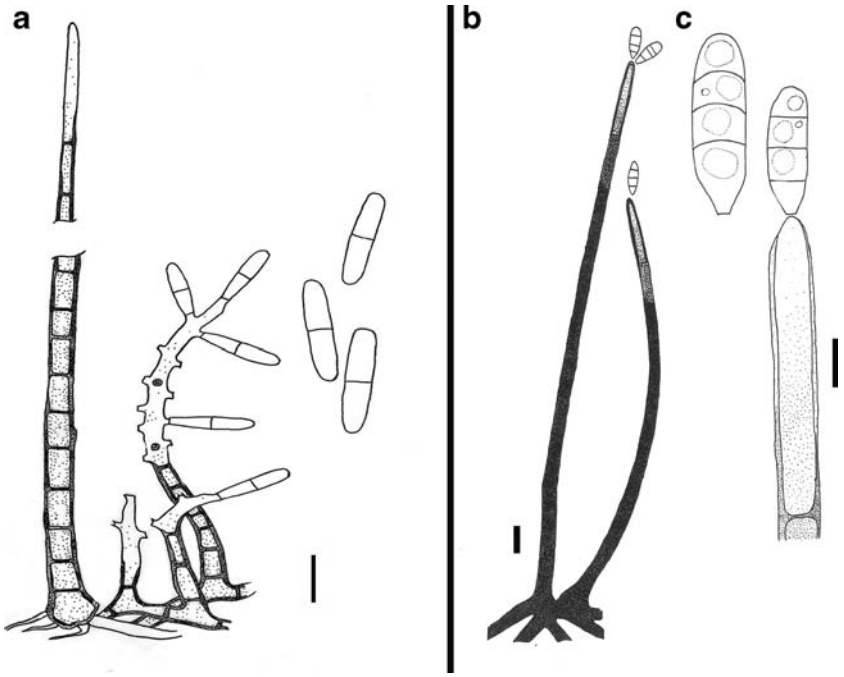

Fig. 125 Different hyphomycetous asexual morphs of *Reticulascaceae* asexual morph of *Reticulascus tulasneorum* redrawn from Réblová and Gams (1999), asexual morph *Kylindria trisepta* redrawn from DiCosmo et al. (1983) **a** Conidiophores and hyaline conidia of *Reticulascus tulasneorum* **b** Conidiophores and conidia of *Kylindria trisepta* **c** Conidiogenous cell and conidia of *K. trisepta* Scale bars: **b** = 50 μm, **a**, **c** = 20 μm

Type species: ***Kylindria triseptata*** (Matsush.) DiCosmo, S.M. Berch & W.B. Kendr., Mycologia 75(6): 971 (1983)

Sporoschismopsis Hol.-Jech. & Hennebert, Bull. Jard. Bot. natn. Belg. 42(4): 385 (1972)

Synonym: *Porosphaerellopsis* Samuels & E. Müll., in Müller & Samuels, Sydowia 35: 143 (1982)

Type species: ***Sporoschismopsis moravica*** Hol.-Jech. & Hennebert, Bull. Jard. Bot. natn. Belg. 42(4): 387 (1972)

Key to genera of *Reticulascaceae*

1. Conidiophores often seta-like, with a terminal monophialide at the apex 2
   1. Setae straight, sterile, septate, dark brown . . . . . ***Cylindrotrichum***
   2. Conidia hyaline, 1-several septate, oblong-ellipsoidal. . . . . ***Kylindria***
2. Conidia, uniformly brown or with paler distal and/or basal cells, 3-septate, clavate-sub-cylindrical clavate. . . . . ***Sporoschismopsis***

Robillardaceae Crous, in Crous et al., IMA Fungus 6: 184 (2015)

Facesoffungi number: FoF 01912

Saprobic or *pathogenic* on plants in terrestrial and aquatic habitats. **Sexual morph**: Undetermined. **Asexual morph**: *Conidiomata* stromatic, pycnidial to pycnidioid or indeterminate, immersed to partially erumpent, unilocular to convoluted, dehiscing by an ostiole or by an irregular split in the apical wall and overlying host tissue; wall thick of *textura angularis* to *textura prismatica*. *Conidiophores* reduced to conidiogenous cells lining the cavity of the locule. *Conidiogenous cells* discrete, ampulliform to lageniform, hyaline, smooth; proliferating sympodially. *Conidia* composed of a conidium body and a separate apical cell modified into a branched appendage; conidium body ellipsoid or fusiform, 1-euseptate, wall smooth, hyaline to pale brown; apical cell dividing into appendages.

Type: ***Robillarda*** Sacc.

Notes: This is a recently introduced monotypic family based on ITS sequence data supplemented with HIS sequence data. *Robillarda* showed a distinct lineage from other taxa in *Xylariales* and therefore Crous et al. (2015a) introduced a monotypic family *Robillardaceae* with the *Robillarda* as the type genus.

Robillarda Sacc., Michelia 2(no. 6): 8 (1880)

Facesoffungi number: FoF 02130; Fig. 126

Saprobic or *pathogenic* on plants. **Sexual morph**: Undetermined. **Asexual morph**: *Conidiomata* pycnidial to pycnidioid, scattered to gregarious, occasionally confluent, immersed to partly erumpent, unilocular to variably loculate with the locule often convoluted, glabrous; wall thick of *textura angularis* to *textura prismatica*. *Conidiophores* reduced to *conidiogenous* cells or with 1–2 supporting cells lining the cavity of the locule. *Conidiogenous cells* discrete, ampulliform to lageniform, hyaline, smooth; proliferating sympodially or percurrently near apex. *Conidia* composed of a conidium body and a separate apical cell modified into a branched appendage; conidium body ellipsoid or fusiform, 1-euseptate, wall smooth and occasionally constricted at the septum, hyaline to pale brown, often guttulate; apical cell short-cylindrical at

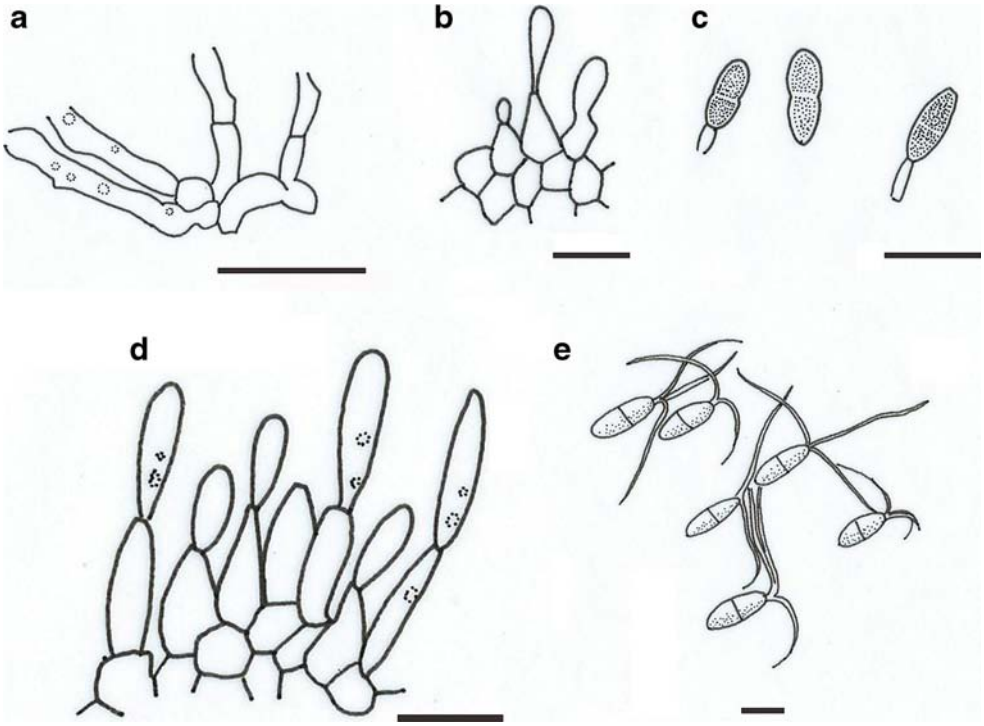

Fig. 126 ***Robillarda sessilis*** (CBS 114312, **epitype**) (redrawn from Crous et al. 2015a) **a–d** Conidiogenous cells **e** Conidia. Scale bars = 10 μm

base, then dividing into 2–5 branches, branches thin-walled, tubular, ends pointed or swollen, flexuous, divergent, smooth, hyaline, devoid of contents.

Type species: ***Robillarda sessilis*** (Sacc.) Sacc., Michelia 2(no. 6): 8 (1880)

Notes: There are 38 names referred to *Robillarda* Sacc. (Index Fungorum 2016). However, many of them are still without critical reappraisal and need to be transferred to *Chaetoconis Hyalotiella*, *Neottiospora*, *Pestalotiopsis* and *Pseudorobillarda* (Crous et al. 2015a). The type of *Robillarda*, *R. sessilis* was isolated from wilted leaves of *Rubus caesius* in Italy. Crous et al. (2015a) designated an epitype collected from soil dust in Germany.

Savoryellaceae Jaklitsch & Réblová, Index Fungorum 209: 1 (2015)

Facesoffungi number: FoF 01283

Saprobic on submerged wood in freshwater, marine and brackish habitats. **Sexual morph**: *Ascomata* perithecial, brown to black, immersed or superficial, globose to pyriform, coriaceous, periphysate, ostiolate, papillate. *Papilla* central, or eccentric when lying horizontally to the host. *Peridium* membranous, comprising several layers of brown, thick-walled cells of *textura angularis*, hyaline inwardly. *Hamathecium* comprising hypha-like, numerous or sparse, septate paraphyses. *Asci* 2–8-spored, unitunicate, clavate to cylindrical, pedicellate, persistent, with a small or relatively large, J-, apical ring. *Ascospores* uniseriate or overlapping biseriate, versicolorous with brown middle cells and hyaline end cells, ellipsoid, fusiform, 3 to many septate, smooth, thick-walled, with or without polar mucilaginous pads or appendages. **Asexual morph**: hyphomycetous. *Hyphae* septate, branched, white to pale brown. *Conidiogenous cells* absent, if present erect, smooth and thick-walled, cylindrical, flask-shaped. *Conidia* solitary, dry, smooth, applanate or rounded, globose to subglobose or obovate to oval, holoblastic, with 3–6 longitudinal septa and 4–6 transverse septa or 1–4 transverse septa, slightly constricted at the septa, with a pale brown small basal cell, olive green to brown or blackish brown to black, with prominent scar at the point of secession from the conidiogenous cell.

Type: ***Savoryella*** E.B.G. Jones & R.A. Eaton

Notes: *Savoryella* has been placed in the order Sphaeriales family incertae sedis by Kohlmeyer and Kohlmeyer (1979), ascomycetes incertae sedis by Kohlmeyer (1986), Eriksson and Hawksworth (1986), *Amphisphaeriaceae* Eriksson and Hawksworth (1987) and *Sordariales* (Jones and Hyde 1992). Barr (1990) transferred this genus to the order *Halosphaeriales* (now *Microascales*) based on morphology (the catenophyses-like paraphyses) and ultrastructural observations. Vijaykrishna et al. (2006) and Cai et al. (2006a) referred *Savoryella elongata* and *S. longispora* to the order *Hypocreales*, subclass *Hypocreomycetidae*, based on a phylogenetic analysis of LSU rDNA data, although with weak statistical support. Jones et al. (2009b) referred the genus to the *Sordariales* genera *incertae sedis* based on morphological observations. Boonyuen et al. (2011) introduced the new order *Savoryellales* to accommodate the genera *Ascotaiwania*, *Ascothailandia* (and its asexual morph, *Canalisporium*) and *Savoryella* based on multi-gene dataset. The genus

Ascothailandia was introduced to accommodate a sexual morph that grouped with the asexual morph *Canalisporium*, forming a sister clade to *Savoryella* and *Ascotaiwania*. Subsequently, Jaklitsch (2015) erected the family *Savoryellaceae* and this was accepted by Maharachchikumbura et al. (2015) and Jones et al. (2015).

Savoryella E.B.G. Jones & R.A. Eaton, Trans. Br. mycol. Soc. 52(1): 161 (1969)

Facesoffungi number: FoF 02131; Fig. 127, 128, 129

Saprobic on submerged wood in cooling towers, rivers, streams and marine environments. **Sexual morph**: *Ascomata* perithecioid, globose, subglobose or ellipsoidal, immersed, partly immersed or superficial, ostiolate, papillate, membranous, and pale to dark brown, long necked, brown coloured, periphysate. *Peridium* brown, composed of several layers of thick-walled angular cells forming *textura angularis*. *Paraphyses* present, but sparse. *Asci* 2–8-spored, cylindrical or clavate, short-stalked, unitunicate, persistent, with an apical truncate non-amyloid apical thickening containing a pore. *Ascospores* uni- or biseriate, ellipsoidal, 3-septate, not markedly constricted at the septa, central cells brown, apical cells smaller and hyaline. **Asexual morph**: Undetermined.

Type species: ***Savoryella lignicola*** E.B.G. Jones & R.A. Eaton, Trans. Br. mycol. Soc. 52(1): 162 (1969)

Notes: Jones and Eaton (1969) established the genus *Savoryella* with *S. lignicola* as the type species. *Savoryella* has been placed in the order *Sphaeriales* family *incertae sedis* by Kohlmeyer and Kohlmeyer (1979), ascomycetes *incertae sedis* by Kohlmeyer (1986),

Other genera included

Ascotaiwania Sivan. & H.S. Chang, Mycol. Res. 96(6): 481 (1992)

Type species: ***Ascotaiwania lignicola*** Sivan. & H.S. Chang, Mycol. Res. 96(6): 481 (1992)

Canalisporium Nawawi & Kuthubutheen, Mycotaxon 34(2): 477 (1989); Fig. 128

= *Ascothailandia* Sri-indr. et al., Mycoscience 51(6): 414 (2010)

Saprobic on submerged wood. **Sexual morph**: *Ascomata* immersed to semi-immersed or superficial, perithecial, globose to sub-globose, dark brown to black, solitary, scattered, long neck, ostiolate. *Ostiole* mostly central but if ascomata are lying horizontal to the host surface, then at one end and curving upwards, long or short, mostly brown or black, periphysate. *Paraphyses* hypha like, numerous, tapering distally, not embedded in a gelatinous matrix. *Asci* 8-spored, long cylindrical, pedunculate, unitunicate, apically truncate, with a refractive, J-apical ring, cylindrical, persistent. *Ascospores* uniseriate or overlapping uniseriate, fusiform, straight or curved, 3-euseptate and versicolurus (Modified description of Sri-indrasutdhi et al. 2010). **Asexual morph**: *Colonies* sporodochial, punctiform, scattered, glistening, white to yellow when young, dark brown to black when mature. *Mycelium* immersed, consisting of branched, septate, smooth, thin-walled, hyaline to pale brown hyphae. *Conidiophores* semi-macronematous, unbranched, septate, smooth, thin-walled, hyaline, becoming vesiculate and disintegrating as conidia mature. *Conidiogenous cells* monoblastic, integrated, terminal, determinate, oblong or often becoming swollen, hyaline or pale brown. *Conidia* acrogenous, solitary, brown or pale olive brown, smooth, thick-walled, broadly ellipsoidal to obovoid in surface view, cylindrical to clavate in lateral view, muriform, with ordered arrangement of a single, straight or slightly curved column vertical septum and 2–6 rows transverse septa, slightly constricted at the septa; septa becoming darker progressively with conidial maturity; basal cell pale brown, cuneiform, Conidial secession rhexolytic. Modified description of Nawawi and Kuthubutheen (1989).

Type species: ***Canalisporium caribense*** (Hol.-Jech. & Mercado) Nawawi & Kuthubutheen, Mycotaxon 34 (2): 479 (1989)

Notes: *Canalisporium* species are saprobes on rotten wood and have a pantropical distribution (Goh et al. 1998). The genus has been recorded in Cuba (Holubová-Jechová and Sierra 1984), India (Rao and de Hoog 1986), Kenya (Kirk 1985), Malaysia (Nawawi and Kuthubutheen 1989), Taiwan (Matsushima 1987), and Uganda (Matsushima 1987). The genus *Canalisporium* Nawawi & Kuthubutheen (1989) was first introduced to accommodate *Berkleasmium caribense* Hol.-Jech. & Mercado, *Berklea smiumpulchrum* Hol.-Jech. & Mercado (Holubová-Jechová and Sierra 1984), and a new species, *Canalisporium elegans* Nawawi & Kuthubutheen (1989). *Canalisporium* species are characterized by having scattered, punctiform, pulvinate, granular, black, glistening sporodochia that contain acrogenous, holoblastic conidia developing in a hyaline gelatinous sheath (Goh et al. 1998). At present, 12 species are included under this genus including the recently introduced *Canalisporium microsporum* G.Z. Zhao (Zhao et al. 2012). *Canalisporium grenadoidia* has borne on ascospore isolates of *Ascothailandia* on the culture (Sri-indrasutdhi et al. 2010). Combined analysis of SSU, LSU and ITS showed that seven *Canalisporium* species forms a highly supported monophyletic clade in the *Hypocreomycetidae* (*Sordariomycetes*) together with *Ascothailandia*. Thus *Ascothailandia,* which is a recent name, becomes a

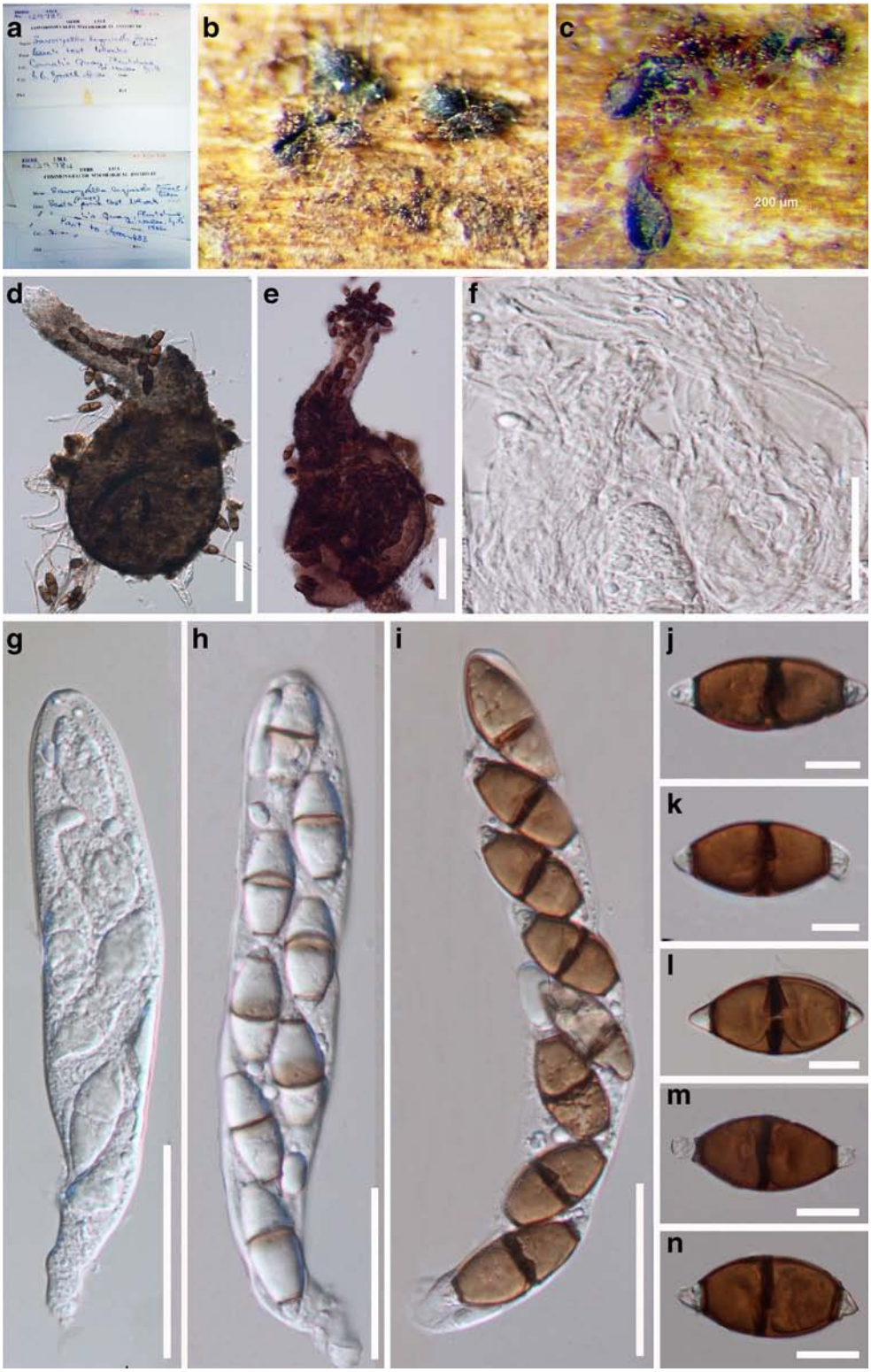

Fig. 127 ***Savoryella lignicola*** (Material examined: UK, Flintshire, Connahis Quay, Test block, 1966, IMI 129784, IMI 129785, **holotype**) **a** Herbarium specimen **b**, **c** Ascomata on host **d**, **e** Ascomata **f** Paraphyses **g–i** Asci **j–n** Ascospores. Scale bars: **c** = 200 µm, **d–e** = 100 µm, **g–i** = 50 µm, **j–n** = 20 µm

synonym of *Canalisporium* (Sri-indrasutdhi et al. 2010, Maharachchikumbura et al. 2015).

Monotosporella S. Hughes, Can. J. Bot. 36: 786 (1958)

Type species: ***Monotosporella setosa*** (Berk. & M.A. Curtis) S. Hughes, Can. J. Bot. 36: 787 (1958)

Taxonomic position in the family needs verification

Helicoon Morgan, J. Cincinnati Soc. Nat. Hist. 15: 49 (1892)

Type species: ***Helicoon sessile*** Morgan, J. Cincinnati Soc. Nat. Hist. 15: 50 (1892)

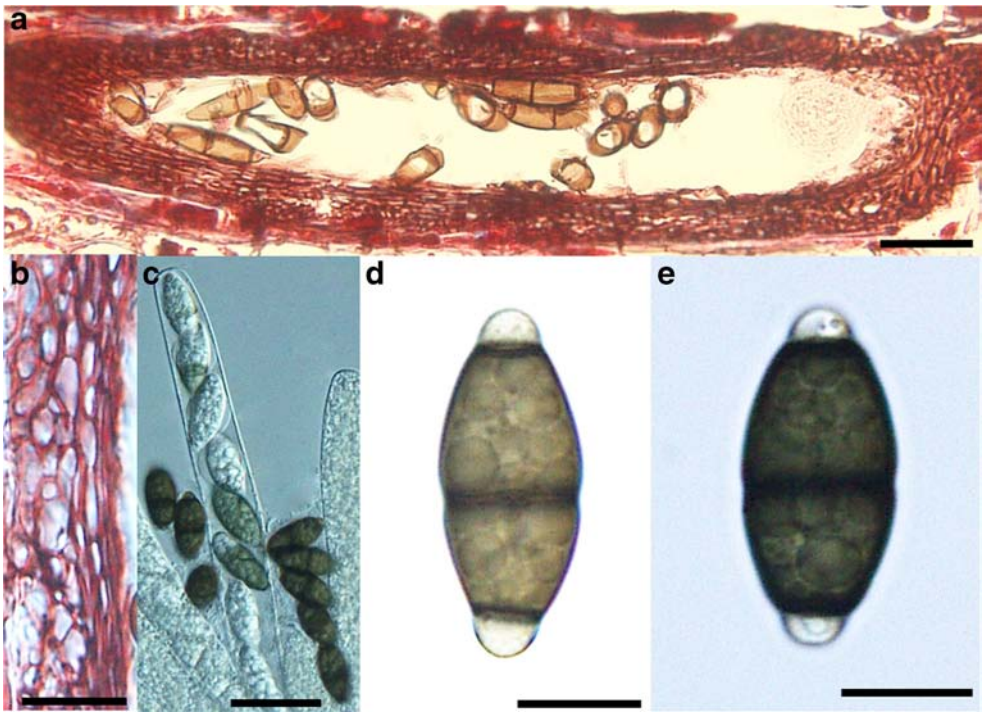

Fig. 128 ***Savoryella lignicola*** (Material examined: MALAYSIA, Tioman island, Mangrove, on dead mangrove wood, 12 July 2010, K. L. Pang) **a** Immersed ascoma **b** Peridium composed of a few layers of angular cells forming *textura angularis* **c** Cylindrical asci **d–e** Ascospores with brown central and hyaline end cells. Scale bars: **a**, **c** = 30 μm, **b**, **d–e** = 10 μm

Key to genera of *Savoryellaceae*

1. Sexual morph perithecioid 4
   1. Asexual morph hyphomycetous 2
   2. Conidia applanate or helicoid 3
   2. Conidia obovate to oval . . . . . ***Monotosporella***
   3. Conidia applanate . . . . . ***Canalisporium***
   3. Conidia helicoid . . . . . ***Helicoon***
   4. Asci with massive, refractive, apical ring; ascospores fusiform, with pointed end cells . . . . . ***Ascotaiwania***
   4. Asci with small, discoid, apical pore/ring; ascospores ellipsoid, with rounded end cells . . . . . ***Savoryella***

Schizoparmaceae Rossman, Mycoscience 48 (3): 137 (2007)

Facesoffungi number: FoF 01405

Saprobic, *parasitic* or *pathogenic* on woody, herbaceous plants. **Sexual morph**: *Ascomata* perithecial, solitary, scattered, subepidermal, erumpent to superficial, globose, coriaceous, brown to black, short-papillate, ostiolate, with hyaline periphyses. *Peridium* comprising thick-walled, brown cells of *textura angularis*. *Hamathecium* lacking paraphyses. *Asci* 8-spored, unitunicate, ellipsoid to fusiform, sessile, with a J-, apical ring. *Ascospores* bi-seriate, hyaline, ellipsoidal, aseptate. **Asexual morph**: Coelomycetous. *Conidiomata* pycnidial, subepidermal, erumpent, globose, slightly depressed globose to subglobose. *Conidiomata wall* comprising thick-walled, brown cells of *textura angularis*. *Conidiophores* densely aggregated, slender, subulate, simple or branched, 0–3-septate. *Conidiogenous cells* annellidic, simple, smooth, with prominent periclinal thickening. *Conidia* hyaline or hyaline when young, becoming medium brown to dark brown at maturity, broad or narrowly ellipsoidal, with tapering apices, with or without a longitudinal germ slit.

Type: ***Pilidiella*** Petr. & Syd.

Notes: The family *Schizoparmaceae* was introduced to accommodate the genus *Schizoparme* and the asexual-morph genera *Coniella* and *Pilidiella*. (Castlebury et al. 2002; van Niekerk et al. 2004). Some species in this family are plant pathogens that cause leaf, stem and root diseases on a wide variety of hosts (van Niekerk et al. 2004). *Schizoparme* has been synonymized under *Pilidiella* giving priority to the older name *Pilidiella* (Maas et al. 1979; Rossman et al. 2015). Sutton (1980) and Nag Raj (1993) treated *Pilidiella* as a synonym of *Coniella* but recent phylogenetic analyses showed that these genera have distinct phylogenetic lineages in *Schizoparmeaceae* (van Niekerk et al. 2004; Wijayawardene et al. 2016). *Coniella* has dark brown conidia while *Pilidiella* having hyaline to pale brown conidia (Wijayawardene et al. 2016). However, *Pilidiella eucalyptorum* Crous & M.J. Wingf.and *P. tibouchinae* B.E.C. Miranda et al. have dark brown conidia which resemble *Coniella* (van Niekerk et al. 2004; Miranda et al. 2012; Wijayawardene et al. 2016). Nevertheless, Miranda et al. (2012) and Wijayawardene et al. (2016) showed that these both species cluster in *Pilidiella sensu stricto* in their phylogenetic analyses.

Pilidiella Petr. & Syd., Beih. Reprium nov. Spec. Regni veg. 42(1): 462 (1927)

Basionym: *Macroplodia quercicola* Oudem., Ned. kruidk. Archf, 3 sér. 2(3): 752 (1902)


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◀ **Fig. 129** ***Canalisporium caribense*** (Material examined: THAILAND, Chiang Rai Province, stream flowing in Tham Luang Nang Non Cave, on submerged wood, 25 November 2014, J. Yang, MFLU 15-3581, **holotype**) **a** Substrate **b–d** Sporodochia on wood **e–f** Squash mount of a sporodochium **g** Conidiophores **h–i** Vesiculate conidiogenous cell **j** Germinated conidium on nature substrate **k** Germinated conidium on PDA medium **l–o** Conidia. Scale bars: **b** = 500 μm, **c–d** = 50 μm, **e**, **i–k** = 20 μm, **f** = 30 μm, **g–h** = 15 μm, **l–o** = 10 μm

Facesoffungi number: FoF 01569; Fig. 130

Saprobic, *parasitic* or *pathogenic* on woody, herbaceous plants. **Sexual morph**: *Ascomata* perithecial, solitary, scattered, subepidermal, erumpent to superficial, globose, coriaceous, brown to black, warty structures forming around the erumpent parts, short papillate, ostiolate. *Papilla* wide, short, internally lined by hyaline periphyses. *Peridium* comprising thick-walled, brown, cells of *textura angularis*. *Hamathecium* lacking paraphyses. *Asci* unitunicate, 8-spored, unitunicate, ellipsoid to fusiform, sessile, apex wide and blunt, with thick-walled, J-, apical ring. *Ascospores* bi-seriate, ellipsoidal, hyaline, aseptate, thick-walled, granulate, with or without terminal mucous caps. **Asexual morph**: Coelomycetous. *Conidiomata* pycnidia, subepidermal, erumpent, globose, slightly depressed globose to subglobose, sometimes tapering slightly towards the ostiole, smooth, initially hyaline, becoming medium to dark brown. *Ostiole* central, comprising 3–6 layers of dark brown cells of *textura angularis* and central cushion of hyaline cells at the base, giving rise to conidiophores. *Conidiophores* densely aggregated, slender, simple or branched, 0–3-septate, surrounded by a mucous coating. *Conidiogenous cells* simple, slender, hyaline, smooth, with prominent periclinal thickening. *Conidia* hyaline when immature hyaline to medium brown at maturity, inequilateral, smooth-walled, frequently with a hyaline, lateral appendage, narrowly ellipsoidal, apices tapering, subobtusely rounded, acutely rounded bases subtruncate, guttulate, with a longitudinal germ slit, straight to slightly curved.

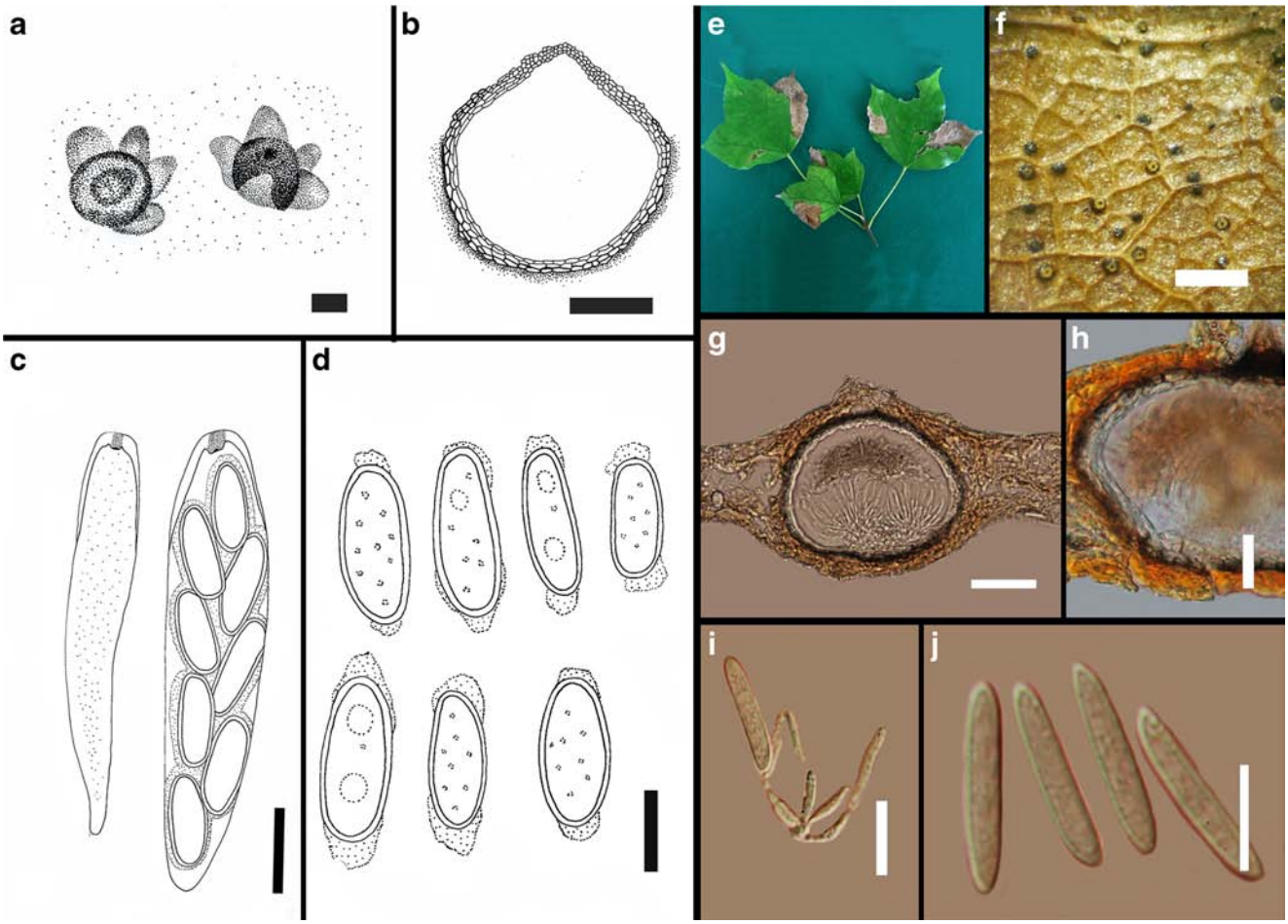


Fig. 130 ***Pilidiella quercicola*** **a** Ascomata on host substrate **b** Cross section of ascoma (redrawn from Rossman et al. 2007) ***Pilidiella destruens*** **c** Asci **d** Ascospores (redrawn from Van Niekerk et al. 2004) ***Pilidiella castenicola*** (CHINA, Guizhou Province, Guiyang, Huaxi, on *Acer buergerianum* Miq. (*Sapindaceae*) leaves, 28 September 2013, N.N. Wijayawardene G0928-2 (HGUP502, MFLU 13-0006); living culture GDUP N77, ICMP 19810, MFLUCC 13-0299) **e** Disease symptoms on host tissues **f** Conidiomata on host substrate **g** Cross section of conidioma **h** Peridium **i** Conidia attached to the conidiogenous cells **j** Conidia. Scale Bars: **a**, **d**, **e**, **h** = 10 μm, **b**, **g** = 100 μm, **c**, **i**, **j** = 20 μm, **f** = 500 μm

Type species: ***Pilidiella quercicola*** (Oudem.) Petr., Beih. Reprium nov. Spec. Regni veg. 42(1): 462 (1927) [1926]

Notes: *Pilidiella* was introduced and typified by *Pilidiella quercicola* (Oudem.) Petr., and currently comprises twenty two epithets (Index Fungorum 2016). *Pilidiella* species are commonly associated with a wide variety of woody and herbaceous hosts (Van Niekerk et al. 2004). Type species of *Pilidiella, P. quercicola* and Type species of *Schizoparme, S. straminea* are congeneric and *Pilidiella* proposed to use over *Schizoparme* (Rossman et al. 2015). Miranda et al. (2012) was introduced a new species *Pilidiella tibouchinae* B.E.C. Miranda et al. which has brown conidia. Crous et al. (2015c) was introduced sexual morph of *Pilidiella eucalyptigena* Crous & M.J. Wingf from *Eucalyptus*.

Other genus included

Coniella Höhn., Ber. dt. bot. Ges. 36: 316 (1918)

Type species: ***Coniella pulchella*** Höhn., Ber. dt.bot. Ges. 36: 316 (1918)

Key to genera of *Schizoparmaceae*

1. Conidia hyaline to pale brown, narrowly ellipsoidal, with acutely rounded apices . . . . . ***Pilidiella***
   1. Conidia dark brown, ellipsoidal, with narrowly, obtusely rounded apices . . . . . ***Coniella***

Scortechiniaceae Huhndorf et al., in Huhndorf et al., Mycol. Res. 108(12): 1387 (2004)

Facesoffungi number: FoF 01123

Saprobic on woody substrates in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, scattered or gregarious, superficial, sub-immersed or immersed on host, sitting on or in a subiculum or subiculum absent, globose, obpyriform or ovoid, dark brown to black, coriaceous to membranous, turbinate or tuberculate or smooth, with or without brown branched setae, collabent or not collapsing. *Subiculum* thin or thick, brown to dark brown, septate, crisp when dry, branched or unbranched hyphae, with spiny termination or smooth. *Peridium* thick (20–80 μm), munk pores present or absent, outer layer composed of black to brown cells of *textura angularis*, thick-walled; inner layer composed of hyaline cells of *textura prismatica*, thin-walled. *Hamathecium* quellkörper present, conical, wide at the base, paraphyses absent or indistinct, filiform, hyaline. *Asci* 8- to multi-spored, unitunicate, cylindrical to clavate, long or short pedicellate, apical ring indistinct or absent, evanescent. *Ascospores* 2-seriate to irregularly arranged, hyaline or light brown, allantoid, ellipsoid to oval, straight to slightly curved, aseptate, with or without appendages. **Asexual morph**: Undetermined.

Type: ***Scortechinia*** Sacc.

Notes: The family *Scortechiniaceae* was introduced by Huhndorf et al. (2004b) based on superficial, black, turbinate ascomata with a quellkörper (this structure is made by a mucilaginous mass of thick-walled cells within the ascoma and is normally conical). Kirk et al. (2008) considers this characteristic as inducing rupture of the ascoma. Asci are clavate with hyaline ascospores. The genus is typified by *Scortechinia* (Saccardo 1891). Huhndorf et al. (2004b) introduced this family based on LSU sequence data and morphological observations. The quellkörper was accepted as a main structure of this family, and the family is based on this character. *Euacanthe*, *Neofracchiae* and *Scortechinia* were included in the family (Huhndorf et al. 2004b). Mugambi and Huhndorf (2010) included *Biciliospora*, *Coronophorella*, *Cryptosphaerella*, *Scortechiniella*, *Scortechiniellopsis* and *Tympanopsis* in the family based on multi-gene analyses.

Scortechinia Sacc., Syll. fung. (Abellini) 9: 604 (1891)

Facesoffungi number: FoF 01124, Figs 131, 132

Saprobic on woody substrates in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, scattered or gregarious, superficial on host, immersed or sub-immersed in the thick subiculum, globose to subglobose, black, coriaceous or membranous, turbinate or tuberculate, with or without brown branched setae, collabent or not collapsing. *Subiculum* thin or thick, brown to dark brown, septate, crisp when dry, branched or unbranched hyphae, with spiny termination. *Peridium* thick (20–30 μm), munk pores present or absent, outer layer composed of black to brown cells of *textura angularis*, thick-walled; inner layer composed of hyaline cells of *textura prismatica*, thin-walled. *Hamathecium* quellkörper present, conical, wide at the base, paraphyses absent. *Asci* 8-spored, unitunicate, cylindrical to clavate, long or short stipitate, apex rounded, apical ring indistinct or absent, evanescent. *Ascospores* 2-seriate to irregularly arranged, hyaline, allantoid, ellipsoid to oval, straight to slightly curved, aseptate, smooth-walled, without appendages, sometimes with guttules. **Asexual morph**: Undetermined.

Type species: ***Scortechinia culcitella*** (Berk. & Ravenel) Speg., Anal. Soc. cient. argent. 26(1): 29 (1888)

Basionym: *Sphaeria culcitella* Berk. & Ravenel, in Berkeley & Curtis 1860

Notes: The genus *Scortechinia* was introduced by Saccardo (1891) and includes nine epithets according to Index Fungorum (2016). The type species

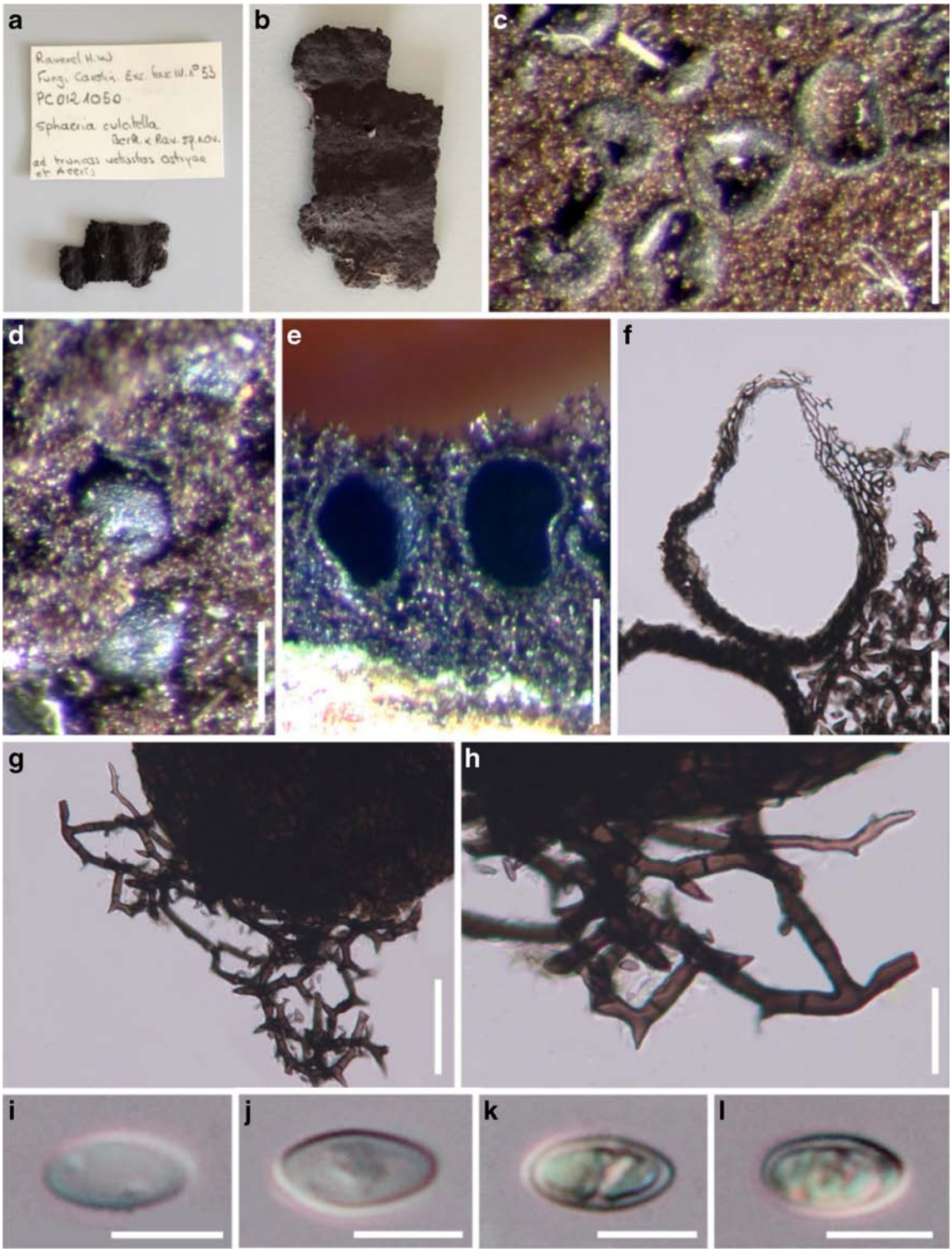


Fig. 131 ***Scortechinia culcitella*** (Material examined: USA, on the old trunk of *Ostrya* sp., PC MNHN-PC-PC0121050) **a** Material label **b** Specimen **c-d** Ascomata on substrate sub-immersed in thick subiculum **e** Ascomata in cross section **f** Section through perithecium **g–h** Spinulose subicular hyphae **j–l** Ascospores Notes: Figs k-l stained in Melzer's reagent. Scale bars: **c–e** = 200 μm, **f–g** = 50 μm, **h** = 20 μm, **i–l** = 5 μm

Scortechinia culcitella, is characterized by tuberculate ascomata with a quellkörper, clavate asci and hyaline ascospores (Huhndorf et al. 2004b).

Other genera included

Biciliospora Petr., Sydowia 6(5–6): 429 (1952)

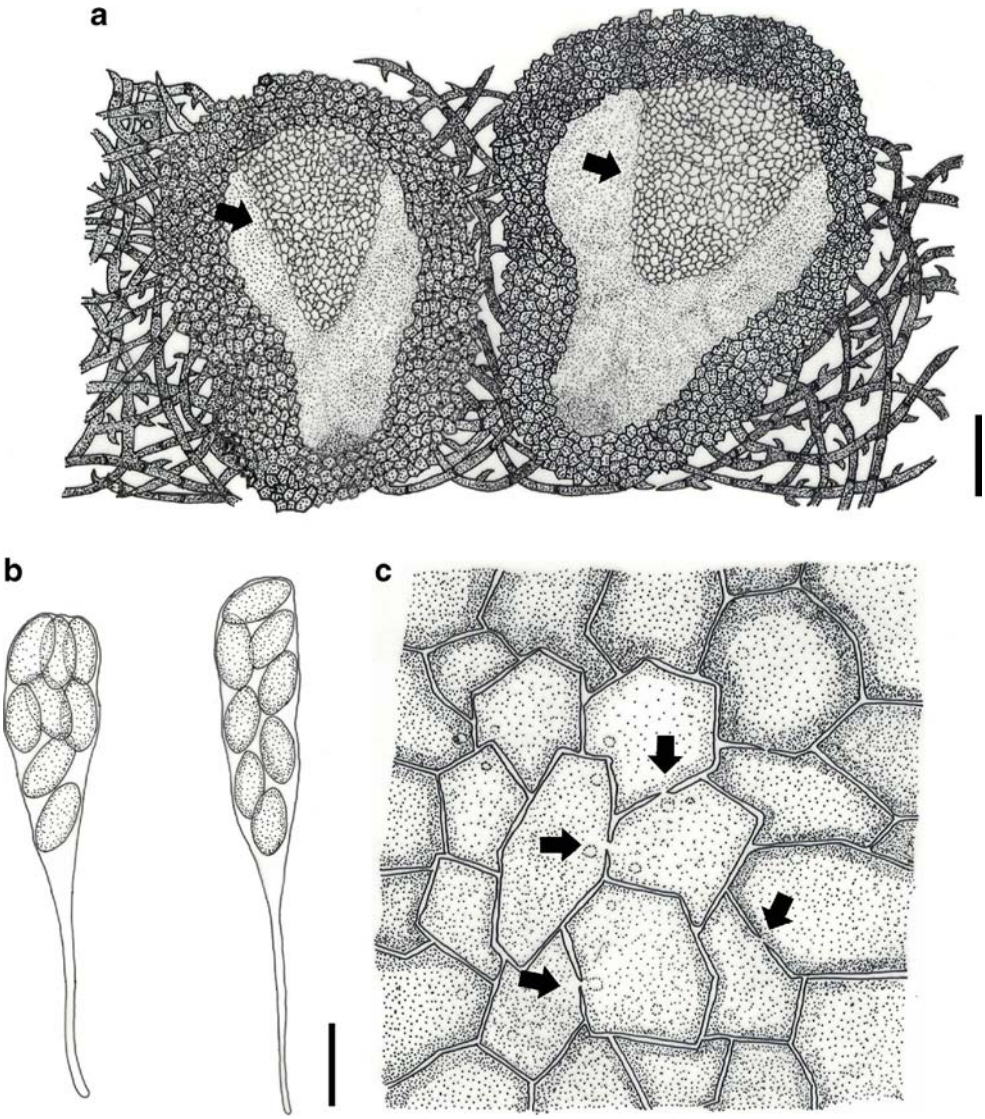


Fig. 132 *Scortechinia culcitella* (Based on the description by Saccardo 1891) **a** Section through perithecium with quellkörper (*arrowhead*) **b** Asci with ascospores **c** Munk pores between cells of the ascoma wall (*arrowhead*). Scale bars: **a** = 100 μm, **b** = 20 μm

Type species: ***Biciliospora velutina*** Petr., Sydowia 6(5–6): 429 (1952)

Coronophorella Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 118: 1507 [47 repr.] (1909)

Type species: ***Coronophorella chaetomioides*** (Penz. & Sacc.) Höhn. 1909

Cryptosphaerella Sacc., Syll. fung. (Abellini) 1: 186 (1882)

Type species: ***Cryptosphaerella nitschkei*** (Auersw.) Sacc., Syll. fung. (Abellini) 1: 186 (1882)

Euacanthe Theiss., Annls mycol. 15(3/4): 272 (1917)

Type species: ***Euacanthe usambarensis*** (Rehm) Theiss., Annls mycol. 15(3/4): 272 (1917)

Neofracchiaea Teng, Sinensia, Shanghai 9: 255 (1938)

Type species: ***Neofracchiaea callista*** (Berk. & M.A. Curtis) Teng, Sinensia, Shanghai 9: 255 (1938)

Scortechiniella von Arx & E. Müll., Beitr. Kryptfl. Schweiz 11(no. 1): 382 (1954)

Type species: ***Scortechiniella similis*** (Bres.) von Arx & E. Müll., Beitr. Kryptfl. Schweiz 11(no. 1): 383 (1954)

Scortechiniellopsis Sivan., Trans. Br. mycol. Soc. 62(1): 36 (1974)

Type species: ***Scortechiniellopsis leonensis*** Sivan., Trans. Br. mycol. Soc. 62(1): 37 (1974)

Tympanopsis Starbäck, Bih. K. svenska Vetensk Akad. Handl., Afd. 3 19(no. 3): 24 (1894)

Type species: ***Tympanopsis euomphala*** (Berk. & M.A. Curtis) Starbäck, Bih. K. svenska Vetensk Akad. Handl., Afd. 3 19(no. 3): 24 (1894)

Key to genera of *Scortechiniaceae*

1. Ascomata immersed and becoming erumpent in the bark of host . . . . . ***Cryptosphaerella***
1. Ascomata superficial on host 2

2. Ascospores with appendage at the ends 3
2. Ascospores without appendages 4
3. Asci more than 8-spores . . . . . ***Biciliospora***
3. Asci multi-spored . . . . . ***Scortechiniella***
4. Ascomata with setae . . . . . ***Euacanthe***
4. Ascomata without setae 5
5. Ascomata with curved tomentum . . . . . ***Neofracchiaea***
5. Ascomata smooth 6
6. Asci 8-spored 7
6. Asci more than 8-spores . . . . . ***Scortechiniellspsis***
7. Ascospores allantoid . . . . . ***Coronophorella***
7. Ascospores ellipsoid to globose 8
8. Ascomata on thick subiculum, hyphae with spiny termination . . . . . ***Scortechinia***
8. Ascomata on smooth subiculum . . . . . ***Tympanopsis***

Sordariaceae G. Winter [as 'Sordarieae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 162 (1885)

Facesoffungi number: FoF 01148

Saprobic on wood, rotting vegetation and dung in terrestrial habitats, also associated with food. **Sexual morph**: *Ascomata* perithecial or cleistothecial, brown to black, gregarious or scattered, solitary, superficial, erumpent or immersed, globose, subglobose to ovoid, carbonaceous, coriaceous or membranaceous, tuberculate or smooth, with setae or hairs, papillate or indistinct or absent, ostiole, with hyaline periphyses or absent. *Peridium* thick (5–60 μm), comprising brown to hyaline cells of *textura angularis*, *globulosa* or *prismatica*, carbonaceous, coriaceous or membranaceous. *Hamathecium* comprising numerous, septate, branched or unbranched, filiform or cylindrical paraphyses or paraphyses absent. *Asci* 8-spored, unitunicate, thin-walled, cylindrical to clavate, pedicellate, not amyloid. *Ascospores* hyaline, yellowish, brown or black, stellate, oval or ellipsoid, 0–1-septate, concolourous or versicolorous, with uneven thickness giving a striate to reticulate pattern, or with a sheath, with or without germ pores, appendages present or absent, with or without guttules. **Asexual morph**: Undetermined.

Type: ***Sordaria*** Ces. & De Not

Notes: The family *Sordariaceae* was introduced by Winter (1885) based on brown to black ascomata and cylindrical asci with brown to black ascospores, and is typified by *Sordaria*. This family is closely related to *Lasiosphaeriaceae* (Lundqvist 1972; Huhndorf et al. 2004a). Species in this family have been used as model organisms in various biological, biochemical, ecological, genetic and evolutionary studies (Randall and Metzenberg 1995; Nelson 1996; Coppin et al. 1997; Dettman et al. 2003; Jacobson et al. 2004; Cai et al. 2006c). Most species in this family are coprophilous. They can be heterothallic, homothallic or pseudo-homothallic (Cai et al. 2006c). Maharachchikumbura et al. (2015) accepted eight genera in this family.

Sordaria Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 225 (1863)

Facesoffungi number: FoF 01149, Fig. 133

Saprobic on wood, on dung and rotting vegetation in terrestrial habitats. **Sexual morph**: *Ascomata* perithecial, brown to black, gregarious or scattered, solitary, superficial or subimmersed, subglobose to ovoid, membranaceous, or tuberculate, with setae or hairs, papillate or ostiole or indistinct, with hyaline periphyses or periphyses absent. *Peridium* thick (10–30 μm), comprising brown to hyaline cells of *textura angularis*, *globulosa* or *prismatica*, membranaceous. *Hamathecium* comprising numerous, septate, filiform pseudoparaphyses or pseudoparaphyses absent. *Asci* 8-spored, unitunicate, thin-walled, cylindrical to clavate, pedicellate, with apical ring or apical ring instinct, not amyloid. *Ascospores* hyaline, brown or dark brown, oval to ellipsoid, 0–1-septate, concolourous, smooth-walled, with reticulate pattern or with sheath, with or without germ pores, appendages present or absent, with or without guttules. **Asexual morph**: Undetermined

Type species: ***Sordaria fimicola*** (Roberge ex Desm.) Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 226 (1863)

Notes: The genus *Sordaria* was introduced by Cesati and De Notaris (1863), to accommodate the type species *S. fimicola* and 109 epithets are listed in Index Fungorum (2016). This genus was included in *Sordariaceae*, in the *Sordariales* based on its smooth-walled ascospores with a pore and sheath (Barr 1990). *Sordaria* is characterized by dark ascomata, cylindrical asci and brown ascospores, with gelatinous sheath or appendages.

Other genera included

Copromyces N. Lundq., Ark. Bot. 6: 327 (1967)

Type species: ***Copromyces bisporus*** N. Lundq., Ark. Bot. 6: 328 (1967)

Effetia Bartoli et al., Mycotaxon 19: 517 (1984)

Type species: ***Effetia craspedoconidica*** Bartoli et al., Mycotaxon 19: 517 (1984)

Gelasinospora Dowding, Can. J. of Res., Section C 9: 294 (1933)

Type species: ***Gelasinospora tetrasperma*** Dowding, Can. J. of Res., Section C 9: 294 (1933)

Guilliermondia Boud., Bull. Soc. mycol. Fr. 20: 19 (1904)

Type species: ***Guilliermondia saccoboloides*** Boud., Bull. Soc. mycol. Fr. 20: 20 (1904)

Neurospora Shear & B.O. Dodge, J. Agric. Res., Washington 34: 1025 (1927)

Type species: ***Neurospora sitophila*** Shear & B.O. Dodge, J. Agric. Res., Washington 34: 1026 (1927)

Pseudoneurospora Dania García et al., Mycol. Res. 108(10): 1139 (2004)

Type species: ***Pseudoneurospora amorphoporcata*** (Udagawa) Dania García et al., in García et al., Mycol. Res. 108(10): 1139 (2004)

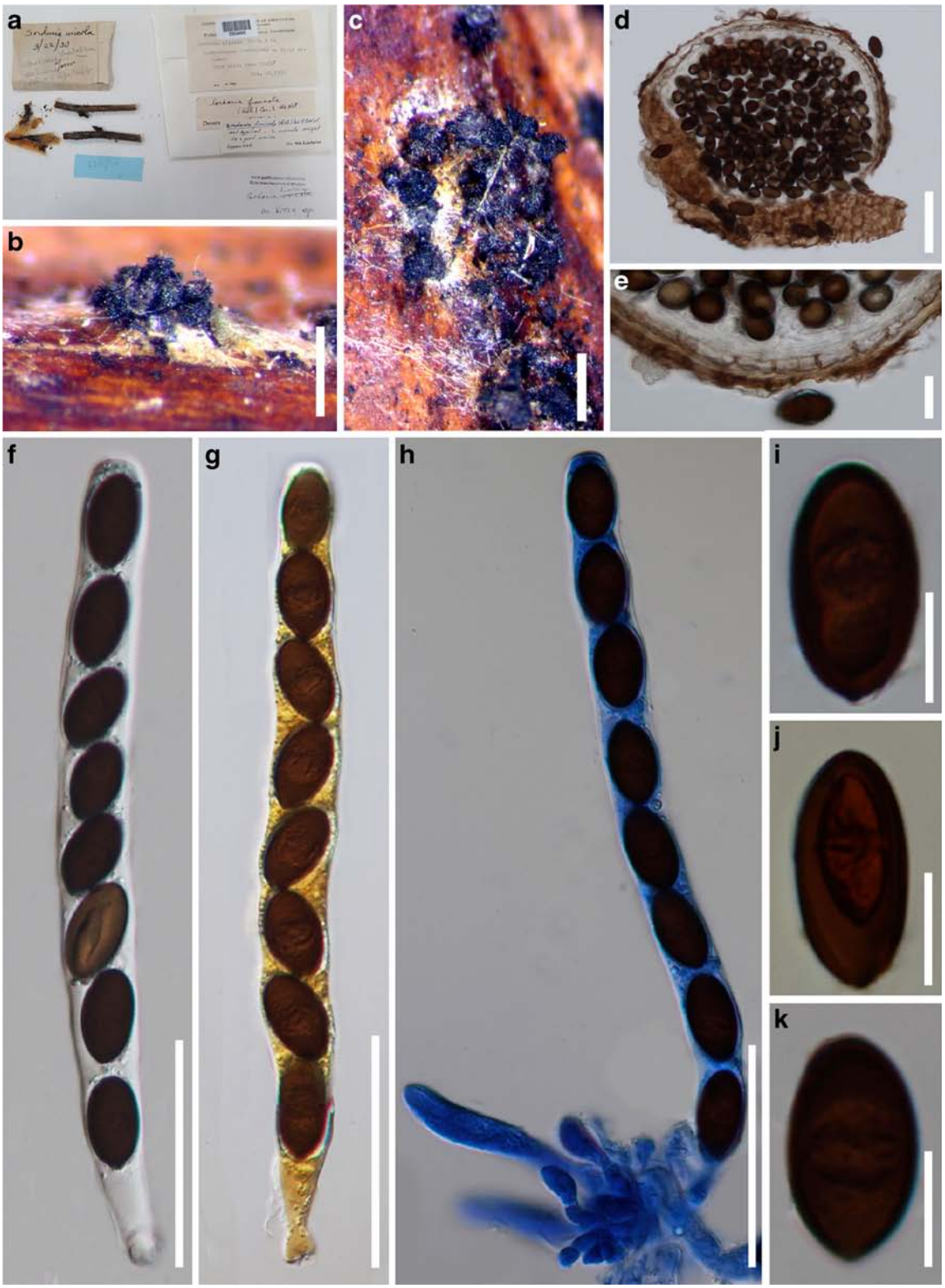


Fig. 133 ***Sordaria fimicola*** (Material examined: ITALY, on decaying *Vitis* sp., 22 March 1930, BPI 580866) **a** Material label **b** Ascoma **c** Ascomata **d** Vertical section of ascoma **e** Peridium **f-i** Asci immature to mature **j–l** Ascospores Note: Figures f, i and j are stained in Melzer's reagent, Figure h is stained in cotton blue. Scale bars: **b–c** = 500 μm, **d** = 100 μm, **e** = 25 μm, **f–h** = 50 μm, **i–k** = 10 μm

Stellatospora Tad. Ito & Nakagiri, Mycoscience 35(4): 413 (1994)

Type species: ***Stellatospora terricola*** Tad. Ito & Nakagiri, Mycoscience 35(4): 413 (1994)

Key to genera of *Sordariaceae*

1. Ascomata cleistothecial . . . . . ***Copromyces***
1. Ascomata perithecial 2
2. Ascospores oval to ellipsoid. 3
2. Ascospores stellate, with germ pore . . . . .***Stellatospora***
3. Paraphyses absent 4
3. Paraphyses present, filiform 6
4. Ascospores with gelatinous sheath . . . . . ***Sordaria***
4. Ascospores lacking gelatinous sheath. 5
5. Ascomata without hairs, asci without ring at apex . . . . . ***Effetia***
5. Ascomata with hairs, asci with ring at apex. . . . . ***Gelasinospora***
6. Paraphyses branched . . . . . ***Guilliermondia***
6. Paraphyses unbranched, evanescent 7
7. Ascospore ornamentation unevenly thickened, giving a striate to reticulate pattern . . . . . ***Neurospora***
7. Ascospore ornamentation irregular, rounded, crest pattern. . . . . ***Pseudoneurospora***

Spathulosporaceae Kohlm., Mycologia 65(3): 615 (1973)

Facesoffungi number: FoF 01798

Parasitic on marine algae. **Sexual morph**: *Ascomata* subglobose, ovoid, pyriform, subiculate, coriaceous or leathery, dark brown, sterile hairs enclosing ascoma, ostiolate, ostiolar canal filled surrounded by tube-like projection extending into the ascomatal cavity, papillate or epapillate, lacking paraphyses. *Asci* clavate to subglobose, thin-walled, unitunicate, without apical ring, deliquescing early. *Ascospores* hyaline, fusiform, cylindrical, ellipsoidal, 0–3-septate, with an appendage at each end. **Reproductive structures**: Antheridial. *Spermatia* ellipsoidal to fusiform, without appendages. *Trichogynes* simple or branched, septate, arising from the margin of young ascoma.

Type: ***Spathulospora*** A.R. Caval. & T.W. Johnson

Notes: The family *Spathulosporaceae* was introduced by Kohlmeyer (1973) and currently comprises the genera *Spathulospora* and *Retrostium*. Members of this family are characterized by crustose, dark thalli, peg-like penetrating cells, intracellular crusts and stromata, antheridia with spermatia and trichogynes, ostiolate ascomata without paraphyses, deliquescing asci, and 1-celled, appendaged ascospores. Kohlmeyer (1973) placed this family in the order *Spathulosporales*. Later, Inderbitzin et al. (2004); Campbell et al. (2005); Jones et al. (2009b) placed it in the order *Lulworthiales*. However, Maharachchikumbura et al. (2015) confirmed the placement of *Spathulosporaceae* in the order *Spathulosporales* by molecular analysis using available sequence data from GenBank.

Spathulospora A.R. Caval. & T.W. Johnson, Mycologia 57(6): 927 (1965)

Facesoffungi number: FoF 02133; Fig. 134

Parasitic on red algae. **Sexual morph**: *Ascomata* superficial to immersed, globose to subsphaerical, carbonaceous or subcarbonaceous, brown or black, ostiolate. *Ostiole* conical, papillate. *Peridium* composed of several cell layers of sscleroplectenchymatous cells. *Asci* 8-spored, overlapping, unitunicate, deliquescent. *Ascospores* elongate, straight or curved, aseptate, with an equatorial, cytoplasmic band, ends spatulate, provided with a gelatinous, lateral, appressed appendage. **Asexual morph**: Undetermined.

Type *species*: ***Spathulospora phycophila*** A.R. Caval. & T.W. Johnson, Mycologia 57(6): 927 (1965)

Notes: *Spathulospora* is a marine genus on seaweed with *Spathulospora phycophila* A.R. Caval. & T.W. Johnson as the type species. It was introduced by Cavaliere and Johnson (1965) and referred variously to the *Spathulosporomycetes*, *Spathulosporomycetidae* (Locquin 1984), *Spathulosporales* (Kohlmeyer 1973), *Spathulosporaceae* (Kohlmeyer 1973) based on morphological observations. However, two *Spathulospora* species (*S. antarctica* Kohlm., *S. adelpha* Kohlm.), have shown a relationship to the order *Lulworthiales* with weak support (Inderbitzin et al. 2004; Campbell et al. 2005; Jones et al. 2009b). Further collections, isolation and sequencing are required to determine the phylogenetic placement of this genus in the Ascomycota, especially as the type species is yet to be sequenced.

Other genus included

Retrostium Nakagiri & Tad. Ito, Mycologia 89(3): 485 (1997)

Type *species*: ***Retrostium amphiroae*** Nakagiri & Tad. Ito, Mycologia 89(3): 485 (1997)

Key to genera of *Spathulosporaceae*

1. Ascospores elongate, with spatulate ends, with a gelatinous, lateral, appressed appendage . . . . . ***Spathulospora***
1. Ascospores oblong to ellipsoidal, with one mucilaginous appendage at each end . . . . . ***Retrostium***

Sporocadaceae Corda (as 'Sporocadeae'), Icon. Fungorum (Prague) 5: 34. 1842

= *Discosiaceae* Maharachch. & K.D. Hyde

Saprobic or *pathogenic* on leaves of flowering plants and gymnosperms. **Sexual morph**: *Ascomata* scattered, immersed to erumpent. *Ostiole* circular, papillate. *Peridium* comprising several layers of cells of *textura prismatica*, brown at the base, dark brown outwardly. *Hamathecium* comprising numerous, hypha-like, flexuose, paraphyses. *Asci* 8-spored, unitunicate,

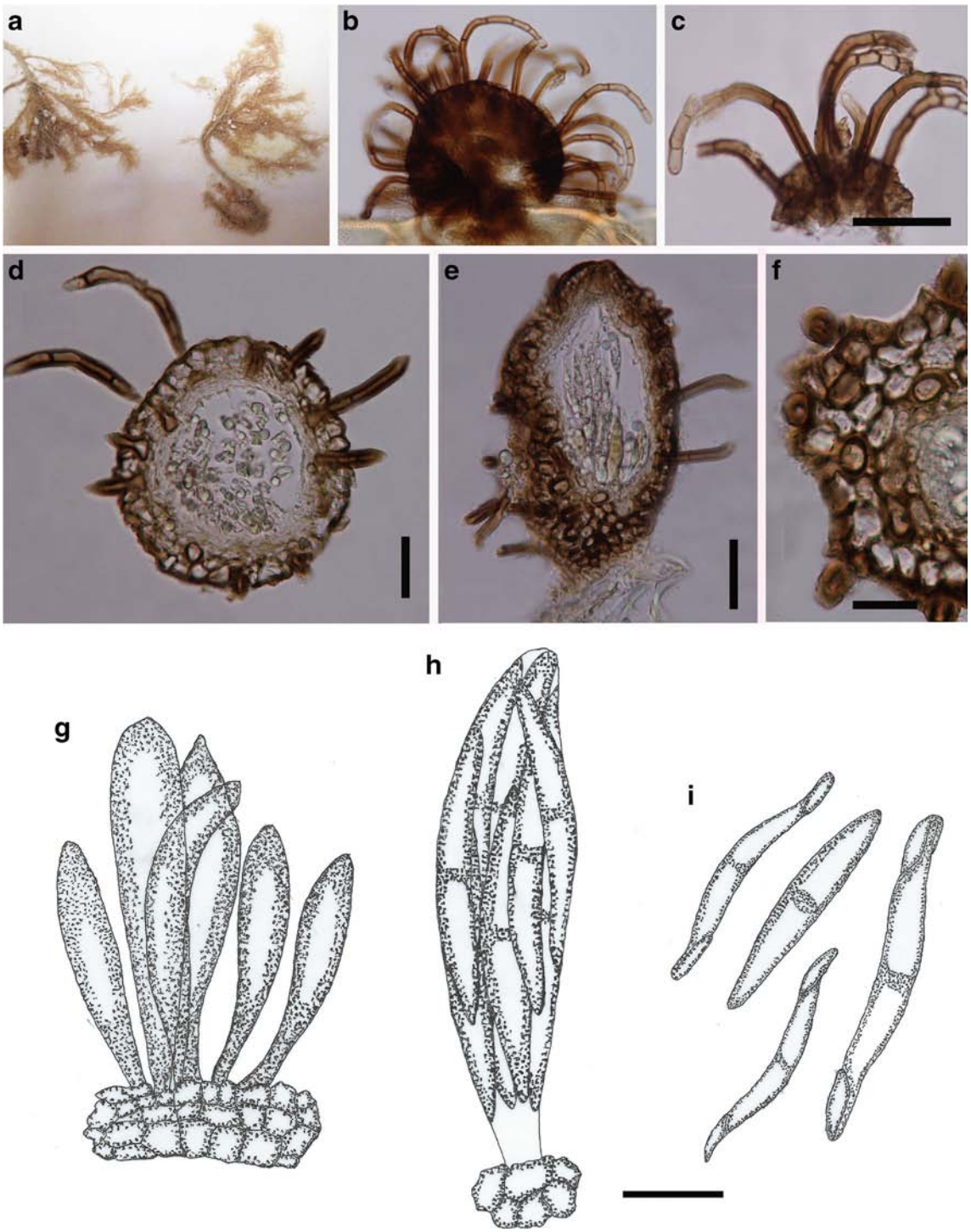


Fig. 134 ***Spathulospora phycophila*** (Material examined: AUSTRALIA, Warrnambool, Victoria, on *Ballia callitricha* C. Agardh (*Balliaceae*), April 1959, Norris L. R. E, NY 01350180, NY 01350182 NY 01350186, NY 01350185, NY 01350187, NY 01350178, NY 01350183, slides from the **holotype**); *Ibid*. BPI 580727, **holotype**). **a** Herbarium specimen **b** Ascomata on host surface **c** Hairs **d**, **e** Section through ascoma **f** Peridium **g** Young asci **h** Young ascospores showing equatorial cytoplasmic bands **i** Mature ascospores. Scale bars: **c**–**d** = 100 μm. **e**–**f** = 50 μm. **g**–**h** = 25 μm

obclavate to cylindrical, with a discoid, J+ subapical ring. *Ascospores* overlapping uniseriate or biseriate, obovoid to ellipsoid, transversally septate, longitudinal septum in mid cells, with or without vertical septa, hyaline. **Asexual morph**: Coelomycetous. *Conidiomata* stromatic, scattered to gregarious, subepidermal or subepidermal in origin, immersed to

erumpent. *Peridium* composed of 3–4 layers of cells of *textura angularis*, outer 1–2-layers brown and inner 1–2 layers hyaline or pale brown. *Conidiophores* arising from the inner layer cells of basal stroma, absent or reduced to conidiogenous cells, when present long, septate and branched. *Conidiogenous cells* holoblastic, annellidic, cylindrical or lageniform, hyaline. *Conidia* cylindrical to clavate, or fusiform, straight or curved, 2–4-euseptate, hyaline, pale olivaceous, or brown, bearing cellular, filiform or attenuated appendages.

Type: ***Seimatosporium*** Corda

= *Sporocadus* Corda

Notes: Members of the family *Sporocadaceae* are saprobes, endophytes, or foliar pathogens in tropical and temperate regions (Nag Raj 1993; Tanaka et al. 2011). The genus *Sporocadus* was synonymized under *Seimatosporium*. The genera *Adisciso*, *Discosia*, *Discostroma*, *Sarcostroma* and the type genus *Seimatosporium* are placed in *Sporocadaceae* following the studies by Maharachchikumbura et al. (2015) and Senanayake et al. (2015). In addition, the genus *Strickeria* was included into the family by Jaklitsch et al. (2016) based on morphology and phylogeny.

Seimatosporium Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 3(13): 79 (1833)

Facesoffungi number: FoF 02134; Figs 135, 136

Saprobic on leaves, stem and bark of various plants, pathogenic on leaves of *Eucalyptus* spp. **Sexual morph**: Discostroma-like. **Asexual morph**: *Conidiomata* acervular, solitary to gregarious, superficial to immersed, unilocular, globose to subglobose, dark brown to black. *Peridium* composed of brown thin or thick-walled textura angularis. *Conidiophores* cylindrical, filiform, septate, branched, hyaline. *Conidiogenous cells* holoblastic, annellidic, integrated or discrete, hyaline, determinate. *Conidia* variable, cylindrical, fusiform or clavate or obovoid, (2 −)3(−5)-septate, eguttulate, medium cells brown, basal cell hyaline, with or without basal appendage, or with the apical cell provided with a single, cellular, simple or branched appendage, basal cell truncate, continuous or occasionally constricted at the septa.

Type species: ***Seimatosporium rosae*** Corda, in Sturm, *Deutschl. Fl.*, 3 Abt. (Pilze Deutschl.) 3(13): 79 (1833)

Notes: The genus *Seimatosporium* was introduced by Corda (1833) based on the type *S. rosae*. von Arx (1981) treated *Bartalinia*, *Bartaliniopsis*, *Bleptosporium*, *Doliomyces* and *Hyalotia* as synonyms of *Seimatosporium*. This was not accepted by Nag Raj (1993) and furthermore is not supported by molecular data (Maharachchikumbura et al. 2015). *Seimatosporium* species have been linked to *Discostroma* sexual morphs through molecular data (Tanaka et al. 2011), however the type of *Discostroma* lacks molecular data to confirm this. Therefore both names have been retained until further studies based on fresh collections and molecular data are conducted (Maharachchikumbura et al. 2015).

Other genera included

Adisciso Kaz. Tanaka et al., in Tanaka et al., Persoonia, Mol. Phyl. Evol. Fungi 26: 90 (2011)

Type species: ***Adisciso yakushimense*** Kaz. Tanaka et al., in Tanaka et al., Persoonia, Mol. Phyl. Evol. Fungi 26: 92 (2011)

Discosia Lib., Pl. crypt. Arduenna, fasc. (Liège) 4: no. 346 (1837)

Type species: ***Discosia artocreas*** (Tode) Fr., Summa veg. Scand., Section Post. (Stockholm): 423 (1849)

Discostroma Clem., Gen. fung. (Minneapolis): 50 (1909)

Type species: ***Discostroma rehmii*** (Schnabl) Clem., Gen. fung. (Minneapolis): 1–227 (1909)

Sarcostroma Cooke, Journal of the Quekett microsc. Club 2: 267 (1871)

Type species: ***Sarcostroma berkeleyi*** Cooke, Journal of the Quekett microsc. Club 2: 267 (1871)

Strickeria Körb., Parerga lichenol. (Breslau) 5: 400 (1865)

Type species: ***Strickeria kochii*** Körb., Parerga lichenol. (Breslau) 5: 400 (1865)

Key to the sexual genera of *Sporocadaceae*

1. Ascospores arranged biseriately . . . . . ***Adisciso***
1. Ascospores arranged uniseriately 2
2. Ascospores hyaline . . . . . ***Discostroma***
2. Ascospores brown, end cells subhyaline. . . . ***Strickeria***

Key to the asexual genera of *Sporocadaceae*

1. Conidiomata not stromatic, immersed, conidia subhyaline to pale brown . . . . . ***Discosia***
1. Conidiomata stromatic, semi-immersed to erumpent, conidia brown 2
3. Conidiophores unbranched or irregularly branched, conidiogenous cells with minute periclinal thickenings, conidia fusiform, 3–5-septate, occasionally 7-septate . . . . . ***Sarcostroma***
3. Conidiophores branched, conidiogenous cells without minute periclinal thickenings, conidia ellipsoid to clavate, 2–4-septate, occasionally 5-, 6-septate . . . . . ***Seimatosporium***

Stachybotriaceae L. Lombard & Crous, in Crous et al., Persoonia, Mol. Phyl. Evol. Fungi 32: 283 (2014)

Facesoffungi number: FoF 01245

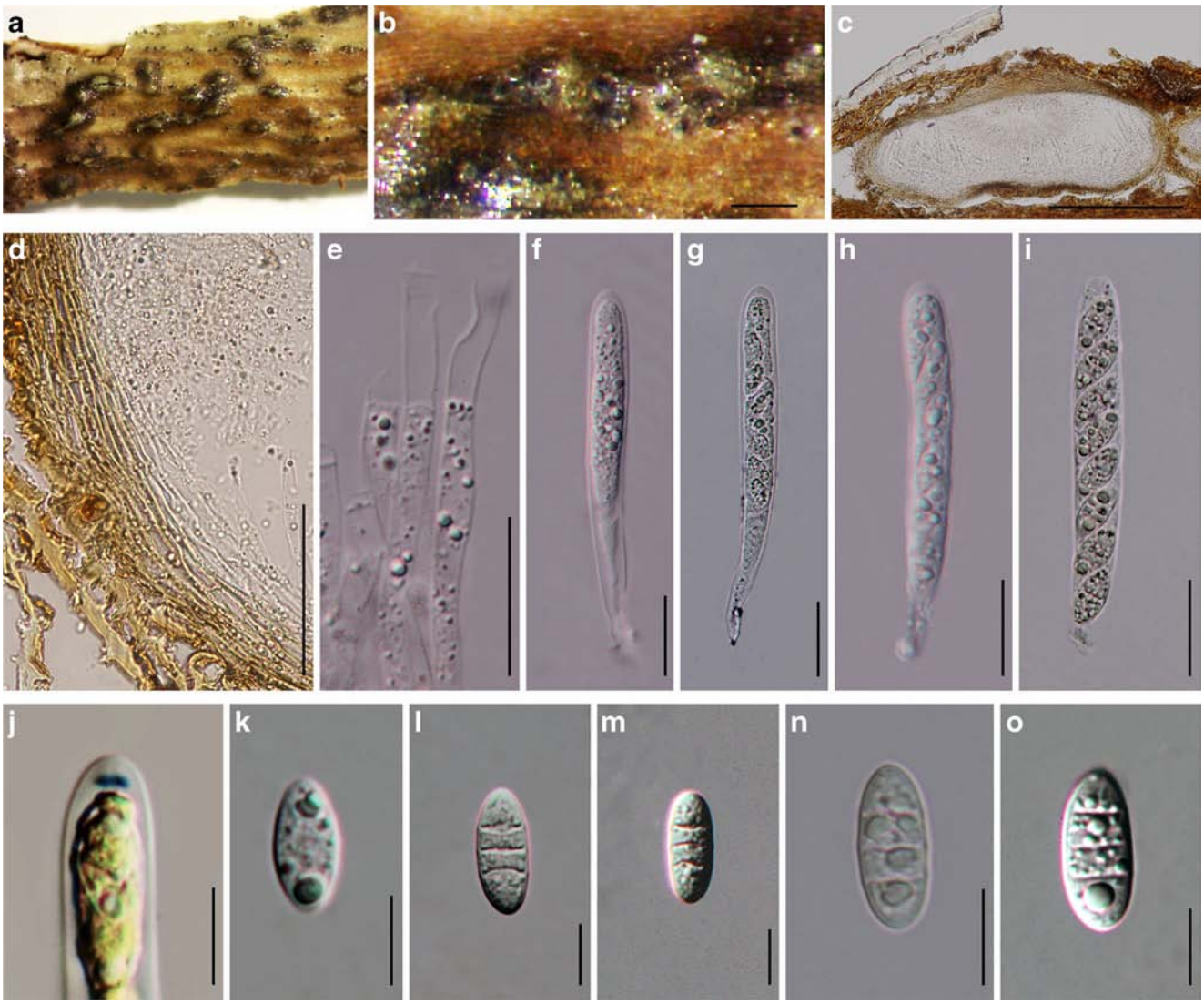


Fig. 135 ***Discostroma fuscellum*** (Material examined: ITALY. Province of Forlì-Cesena [FC], Poggio Baldo - Predappio Alta, on dead stem of *Rosa canina* L. (*Rosaceae*), 3 March 2013, E. Camporesi, IT 1093 (MFLU 15-0750)) **a-b** Ascomata on host surface **c** Section of ascoma **d** Peridium **e** Paraphyses. **f–h** Immature asci **i** Mature ascus **j** Ring-like apical ring of ascus in Congo red **k-o** ascospore. Scale bars: **b**, **f–i** = 200 μm, **c** = 100 μm, **d–e**, **j** = 50 μm, **f–I** = 20 μm, **k–o** = 30 mm

Saprobic or *pathogenic* on plants and commonly isolated from soil. **Sexual morph**: *Ascomata* superficial or immersed, solitary or scattered, sometimes fused, globose to subglobose, bright to dark yellow or black, sometimes covered with intertwined hyphae. *Papilla* central, short, black, without periphyses. *Ostiole* conical, thin, black. *Peridium* composed of several layers of dark brown, thin walled cells of *textura angularis* (*Stachybotrys*), or *textura intricata* (*Scopinella*); or outwardly composed of thick-walled *textura angularis* and inwardly with *textura prismatica* (*Peethambara*). *Hamathecium* comprising moniliform or filiform, hyaline, septate or aseptate paraphyses, intermingled with asci. *Asci* 4–8-spored, unitunicate, clavate to cylindrical, apex rounded to nearly truncate, deliquescent at maturity, lacking an apical ring. *Ascospores* 2–3-seriate, hyaline or brown to dark-brown, ellipsoidal to fusiform or broadly reniform, 0–1-septate, with or lacking a mucilaginous sheath. **Asexual morph**: Hyphomycetous. *Conidiophores* single, sporodochial or synnematous, if conidiophore simple, macronematous, mononematous, solitary or gregarious, clavate to broadly reniform phialides with conspicuous collarettes, simple or irregularly branched, hyaline or pale brown, smooth-walled; if conidiophores sporodochial and synnematous scattered, amphigenous, pulvinate, gelatinous, hyaline to dark green, with or without setae, with irregularly penicillate, bi- or triverticillately branched conidiogenous ring.

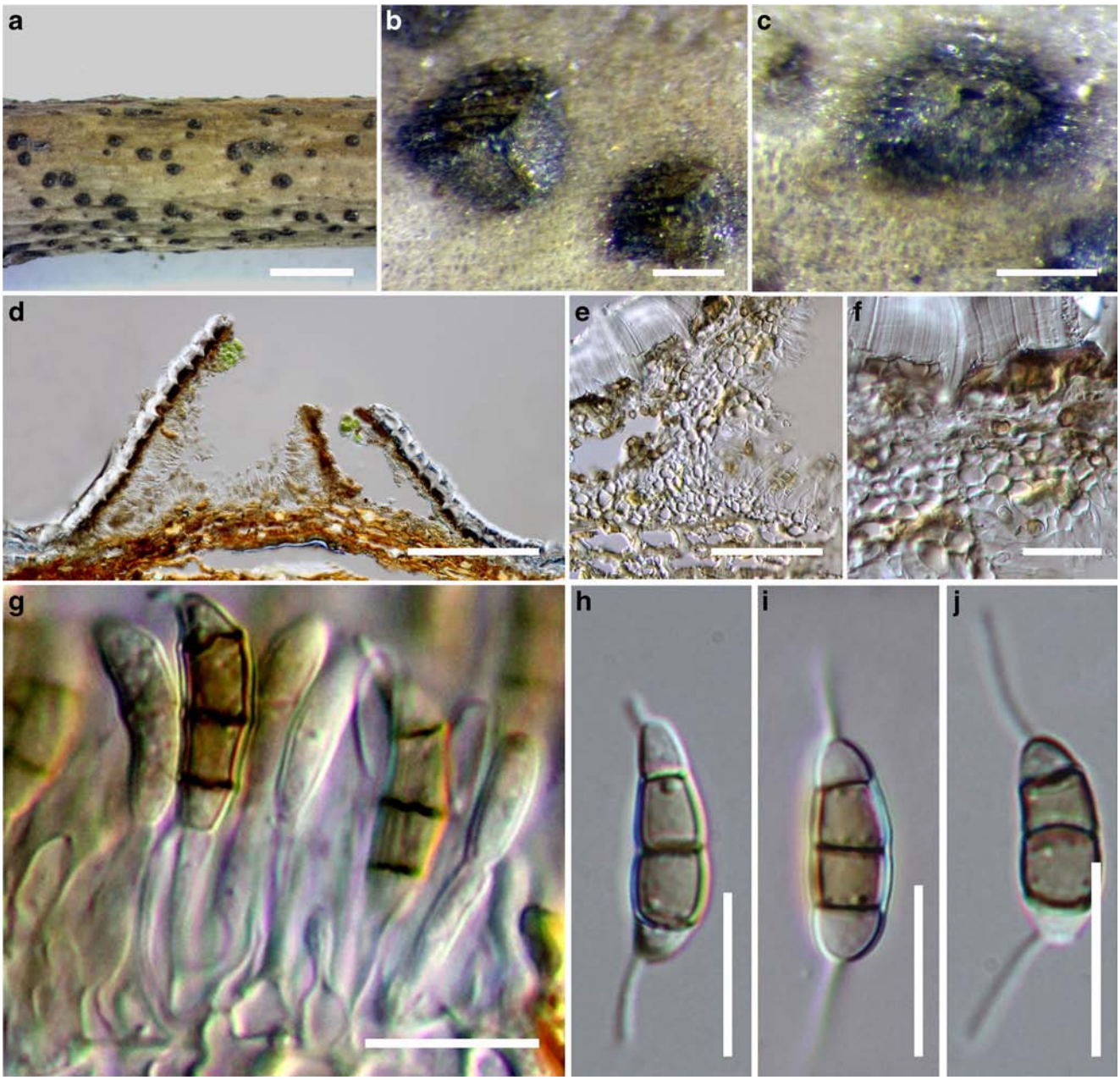


Fig. 136 ***Seimatosporium rosae*** (Material examined: RUSSIA, Rostov Region, Krasnosulinsky District, Donskoye Forestry, edge of ravine forest, on dying and dead branches of *Rosa kalmiussica*, 21 May 2014, T. Bulgakov T−056, MFLU 14-0771, **epitype**) **a** Habit in wood **b**, **c** Fruiting bodies on host substrate **d** Cross section of fruiting body **e**, **f** Peridium **g** Conidiogenous cells **h-j** Conidia Scale bars: **c** = 200 μm; **d** = 300 μm; **e**, **f**, = 20 μm; **h–j** = 10 μm

Conidiogenous cells enteroblastic, monophialidic, discrete, cylindrical, ellipsoidal or clavate, proliferating percurrently, with terminal phialides, clavate to broadly reniform, initially hyaline becoming pale brown at maturity. *Conidia* arising from the apices of the phialides, elongate, cylindrical or fusiform or ellipsoidal, 1–3-septate or aseptate, smooth-walled, sometimes striate or roughened, hyaline or brown to dark brown, aggregated in slimy, dark green to black masses.

Type: ***Stachybotrys*** Corda

Notes: *Stachybotriaceae* was introduced by Crous et al. (2014b) as a new family in the order *Hypocreales* to accommodate the genera *Myrothecium*, *Peethambara* and *Stachybotrys*. Previously, Castlebury et al. (2004) based on combined SSU and LSU gene analysis, classified these three genera in *Hypocreales* genera *incertae sedis*, which were distinct from other families in the order *Hypocreales*. Summerbell et al. (2011) refrained from introducing a new

family to accommodate these taxa, considering that more sexual morphs belonging to these genera are needed to be studied. Maharachchikumbura et al. (2015) provided an updated outline of the family *Stachybotriaceae* with seven genera, which included both sexual and asexual morphs.

Stachybotrys Corda, Icon. fung. (Prague) 1: 21 (1837)

Faces of fungi number: FoF 01246; Figs 137, 138

Saprobic on plant material and *pathogens* on human and animals in indoor environments. **Sexual morph**: *Ascomata* superficial, globose, sunken when dry, black, coriaceous, lacking or covered with numerous setae, papillate. *Papilla* short, or a neck, black, shiny, with or without periphyses. *Peridium* thin-walled, comprising 4–8 layers of dark brown cells of *textura angularis*. *Hamathecium* comprising filiform, septate or aseptate paraphyses. *Asci* 8-spored, unitunicate, thin-walled, clavate, pedicellate, lacking an apical ring, deliquescent at maturity. *Ascospores* 2–3-seriate, hyaline, ellipsoidal, 1-septate, verrucose, with or lacking a mucilaginous sheath. **Asexual morph**: Hyphomycetous. *Conidiophores* macronematous, simple or cymosely branched, with clusters of several ellipsoidal or subclavate phialides at the apex formed in succession. *Phialides* terminal, clavate to broadly reniform, hyaline becoming pale brown. *Conidia* 1-celled, ellipsoidal, cylindrical, reniform or fusiform, ornamented or smooth-walled, pigmented or hyaline, held together in slimy drops or chains.

Type species: ***Stachybotrys chartarum*** (Ehrenb.) S. Hughes, Canad. J. Bot. 36: 812. 1958.

Facesoffungi number: FoF 01247

Notes: The genus *Stachybotrys* was introduced by Corda (1837) with *S. chartarum* as the type species, and was isolated from the walls of a bedroom in Prague. *Stachybotrys* is characterized by macronematous, mononematous, single or branched conidiophores, with discrete, phialidic conidiogenous cells, producing aseptate conidia, in a usually dark colored slimy mass (Jong and Davis 1976; Mercado-Sierra et al. 1997). *Stachybotrys* was earlier classified in *Hypocreales* genera *incertae sedis* based on sequence data (SSU and LSU) (Castlebury et al. 2004). Crous et al. (2014b) transferred it to the newly established family *Stachybotriaceae* based on analysis of ITS and LSU sequence data. Wang et al. (2015) discussed and accepted 74 species in *Stachybotrys*. *Stachybotrys*, is known as 'black mold' or'toxic mold', due to its ability to produce some rather potent mycotoxins that cause stachybotrytoxicosis and its association with long-term water-damaged surfaces on buildings (Wang et al. 2015)

Stachybotrys albipes (Berk. & Broome) S.C. Jong & Davis, has been linked to the sexual morph reported as *Melanopsamma pomiformis* (Pers.) Sacc. (type), based on combined LSU, SSU, EF1, ATP6 and RPB1 gene analysis, with strong support (Castlebury et al. 2004). The phylogenetic analysis by Wang et al. (2015) based on ITS sequence data also supported the opinion that *Melanopsamma* is the sexual morph of *Stachybotrys*. The name *Stachybotrys* was accepted over *Melanopsamma* based on phylogenetic analysis (ITS gene) (Wang et al. 2015).

Other genera included

Albosynnema E.F. Morris, Mycopath. Mycol. appl. 33: 179 (1967)

Type species: ***Albosynnema elegans*** E.F. Morris, Mycopath. Mycol. appl. 33: 179 (1967)

Myrothecium Tode, Fung. mecklenb. sel. (Lüneburg) 1: 25 (1790)

Type species: ***Myrothecium inundatum*** Tode, Fung. mecklenb. sel. (Lüneburg) 1: 25 (1790)

Parasarcopodium Melnik et al., Mycol. Progr. 3(1): 22 (2004)

Type species: ***Parasarcopodium ceratocaryi*** Melnik et al., in Mel'nik et al., Mycol. Progr. 3(1): 24 (2004)

Peethambara Subram. & Bhat, Revue Mycol., Paris 42(1): 52 (1978)

Type species: ***Peethambara sundara*** Subram. & Bhat, Revue Mycol., Paris 42(1): 53 (1978)

Sarcopodium Ehrenb., Sylv. mycol. berol. (Berlin): 12, 23 (1818)

Type species: ***Sarcopodium circinatum*** Ehrenb., Sylv. mycol. berol. (Berlin): 23 (1818)

Scopinella Lév., in Orbigny, Dict. Univ. Hist. Nat. 8: 493 (1846)

Type species: ***Scopinella pleiospora*** (J. Schröt.) Sacc. [as 'plejospora'], Syll. fung. (Abellini) 9: 953 (1891)

Key to the sexual genera of *Stachybotryaceae*

1. Ascospores unicellular, barrel-shaped . . . . . ***.Scopinella***
   1. Ascospores didymosporous 2
   2. Ascomata superficial; ascospores surrounded by a mucilaginous sheath . . . . . ***.Stachybotrys***
2. Ascomata immersed or semi-immersed; ascospores lacking sheath. . . . . ***Peethambara***

Key to the asexual genera of *Stachybotryaceae*

1. Conidiophores macronematous, mononematous 2
   1. Conidiophores micronematous or synnematous 5
   2. Stroma with setae always present 3
   2. Stroma without setae 4

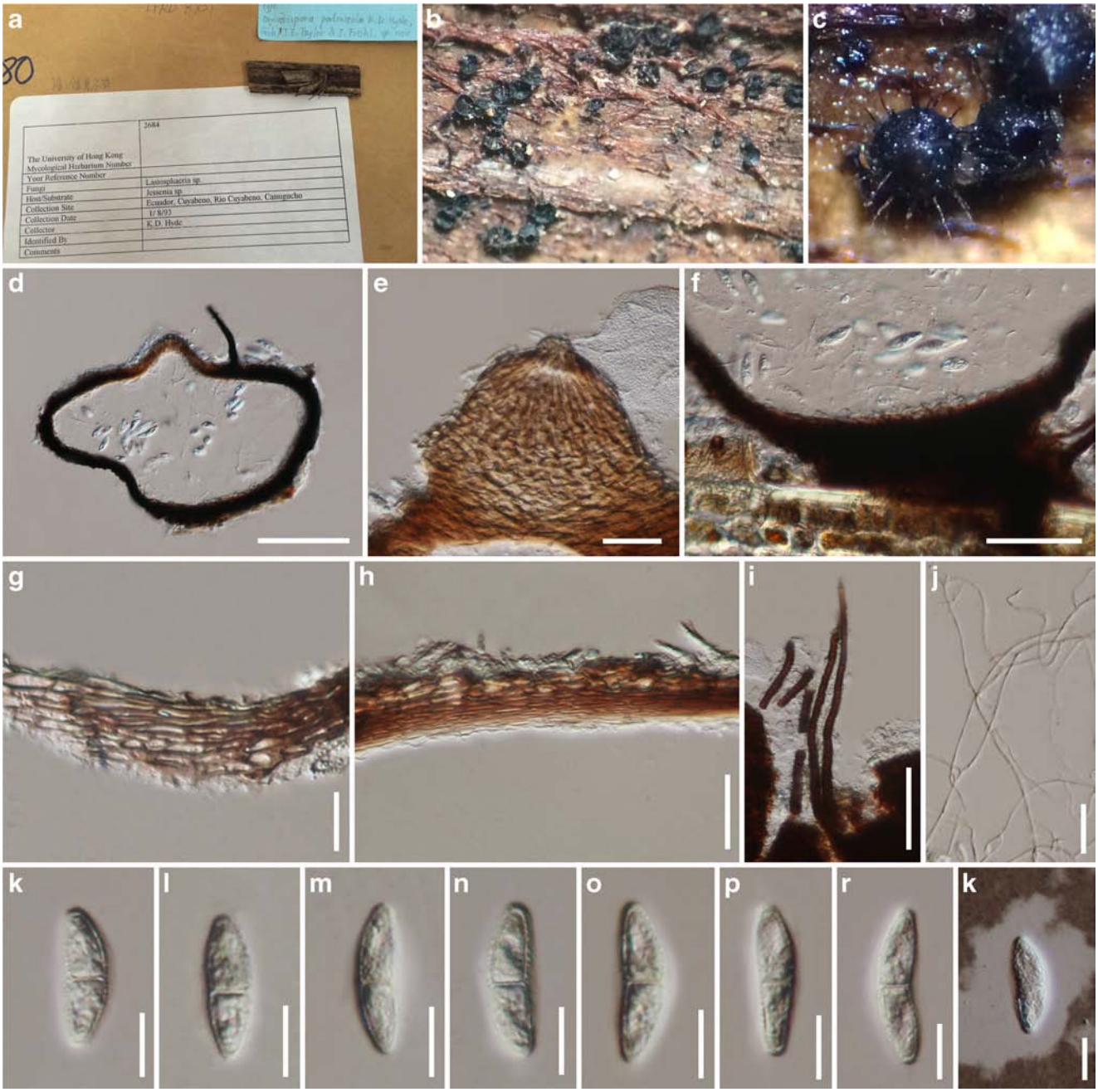


Fig. 137 ***Stachybotrys palmicola*** **– sexual morph** (Material examined: ECUADOR, Oriente, Reserva de Produccion Faunistica Cuyabeno (Cuyabeno Reserve), Rio Cayabeno, forest near the Laguna Grande, Cananguchо, Path A, on dead rachis of a palm, Aug. 1993, K. D. Hyde (HKU(M) 2684, **holotype). a** Herbarium packet and specimen **b** Ascomata on the surface of material **c** Ascomata **d Se**ction of ascoma **e** Papilla **f** The base of the ascoma illustrating the stromatic tissue which firmly anchors it to the substrate **g**, **h** Peridium **i** Intertwined hyphae **j** Paraphyses **k-q** Ascospores **r** Ascospores with verrucose wall and a large mucilaginous sheath. Scale Bars: **d** = 100 um, **f**, **i** = 50 um, **e**, **h**, **j** = 20 um, **g**, **k–r** = 10 um

3. Conidia aggregated in brown to dark brown in slimy masses. . . . . ***Sarcopodium***
3. Conidia aggregated in dark green or black in slimy masses. . . . . ***Myrothecium***
4. Conidia with amorphous mucoid appendages at both ends. . . . . ***Parasarcopodium***
4. Conidia without appendages . . . . . ***Stachybotrys***
5. Conidia 3-septate . . . . . ***Albosynnema***
5. Conidia 1-septate . . . . . ***Peethambara***

Stilbosporaceae Link [as '*Stilbosporei*'], Abh. Königl. Akad. Wiss. Berlin 1824: 180. 1826, emend.

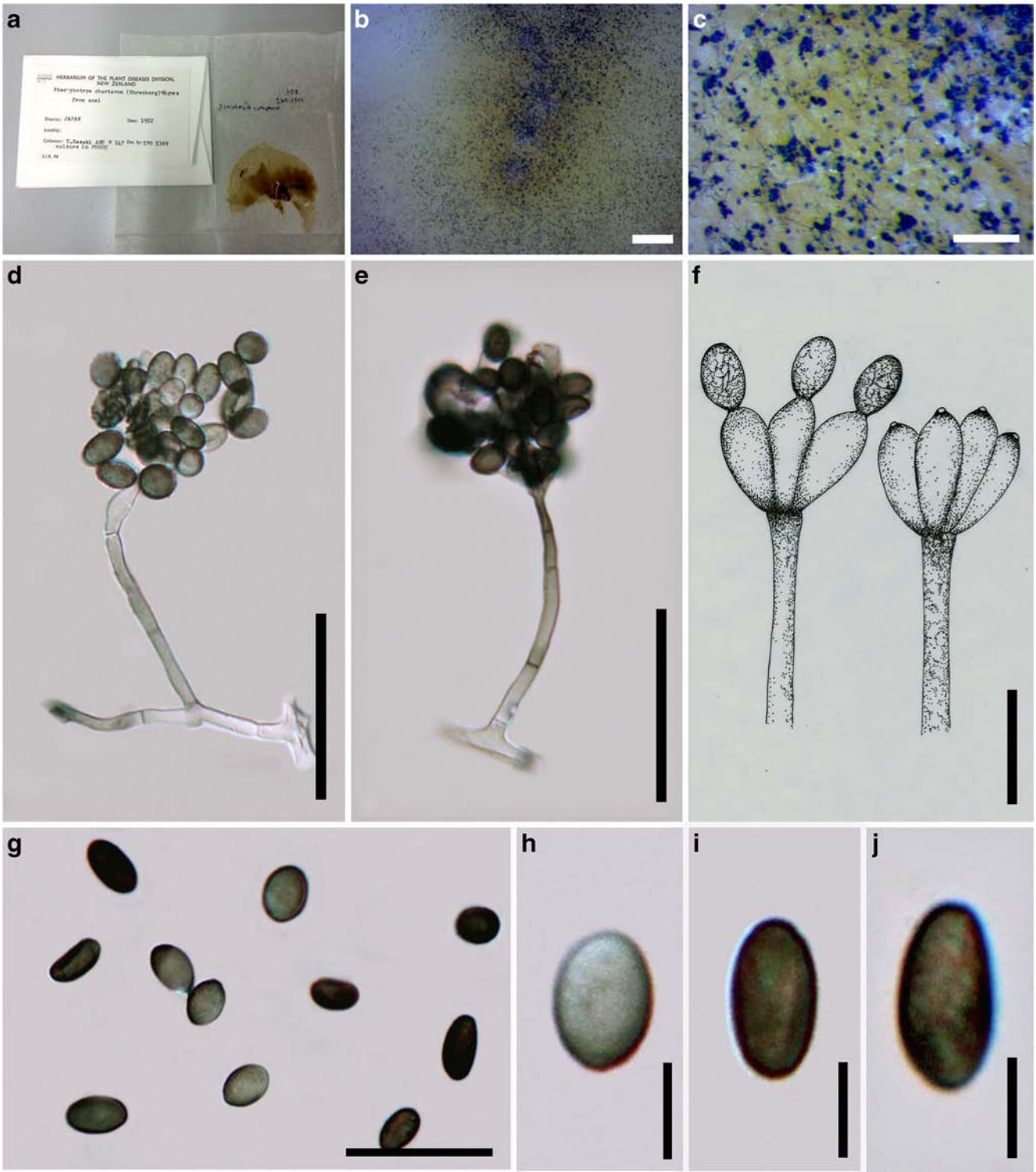


Fig. 138 ***Stachybotrys chartarum*** **- asexual morph** (Material examined: JAPAN, from coal, 1952, Y. Sasaki, PDD 40007). **a** Herbarium packet and material **b**, **c** Conidiophores on the surface of material **d**, **e** Conidiophores and conidiogenous cells **f** Phialides with conidia formation redrawn from Jong and Davis (1976). **G–j** Conidia. Scale bars: **b** = 1 mm, **c** = 200 μm, **d and e** = 40 μm, **f** = 10 μm, **g** = 20 μm, **h–j** = 10 μm

Facesoffungi number: FoF 01411

Saprobic on bark of trees and shrubs. **Sexual morph**: *Pseudostromata* inconspicuous, immersed. *Ectostromatic disc* absent or present, if present inconspicuous, light brown, rarely dark brown. *Entostroma* prosenchymatous, pale-coloured, slightly differentiated from the surrounding

bark tissue. *Ascomata* loosely arranged as valsoid groups in a single layer, immersed, aggregated, globose to subglobose, coriaceous, black, ostiolate, papillate. *Ostiole* not obvious, convergent in groups. *Hamathecium* comprising filiform, aseptate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical, initially attached to the base, later floating in centrum, with J- refractive, apical ring. *Ascospores* overlapping uniseriate to biseriate, brown, ellipsoid to oblong, distoseptate. **Asexual morph**: Coelomycetous. *Conidiomata* acervular, with paraphyses. *Conidiophores* cylindrical, hyaline. *Conidiogenous cells* annellidic. *Conidia* brown, cylindrical, clavate to pyriform, eu- or distoseptate, with or without oblique or longitudinal septa.

Type: ***Stilbospora*** Pers.

Notes: The family *Stilbosporaceae* was introduced by Link (1826) to accommodate *Prosthecium* and its asexual morph. However, it was not a phylogenetically well-supported family. Hence *Stilbosporaceae* was synonymized under several families. Voglmayr and Jaklitsch (2014) resurrected the family *Stilbosporaceae* in *Diaporthales* based on phylogenetic analysis of LSU sequence data and accommodated the genera *Stegonsporium* and *Stilbospora* within the family synonymizing *Prosthecium* under *Stilbospora*.

Stilbospora Pers., Neues Mag. Bot. 1: 93 (1794)

Facesoffungi number: FoF 02135; Fig. 139

Saprobic on decaying wood. **Sexual morph**: *Pseudostromata* not distinct, immersed in substrate, causing cracks. *Ectostroma* not obvious, rarely erumpent, limited to a light grey, orange to brown disc of a gel matrix, containing numerous, tightly packed periphyses, extending from the ostioles. *Entostroma* a loose network of hyaline to brownish hyphae, circular groups of tightly packed ascomata, filling the entostromatic area, or arranged as a valsoid ring. *Ascomata* arranged in a single layer, immersed, aggregated, depressed globose to lenticular, brownish black, coriaceous, papillate, ostiolate. *Papilla* not obvious, cylindrical, convergent, with pale brownish walls, ostiolar openings appearing as subhyaline to brownish circles. *Peridium* comprising dark brown cells of *textura angularis*. *Asci* 8-spored, unitunicate, ellipsoid to fusoid, short pedicellate, apex blunt, without a refractive ring. *Ascospores* uni- or biseriate, brown, ellipsoid to oblong, 3-euseptate, with a gelatinous appendage at each end. **Asexual morph**: Coelomycetous. *Conidiomata* immersed, acervular, circular, appearing as dark brown to black spots, containing simple, septate, hyaline paraphyses. *Conidiophores* hyaline, unbranched cylindrical. *Conidiogenous cells* annellidic. *Conidia* brown, ellipsoid or oblong, slightly curved, truncate at the base, 3-euseptate, with a hyaline sheath.

Notes: The type species of *Stilbospora*, *S. macrosperma* Pers., has been linked to its asexual morph *Prosthecium ellipsosporum* Fresen., the generic type of *Prosthecium* (Voglmayr and Jaklitsch 2008). This genus comprises opportunistic or moderately phytopathogenic fungal species that cause branch dieback or twig blight of various plants.

Type species: ***Stilbospora macrosperma*** Pers., Syn. meth. fung. (Göttingen) 1: 96 (1801)

= *Prosthecium ellipsosporum* Fresen., Beitr. Mykol. 2: 62 (1852)

Other genus included

Crinitospora B. Sutton & Alcorn, Trans. Br. mycol. Soc. 84(3): 437 (1985)

Type species: ***Crinitospora pulchra*** B. Sutton & Alcorn, Trans. Br. mycol. Soc. 84(3): 439 (1985)

Natarajania Pratibha & Bhat, Kavaka 33: 129 (2006) [2005]

Type species: ***Natarajania indica*** Pratibha & Bhat, Kavaka 33: 130 (2006) [2005]

Stegonsporium Corda, in Opiz, Naturalientausch 11: 458. 1827.

Type species: ***Stegonsporium pyriforme*** (Hoffm.) Corda, Icon. Fungorum (Prague) 3: 23. 1839.

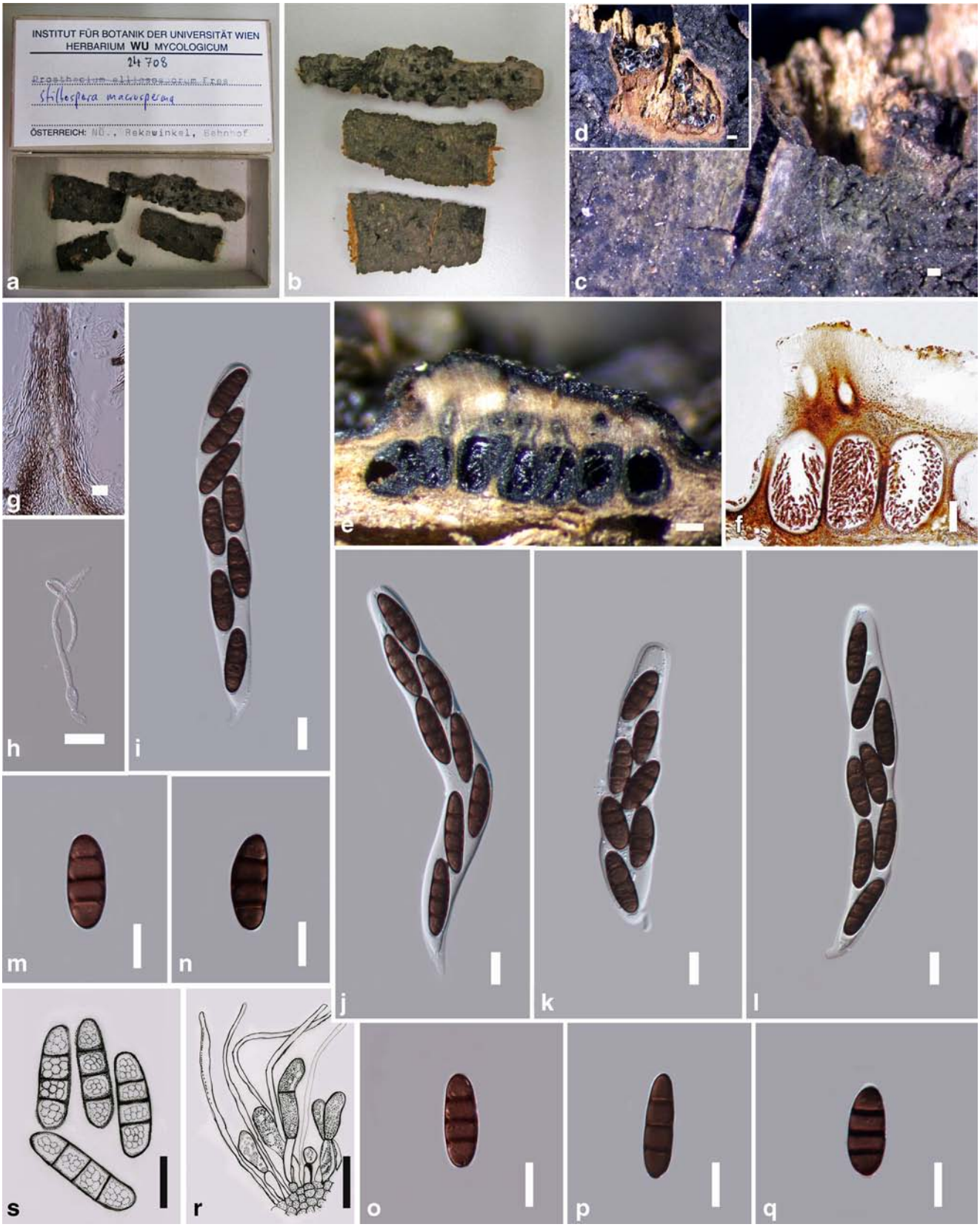
Key to genera of *Stilbosporaceae*

1. Coelomycetous 2
   1. Hyphomycetous . . . . . ***Natarajania***
   2. Conidia hyaline with several tubular, unbranched, filiform apical appendages . . . . . ***Crinitospora***
2. Conidia brown without any appendages 3
   3. Ascospores and conidia with three transverse eusepta, ellipsoid to oblong; asci without a refractive canal in the apex. . . . . ***Stilbospora***
   3. Ascospores and conidia with more than three transverse distosepta, ascospores sometimes and conidia always with additional longitudinal distosepta, ascospores ellipsoid to oblong, conidia mostly pyriform; asci with a cylindrical, slightly refractive canal in the apex. . . . . ***Stegonsporium***

Sydowiellaceae Lar.N. Vassiljeva, Pirenomits. Lokuloaskomits. Severa Dal'nego Vostoka (Leningrad): 210 (1987)

Facesoffungi number: FoF 01412

Saprobic or *parasitic* on plant matter. **Sexual morph**: *Stromata* present or absent, if present, scattered, immersed to erumpent, appear as an aggregation of ostioles, rounded or elliptic in shape, dark brown to black, composed of compact pseudoparenchymatous tissues, several ascomata in a stromata, some species give red colour with 5 % KOH. *Ascomata*


INSTITUT FÜR BOTANIK DER UNIVERSITÄT WIEN
HERBARIUM WU MYCOLOGICUM
24 708
Prosthecium ellipsosporum Fros
Stilbospora macrosperma
ÖSTERREICH: NÖ., Rekawinkel, Bahnhof
a
b
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◀ **Fig. 139** ***Stilbospora macrosperma*** (Material examined: AUSTRIA, Niederösterreich, Rekawinkel, grid square 7862/1, on a trunk of *Carpinus betulus* L. (*Betulaceae*), 20 October 2001, W. Jaklitsch, W.J. 1840, D25 WU 24708, **epitype**) **a**, **b** Herbarium packet and specimen **c** Appearance of ascomata on substrate **d** Horizontal section of ascomata **e**, **f** Vertical sections of ascomata **g** Peridium **h** Paraphyses **i–l** Asci **m–q** Ascospores **r** Conidia attached to the conidiogenous cells **s** Conidia. Notes: s and r based on Voglmayr and Jaklitsch (2014). Scale bars: **c**, **e**, **f** = 200 μm, **d** = 500 μm, **g** = 50 μm, **h** = 10 μm, **i–r** = 20 μm

solitary or aggregated, immersed or erumpent, globose to subglobose, coriaceous, central or asymmetrically located ostiolar canal opens through an individual or combined ostiole, internally covered by filamentous, hyaline periphyses, sometime ostiolar opening wider than canal, black to brown. *Peridium* comprising few layers of brown, thick-walled, *textura angularis* cells. *Hamathecium* comprising cellular, septate, branched, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical to sub-globose, short pedicellate, apex blunt with J– apical ring. *Ascospores* uniseriate to multi-seriate, filamentous, ellipsoid or long fusoid-cylindric, 1–11 septa, hyaline, light brown to dark brown, sometime with apical and basal appendages, wall smooth. **Asexual morph**: *Conidiomata* pycnidia, superficial, aggregated 3–5 in one group, globose, orange to brown, *Conidiomatal wall* comprising thick-walled, orange, 5–10 cell layers of cells of *textura angularis*. *Conidiophores* branched, hyaline, short, few conidiogenous cells arising from one conidiophore, attached to conidiomatal wall. *Conidiogenous cells* cylindrical, hyaline, bottle-shaped, ends pointed, phialidic. *Conidia* ellipsoid, one-celled, hyaline, smooth-walled.

Type: ***Sydowiella*** Petr.

Notes: The family *Sydowiellaceae* was established to accommodate the genus *Sydowiella*, which is typified by *S. fenestrans* and a collection of several fungal taxa that appear to have somewhat variable morphological characters. Initially, most genera and species in this family were placed in *Diaporthales* genera *incertae sedis* (Rossman et al. 2006). However, molecular analysis of different gene regions of taxa in family *Sydowiellaceae* proved it to be a well-supported family (Rossman et al. 2007, Maharachchikumbura et al. 2015). *Sydowiellaceae* includes the genera *Chapeckia*, *Hapalocystis*, *Rossmania*, *Stegophora*, and *Sillia*. In addition, a few species in family *Gnomoniaceae* (e.g., *Gnomonia rostellata*) show an affinity to the *Sydowiellaceae*. Members of this family occur on herbaceous plants, dicotyledonous and hardwood trees as saprobes, parasites and pathogens.

Sydowiella Petr., Annls mycol. 21(1/2): 30 (1923)

Facesoffungi number: FoF 02136; Fig. 140

Saprobic on dead plant matter. **Sexual morph**: *Ascomata* solitary, scattered, erumpent to immersed, globose, brown, short and wide papillate, ostiolate. *Peridium* comprising inner, thin-walled, hyaline cells of *textura angularis* and outer, thick-walled, brown cells of *textura angularis*, papilla comprising brown, elongated cells. *Hamathecium* comprising cellular, septate, hyaline paraphyses. *Asci* 8-spored, unitunicate, cylindrical, short pedicellate, apex blunt with J– apical ring. *Ascospores* overlapping uniseriate, oval to ellipsoid, one median septate, not constricted at the septum, hyaline, smooth-walled. **Asexual morph**: Undetermined.

Type species: ***Sydowiella fenestrans*** (Duby) Petr., Annls mycol. 21(1/2): 30 (1923)

Notes: *Sydowiella* was introduced and typified by *Sydowiella fenestrans*. This genus is characterized by the solitary, erumpent perithecia without stromatic tissue, a *Melanconis*-like hamathecium, and the didymosporous ascospores (Kobayashi 1970). Molecular studies have placed the genus in *Sydowiellaceae* (Rossman et al. 2007; Maharachchikumbura et al. 2015).

Other genera included

Cainiella E. Müll., Sydowia 10(1–6): 120 (1957) [1956]

Type species: ***Cainiella johansonii*** (Rehm) E. Müll., Sydowia 10(1–6): 121 (1957) [1956]

Calosporella J. Schröt., in Cohn, Krypt.-Fl. Schlesien (Breslau) 3.2(4): 442 (1897) [1908]

Type species: ***Calosporella platanoidis*** (Pers.) Höhn., Ber. dt. bot. Ges. 35: 631 (1917)

Chapeckia M.E. Barr, Mycol. Mem. 7: 164 (1978)

Type species: ***Chapeckia nigrospora*** (Peck) M.E. Barr, Mycol. Mem. 7: 165 (1978)

Hapalocystis Auersw. ex Fuckel, Fungi rhenani exsic., fasc. 6: no. 585 (1863)

Type species: ***Hapalocystis berkeleyi*** Auersw. ex Fuckel, Fungi rhenani exsic., fasc. 6: no. 585 (1863)

Lambro Racib., Parasit. Alg. Pilze Java's (Jakarta) 2: 13 (1900)

Type species: ***Lambro insignis*** Racib., Parasit. Alg. Pilze Java's (Jakarta) 2: 10 (1900)

Rossmania Lar.N. Vassiljeva, Mycoscience 42(4): 401 (2001)

Type species: ***Rossmania ukurunduensis*** Lar.N. Vassiljeva, Mycoscience 42(4): 401 (2001)

Sillia P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 20, 159, 251 (1873)

Type species: ***Sillia ferruginea*** (Pers.) P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 159 (1873)

Stegophora Syd. & P. Syd., Annls mycol. 14(5): 364 (1916)

Type species: ***Stegophora ulmea*** (Fr.) Syd. & P. Syd., Annls mycol. 14(5): 364 (1916)

Uleoporthe Petr., Annls mycol. 39(4/6): 279 (1941)

Type species: ***Uleoporthe orbiculata*** (Syd. & P. Syd.) Petr., Annls mycol. 39(4/6): 280 (1941)

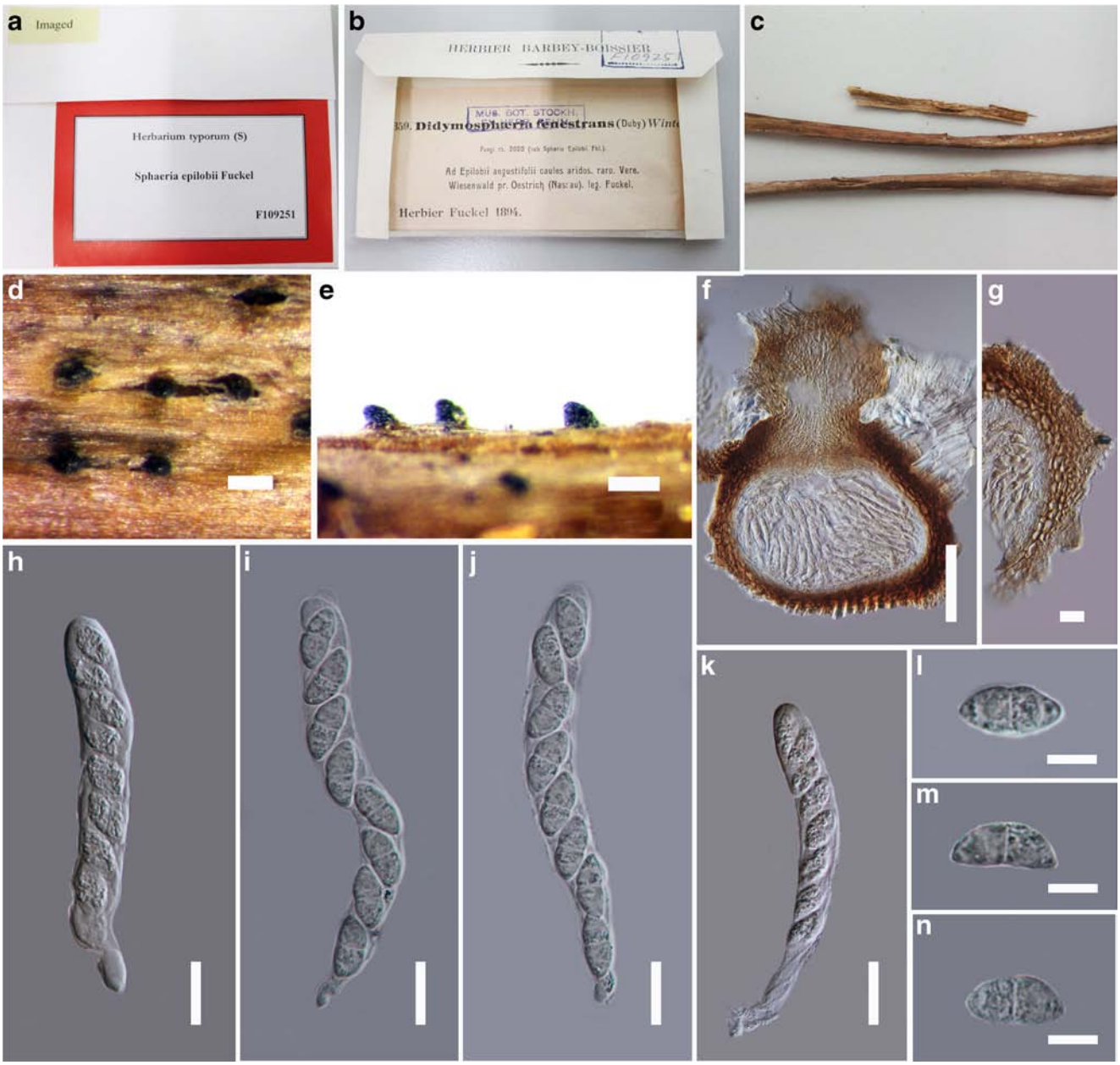


Fig. 140 ***Sydowiella fenestrans*** (Material examined: GERMANY, Hessen, Wiesenwald pr. Oestrich (Nassau), on *Chamerion angustifolium* (L.) Holub. (*Onagraceae*) 1894, F109251, holotype) **a**, **b** Herbarium packets **c** Herbarium specimen **d**, **e** Appearance of ascomata on host surface **f** Cross section of ascoma **g** Peridium **h-k** Asci **l-n** Ascospores. Scale bars: **d–e** = 200 μm, **f** = 100 μm, **g–k** = 20 μm, **l–n** = 10 μm

Winterella (Sacc.) Kuntze, Revis. gen. pl. (Leipzig) 1: 34 (1891)

Type species: ***Winterella tuberculifera*** (Ellis & Everh.) Berl., Icon. fung. (Abellini) 1(3): 94 (1893)

Key to genera of *Sydowiellaceae*

1. Stromata absent; ascomata located in host substrate 2
1. Stromata present; ascomata located in stromatic tissues 3
2. Ascospores long fusoid-cylindrical, 5–11 septate . . . . . ***Rossmania***
2. Ascospores ellipsoid, 1-septate 4
3. Ascospores apiosporous 5
3. Ascospores non-apiosporous 6
4. Stromata well developed, ... ***Lambro***
4. Stromata poorly developed, ... ***Stegophora***
5. Ascospores oval to fusoid, not constricted at the septa. . . . . ***Cainiella***
5. Ascospores fusoid, constricted at the septa . ***Sydowiella***

6. Ascospores with appendages 7
6. Ascospores without appendages 8
7. Ascospores ellipsoidal with broadly rounded ends, 1–3 septate, constricted at the septa. . . . . ***Hapalocystis***
7. Ascospores, fusoid to oblong, 3–4 eusepta, not constricted at the septa . . . . . ***Calosporella***
8. Stromata erumpent, circular, with branched splits, yellowish brown. . . . . ***Uleoporthe***
8. Stromata immersed, round or elliptic, dark brown to black 9
9. Perithecia valsoid, stromatic tissues not colouring with 10 % KOH 10
9. Perithecia diatrypoid, stromatic tissues become dull red with 10 % KOH. . . . . ***Sillia***
10. Ascospores oval to fusoid-oval, ... ***Chapeckia***
10. Ascospores cylindrical to fusoid-cylindrical, . . . ***Winterella***

Thyridiaceae J.Z. Yue & O.E. Erikss., Syst. Ascom. 6(2): 233 (1987)

Facesoffungi number: FoF 01913

Saprobic or *hemibiotrophic* in woody substrates. **Sexual morph**: *Stromata* immersed, becoming erumpent to superficial, soft-textured, reddish brown to brightly pigmented. *Ascomata* immersed in stromata, globose, medium-sized, ostiolate. *Ostioles* periphysate, with short or long papilla or necks, sometimes convergent necks merging into one ostiole. *Peridium* composed of compressed rows of cells, externally brown, internally hyaline. Paraphyses filamentous, septate hyaline. *Asci* unitunicate, usually 8-spored, oblong cylindric, with shallow J-, apical ring. *Ascospores* uniseriate, shades of brown, ellipsoid or biconoid, symmetric, 1-septate or muriform. **Asexual morph**: Coelomycetous. *Conidiomata* stromatic, multi-loculate. *Conidiogenous cells* enteroblastic phialidic. *Conidia* small, hyaline. Holoblastic sympodial conidia also produced from hyphae (Barr 1990).

Type: ***Thyridium*** Nitschke

Notes: The family *Thyridiaceae* was introduced by Yue and Eriksson (1987) with *Thyridium vestitum* (Fr.) Fuckel as the type species. *Thyridium* and *Sinosphaeria* were included in this family (Yue and Eriksson 1987). Later, *Thyridium* was expanded to include *Bivonella* and *Sinosphaeria* (Eriksson and Yue 1989). The family *Thyridiaceae* was placed in *Hypocreales* and synonymised under *Hypocreaceae* by considering the bright pigmentation of stromatic tissues (in some genera like *Sinosphaeria*, pigments are soluble in alcohol and 5 % KOH) and the presence of both paraphyses and periphysoids (Eriksson and Yue 1989). Barr (1990) observed that bright pigments are not a unique character in *Hypocreales* and believed *Thyridium* (including *Sinosphaeria* and *Bivonella*) is different from *Hypocreales* and further maintained this as a separate family *Thyridiaceae* under *Xylariales*. Considering the morphological similarities to *Thyridium*, Barr (1990) included *Valsaria* and *Valsonectria* in *Thyridiaceae. Valsaria* is currently placed in *Diaporthales* and *Valsonectria* in *Hypocreales* (Kirk et al. 2008; Jaklitsch et al. 2015). Rossman et al. (1999) placed *Balzania*, *Mattirolia* and *Thyronectroidea* in *Thyridiaceae*. Checa et al. (2013) examined the type species of *Balzania*, *Mattirolia*, *Thyridium* and *Thyronectroidea*, and accepted only *Mattirolia* and *Thyridium* within *Thyridiaceae*. They recognized *Balzania* and *Thyronectroidea* as synonyms of *Mattirolia* (Checa et al. 2013). Jaklitsch and Voglmayr (2014) revised *Mattirolia* and synonymised under *Thyronectria. Thyronectroidea* was considered as a synonym of *Thyronectria*, whereas *Thyronectria* is distantly related with *Thyridiaceae* (Jaklitsch and Voglmayr 2014; Maharachchikumbura et al. 2015). According to the molecular analysis, *Thyridiaceae* is considered as a member of subclass *Sordariomycetidae* (Spatafora et al. 2006; Réblová 2013; Jaklitsch and Voglmayr 2014). Maharachchikumbura et al. (2015) placed *Thyridiaceae* in the newly introduced subclass *Diaporthomycetidae*, the phylogenetic placement of which is still uncertain within the subclass (Maharachchikumbura et al. 2015).

Thyridium Nitschke, Pyrenomyc. Germ. 1: 110 (1867)

Facesoffungi number: FoF 02137; Fig. 141

Saprobic or *hemibiotrophic* in woody substrates. **Sexual morph**: *Stromata* immersed or erumpent, formed by interwoven yellowish brownish to black hyphae and cells of the substrate, KOH +/−. *Ascomata* perithecial, globose, immersed in stromata, with short or long necks with convergent or separate ostioles. *Ostioles* periphysate. *Asci* 8-spored, cylindrical, with a J-, apical ring. *Ascospores* uniseriate, muriform, ellipsoid or biconoid, symmetric, pale brown to dark brown, or with thickened and pigmented septa. **Asexual morph**: Undetermined (Checa et al. 2013).

Type species: ***Thyridium vestitum*** (Fr.) Fuckel, Jb. nassau. Ver. Naturk. 23–24: 195 (1870) [1869–70]

Notes: The genus *Thyridium* was introduced by Nitschke (1867) to accommodate species with uniseriate, muriform, dark coloured ascospores, 8-spored asci and filiform paraphyses (Nitschke 1867). Later, *Thyridium* was emended to incorporate *Bivonella* and *Sinosphaeria* as synonyms by Eriksson and Yue (1989). However, Barr (1990) did not accept *Bivonella* as a synonym of *Thyridium* since the type species of *Bivonella* (= *Sinosphaeria*) has periphysoids, which are not seen in the type species of *Thyridium* (Checa et al. 2013).

Other genera included

Mattirolia Berl. & Bres., Microm. Trid.: 55 (1889)

Type species: ***Mattirolia roseovirens*** Berl. & Bres., Microm. Trid.: 55 (1889)

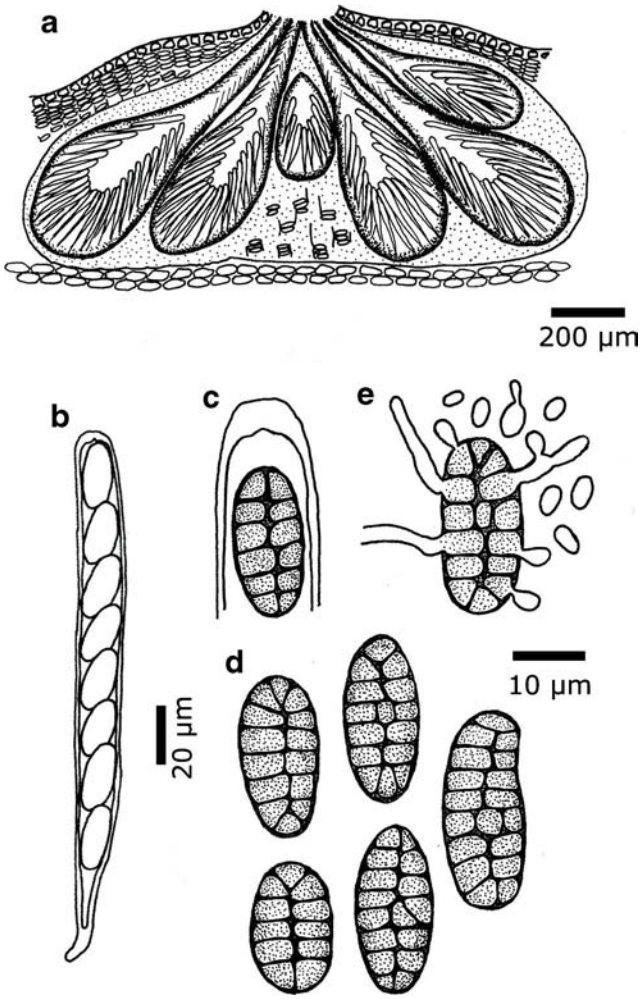


Fig. 141 ***Thyridium vestitum*** (redrawn from Leuchtmann and Müller 1986). **a** Section through the host tissue and stromata **b** Ascus with ascospores **c** Apical part of an ascus **d** Ascospores **e** Germinated ascospore with primary conidia

Pleurocytospora Petr., Annls mycol. 21(3/4): 256 (1923)

Type species: ***Pleurocytospora vestita*** Petr., Annls mycol. 21(3/4): 256 (1923); Fig. 142

Key to sexual genera of *Thyridiaceae*

1. Stromata with short or long necks with convergent or separate ostioles, ascospores very pale brown to dark brown, or with thickened and pigmented septa . . . . . ***Thyridium***
   1. Stromata without convergent ostioles, ascospores hyaline to greenish yellow when mature . . . . . ***Mattirolia***

Tilachlidiaceae L. Lombard & Crous, in Lombard et al., Stud. Mycol. 80: 237 (2015)

Facesoffungi number: FoF 01280

Saprobic or *parasitic* on dead or living *entomogenous* or *foliicolous* fungi. **Sexual morph**: Undetermined. **Asexual morph**: *Colonies* effuse or punctiform, white. *Conidiophores* acremonium-like, basitonously verticillate or synnematous. *Synnemata* when present, simple or branched, cylindrical, narrowing towards the apex, consisting of parallel, longitudinal bundles. *Conidiogenous cells* phialidic. *Phialides* scattered, cymbiform to cylindrical or allantoid, gradually narrowing towards the apex, hyaline to yellow, smooth or becoming verrucose, arranged in groups of 1–4 at the terminal part of synnema, with obvious collarette, sometimes integrated in septate branches. *Conidia* hyaline to yellow, cylindrical, fusiform or ellipsoid to oblong, 0–7 septate, smooth or verrucose to roughened, with distinct hilum at both ends, with or without a mucoid sheath, formed in chains or aggregating into large sphaerical or irregular white masses (description modified from Lombard et al. 2015).

Type: ***Tilachlidium*** Preuss

Notes: The family *Tilachlidiaceae* was introduced by Lombard et al. (2015) based on molecular analysis to accommodate the asexual genera *Septofusidium* and *Tilachlidium*. Gams (1971) classified *Septofusidium* in *Nectriaceae*, while *Tilachlidium* was classified as genus *incertae sedis* in the order *Hypocreales* (Gams 1971).

Tilachlidium Preuss, Linnaea 24: 126 (1851)

Facesoffungi number: FoF 02138; Fig. 143

Saprobic on dead fungi or *hyperparasitic* on living entomogenous fungi. **Sexual morph**: Undetermined. **Asexual morph**: *Conidiophores* synnematous. *Synnemata* simple or branched, cylindrical, narrowing towards the apex, consisting of bundles of parallel, longitudinally arranged, usually closely compacted hyphae. *Conidiogenous cells* phialidic, scattered, subulate, gradually narrowing to an acute apex, hyaline, terminating hyphal cells of the synnema, or as lateral cells of the hyphae, arrange singly or in groups. *Conidia* ellipsoidal to oblong, hyaline, aseptate, smooth, covered by a mucoid sheath, aggregating into large sphaerical or irregular masses (description modified from Lombard et al. 2015).

Type species: ***Tilachlidium brachiatum*** (Batsch) Petch, Trans. Brit. mycol. Soc. 21: 66. 1937

Notes: *Tilachlidium* was described by Preuss (1851) based on *Tilachlidium pinnatum* Preuss reported on dried fungi, chiefly as *Agaricus galericulatus* (Mains 1951). There are 19 epithets in Index Fungorum (2016).

Other genus included

Septofusidium W. Gams, Cephalosporium-artige Schimmelpilze (Stuttgart): 147 (1971)

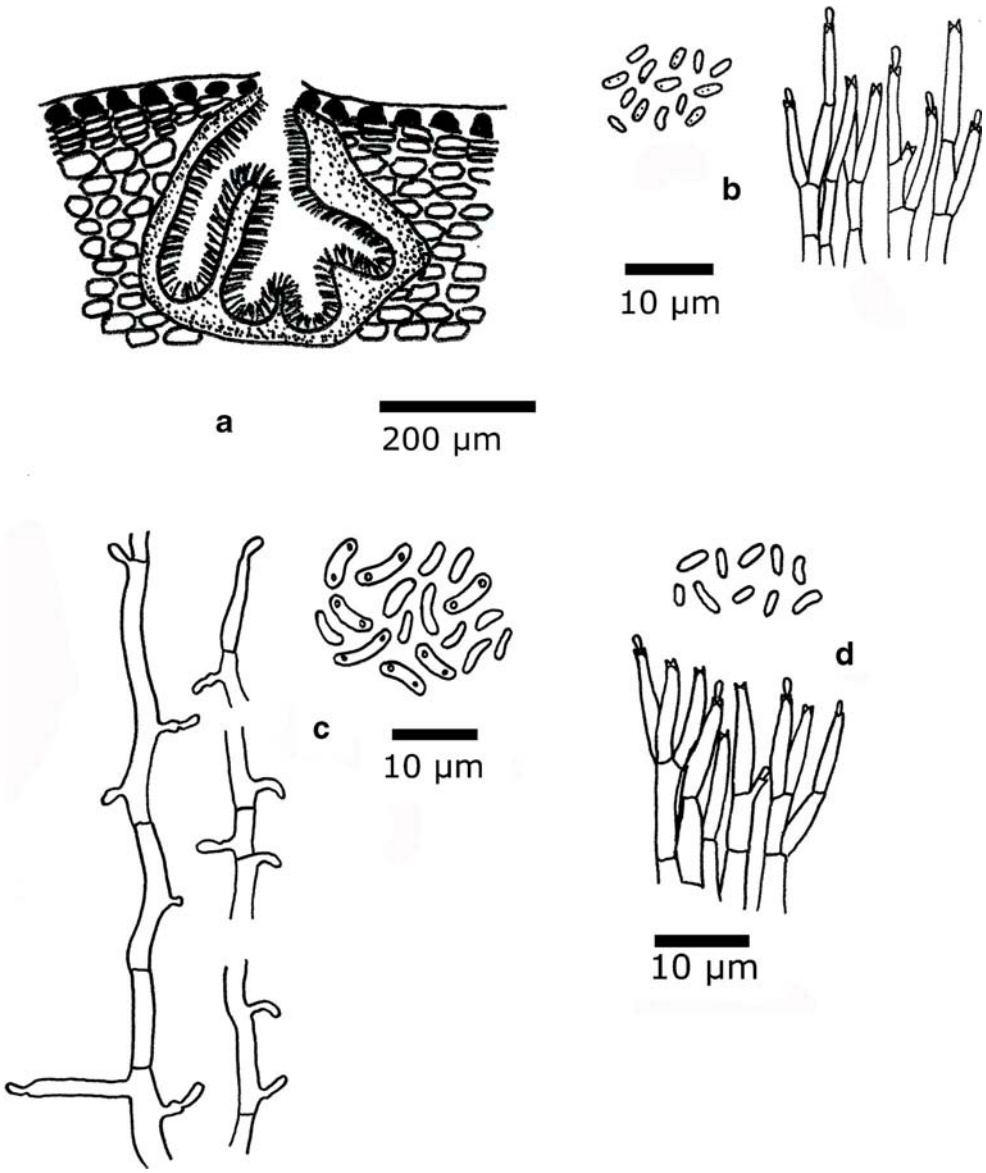


Fig. 142 ***Pleurocytospora vestita*** (redrawn from Leuchtmann and Müller 1986) **a** Section through the host tissue and stroma **b** Conidiophores and conidia **c** Conidia forming mycelium and conidia of 10 days old culture **d** Conidiophores and conidia of the stroma in culture

Type species: ***Septofusidium elegantulum*** (Pidopl.) W. Gams, Cephalosporium-artige Schimmelpilze (Stuttgart): 147 (1971)

Key to genera of *Tilachlidiaceae*

1. Conidia with mucoid sheath, aggregating into large sphaerical or irregular masses . . . . . ***Tilachlidium***
1. Conidia without mucoid sheath, arranged in chains. . . . . ***Septofusidium***

Tirisporellaceae Suetrong et al., in Suetrong et al., Cryptog. Mycol. 36(3): 323 (2015)

Facesoffungi number: FoF 01413

Saprobic on decaying submerged petioles of the mangrove palm (*Nypa fruticans*). **Sexual morph**: *Ascomata* scattered, solitary or gregarious, semi-immersed to superficial, globose to subglobose, coriaceous to carbonaceous, black, papillate, ostiolate. *Neck* short or very long, central, cylindrical, with short hyaline periphyses, black. *Peridium* comprising inner, hyaline, few layers of cells of *textura angularis*, middle, brown, many layers of cells of *textura intricata* and outer, small, black to brown cells of *textura angularis*. *Hamathecium* comprising deliquescent, irregular in width, septate, hyaline, paraphyses tapering towards apices and embedded in a mucilaginous matrix. *Asci* 4–8 spored, unitunicate, cylindrical to clavate, thick-walled, indistinct pedicellate, apex blunt, J- subapical ring comprising a canal and pore. *Ascospores* overlapping bi-seriate to triseriate, fusoid,

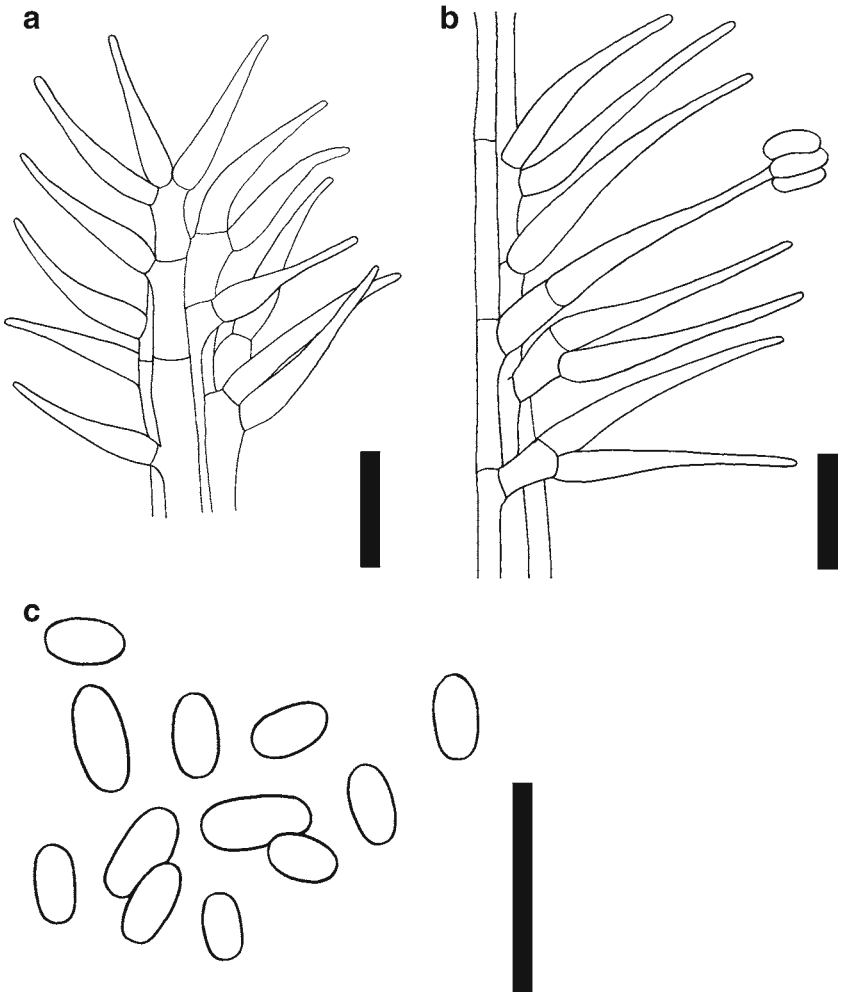


Fig. 143 ***Tilachlidium brachiatum*** (redrawn from CBS 505.67; Lombard et al. 2015) **a** Phialides terminating on hyphae of synnema **b** Lateral phialides extending from synnema **c** Conidia. Scale bars: **a–c** = 10 μm

falcate to lunate, straight or curved, hyaline to brown, basal cell present or absent, if present pointed, hyaline to pale brown, 1–7-septate, smooth or verrucose-walled, with or without 4–5 large guttules, with or lacking appendages. **Asexual morph**: Hyphomycetous. *Mycelium* comprising spreading, septate, superficial, smooth, pale brown, branched hyphae. *Conidiophores* reduced to conidiogenous cells or if present macronematous, mononematous, erect, brown, paler toward the apex, straight or flexuous, smooth. *Conidiogenous cells* intercalary, enteroblastic, monophialidic, integrated on hyphae, terminal, sometime erect on hyphae, pale brown, subcylindrical, narrowly ellipsoid, ampulliform to doliiform. *Conidia* solitary, smooth, clavate, fusoid-ellipsoid, obovoid or ellipsoid, apex obtuse or broadly rounded, tapering to a truncate base, hyaline to pale brown, unicellular or 1-septate. *Chlamydospores* intercalary, pale brown to brown, smooth, globose to narrowly ellipsoid, 0–1-septate.

Type: ***Tirisporella*** E.B.G. Jones et al.

Notes: *Tirisporellaceae* was introduced and typified by *Tirisporella beccariana* and this family comprises marine and freshwater fungal species. The family is referred to the order *Tirisporellales* (Jones et al. 2015). Maharachchikumbura et al. (2015) showed that the family grouped in the *Diaporthales* along with a freshwater fungus *Thailandiomyces bisetulosus*. Suetrong et al. (2015) and Jones et al. (2015) introduced the order *Tirisporellales* to accommodate three aquatic ascomycetes, which formed a sister group to the *Diaporthales*.

Tirisporella E.B.G. Jones et al., Can. J. Bot. 74(9): 1489 (1996)

Facesoffungi number: FoF 02139; Fig. 144

Saprobic on decaying submerged mangrove petioles. **Sexual morph**: *Ascomata* scattered, solitary or gregarious, initially immersed becoming to superficial, globose to subglobose, coriaceous becoming carbonaceous, black, papillate, ostiolate. *Neck* short, central, cylindrical, with short hyaline periphyses, black. *Peridium* comprising inner, hyaline, thin-walled, few layers of cells of *textura angularis*, middle, light brown, many layers of cells of *textura intricata* and outer, small, thick-walled, black to brown cells of *textura angularis*. *Hamathecium* comprising deliquescent, irregular in width, septate, hyaline, unbranched paraphyses tapering towards apices and

embedded in a mucilaginous matrix. *Asci* 8 spored, unitunicate, cylindrical to clavate, thick-walled, indistinct pedicellate, apex flattened, J- subapical ring comprising with canal and pore. *Ascospores* biseriate to triseriate, falcate to lunate, straight or curved, brown, basal cell pointed, hyaline to pale brown, 4–7-septate, verrucose, appendages only at the apical end. **Asexual morph**: Hyphomycetous. *Mycelium* comprising spreading, septate, smooth, branched, pale brown hyphae. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* intercalary monophialidic, integrated on hyphae, pale brown, subcylindrical, ampulliform, doliiform to narrowly ellipsoid. *Conidia* solitary, clavate to fusoid-ellipsoid, apex obtuse, tapering to a truncate base, unicellular to one septate, hyaline to pale brown, smooth. *Chlamydospores* intercalary, globose to narrowly ellipsoid, unicellular to one septate, pale brown to brown, smooth.

Type species: ***Tirisporella beccariana*** (Ces.) E.B.G. Jones et al., in Jones et al., Can. J. Bot. 74(9): 1490 (1996)

Basionym: *Sphaeria beccariana* Ces., Atti Accad. Sci. fis. mat. Napoli 8(no. 3): 20 (1879)

Notes: *Tirisporella* was introduced by Jones et al. (1996) and placed in Dothideomycetes *incertae sedis* because of the thick ascus wall recognized as two walls. This monotypic genus consists of only the type species *Tirisporella beccariana*. The most obvious characters of this genus are the first basal septum delimiting a hyaline to light-coloured basal cell and verrucose cell wall, and the apical ascospore appendage.

Other genera included

Bacusphaeria Norlailatul et al., Phytotaxa. In press;

Type species: ***Bacusphaeria nypenthi*** Norlailatul et al., Phytotaxa. In press

Thailandiomyces Pinruan et al., Fungal Diversity 29: 91 (2008)

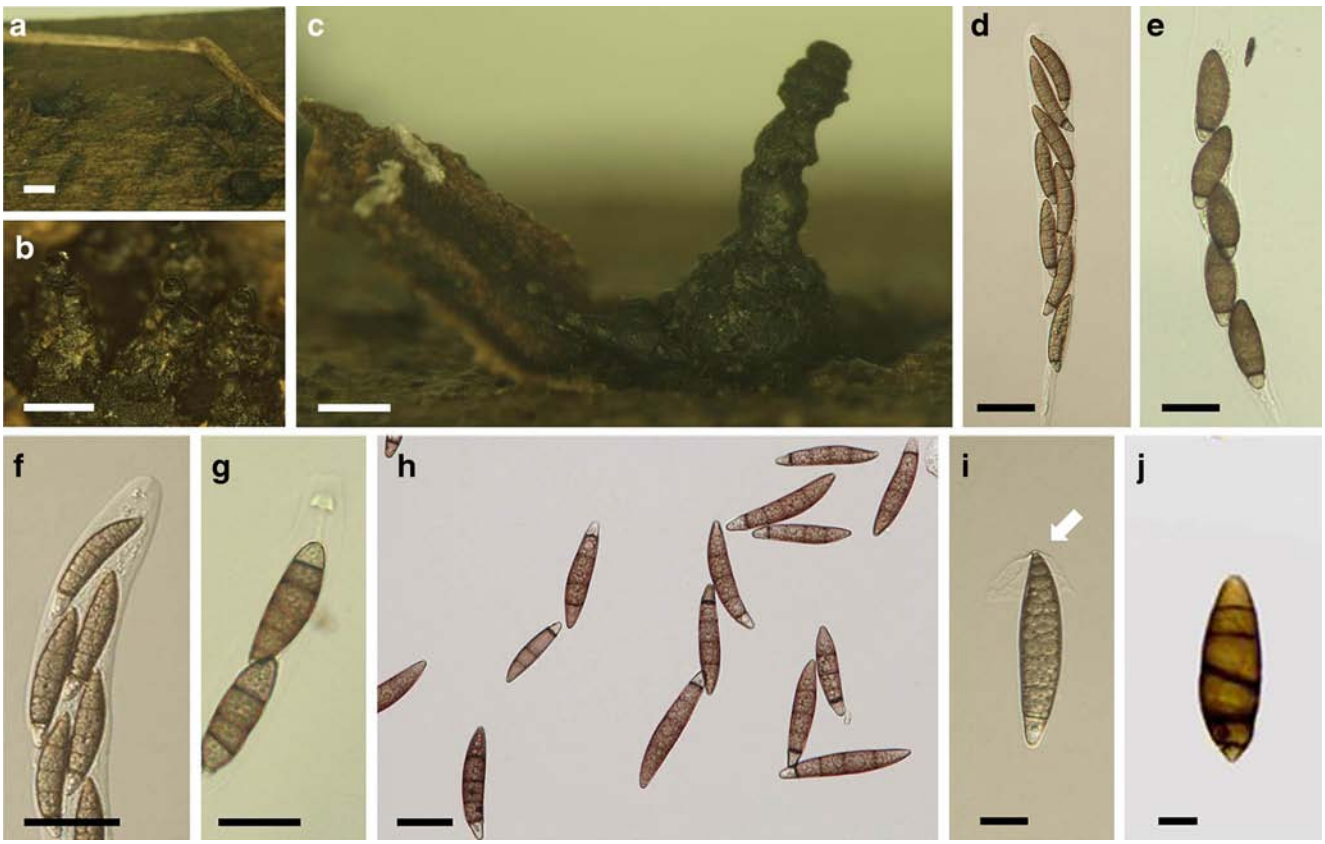


Fig. 144 Morphological features of marine *Tirisporellaceae*: *Tirisporella beccariana* and *Bacusphaeria nypenthi* (Material examined: THAILAND, Trat Province, Ao Salak Phet, Mu Ko Chang National Park, on frond base of *N. fruticans*, 29 June 2008, Satinee Suetrong, BCC32339) **a-c** Partially immersed to superficial ascomata of *T. beccariana* on the lower base of fronds of *Nypa fruticans* **d** Cylindrical ascus **e** Cylindrical ascus of *Bacusphaeria nypenthi* **f** Ascus tip of *Tirisporella beccariana* **g** Ascus tip of *Bacusphaeria nypenthi* **h**, **i** Ascospores with apical appendage of *Tirisporella beccariana* (arrowed) **j** Ellipsoidal ascospores of *Bacusphaeria nypenthi* Scale bars: **a**, **b** = 1000 μm, **c** = 500 μm, **d**–**h** = 25 μm, **I**, **j** = 10 μm

Type species: ***Thailandiomyces bisetulosus*** Pinruan et al., Fungal Diversity 29: 91 (2008)

Key to genera of *Tirisporellaceae*

1. Ascomata, laterally spread on substrate, with long neck; ascospores fusoid, hyaline, ... ***Thailandiomyces***
   1. Ascomata, erect, ascospores falcate to lunate, brown with pointed, hyaline to pale brown basal cell 2
   2. Ascospores 4–7 septate . . . . . ***Tirisporella***
   2. Ascospores predominantly 1–3 septate . . ***Bacusphaeria***

Togniniaceae Réblová et al., Stud. Mycol. 50: 540 (2004)

Facesoffungi number: FoF 01414

Saprobic on plants, or *pathogenic* on human and animals, or soil fungi. **Sexual morph**: *Ascomata* perithecial, aggregated or solitary, superficial, erumpent to immersed, astromatic, globose to subglobose, coriaceous, black, ostiolate, necks long with periphyses. *Peridium* comprising three layers, outer layer of a few dark brown to black, compressed cell layers, middle of brown to dark brown, smaller, rounded or brick-like cells of *textura angularis*, *textura prismatica* to *textura epidermoidea*, and inner layer of hyaline to pale brown, flattened cells of *textura angularis. Hamathecium* comprising abundant, paraphyses. *Asci* arising in acropetal succession, 8-spored, unitunicate, sessile, with broadly rounded to obtuse, thick-walled apex. *Ascospores* uniseriate to biseriate, hyaline, unicellular, allantoid, reniform, cylindrical or oblong-ellipsoidal or subglobose to ellipsoid, 0–1-septate. **Asexual morph**: Hyphomycetous. *Conidiophores* branched or unbranched, erect, cylindrical or slightly tapering, pale brown, with one integrated terminal phialide. *Conidiogenous cells* mostly monophialidic, discrete or integrated, terminal or lateral, with an inconspicuous funnel-shaped collarette. *Conidia* aggregated into globose, slimy heads at the apices of phialides, hyaline, aseptate.

Type: ***Phaeoacremonium*** W. Gams, Crous & M.J. Wingf.

Notes: *Togniniaceae* was introduced by Réblová et al. (2004) based on *Togninia minima* (Tul. & C. Tul.) Berl., and later *Togninia* was synonymised under *Phaeoacremonium* (Gramaje et al. 2015). The family comprises the genera *Conidiotheca* and *Phaeoacremonium* (Réblová and Mostert 2007) based on phylogenetic and morphological distinctiveness. Mostert et al. (2003) placed *Togniniaceae* in *Calosphaeriales* based on its unique morphological characters and phylogenetic analysis. Subsequently, Mostert et al. (2006) placed this family in *Diaporthales* based on combined gene analysis of SSU and LSU sequence data. The morphological characters of *Togniniaceae* are quite different from other families in *Diaporthales*. Maharachchikumbura et al. (2015) showed the placement of *Togniniaceae* to be between *Diaporthales* and *Calosphaeriales* based on combined gene analysis of LSU, SSU, TEF and RPB2 sequence data. They introduced this clade as *Togniniales* to accommodate *Togniniaceae*.

Phaeoacremonium W. Gams, Crous & M.J. Wingf., Mycologia 88: 789 (1996)

Facesoffungi number: FoF 02140; Figs 145, 146

Saprobic on plants, or *pathogenic* on human and animals or soil fungi. **Sexual morph**: *Ascomata* perithecial, aggregated or solitary, superficial, erumpent to immersed, astromatic, globose to subglobose, coriaceous, black, ostiolate, with longnecks. *Neck* straight or curved, internally lined by periphyses. *Peridium* comprising two layers, outer layer of brown to dark brown, small, rounded cells of *textura angularis*, inner layer of hyaline to pale brown, flattened cells of *textura angularis. Hamathecium* comprising abundant, cellular, branched, septate, hyaline paraphyses, slightly constricted at the septa and tapering towards the apex. *Ascogenous hyphae* hyaline, branched, elongate during ascus formation, with remnant bases from which single ascus arises. *Asci* arising in acropetal succession, 8-spored, unitunicate, sessile, apically thickened, base bluntly obtuse. *Ascospores* biseriate to uniseriate, hyaline, allantoid, reniform, cylindrical or oblong-ellipsoidal, unicellular. **Asexual morph**: Hyphomycetous. *Mycelium* branched, septate, with single or bundled hyphae, light brown, are as near to conidia formation becoming pale brown to hyaline, smooth, verruculose or verrucose. *Conidiophores* branched or unbranched, arising from aerial or submerged hyphae, erect, cylindrical or slightly tapering, straight or curved, up to 7-septate, pale brown, paler towards the apex, small warts or verruculose ornamentation at the base, with one integrated terminal phialide and sometimes one or two additional, discrete phialides at the upper most septum. *Conidiogenous cells* phialidic, discrete or integrated, terminal or lateral, mostly monophialidic, sometimes polyphialidic, warted, verruculose or smooth, pale brown to hyaline, with an inconspicuous funnel-shaped collarette. *Conidia* hyaline, aggregated into globose, slimy heads at the apices of phialides, oblong-ellipsoidal to obovate, cylindrical, allantoid or reniform, uncommonly fusiform-ellipsoidal or globose, aseptate, smooth-walled.

Type species: ***Phaeoacremonium parasiticum*** (Ajello et al.) W. Gams et al., in Crous et al., Mycologia 88(5): 794 (1996).

Basionym: *Phialophora parasitica* Ajello, Georg & C.J.K. Wang, Mycologia 66(3): 493 (1974)

Note: *Togninia* was introduced and typified by *T. minima. Togninia* species reported as the sexual morph of *Phaeoacremonium. Phaeoacremonium* comprises 44 species (Réblová et al. 2015). The type species of

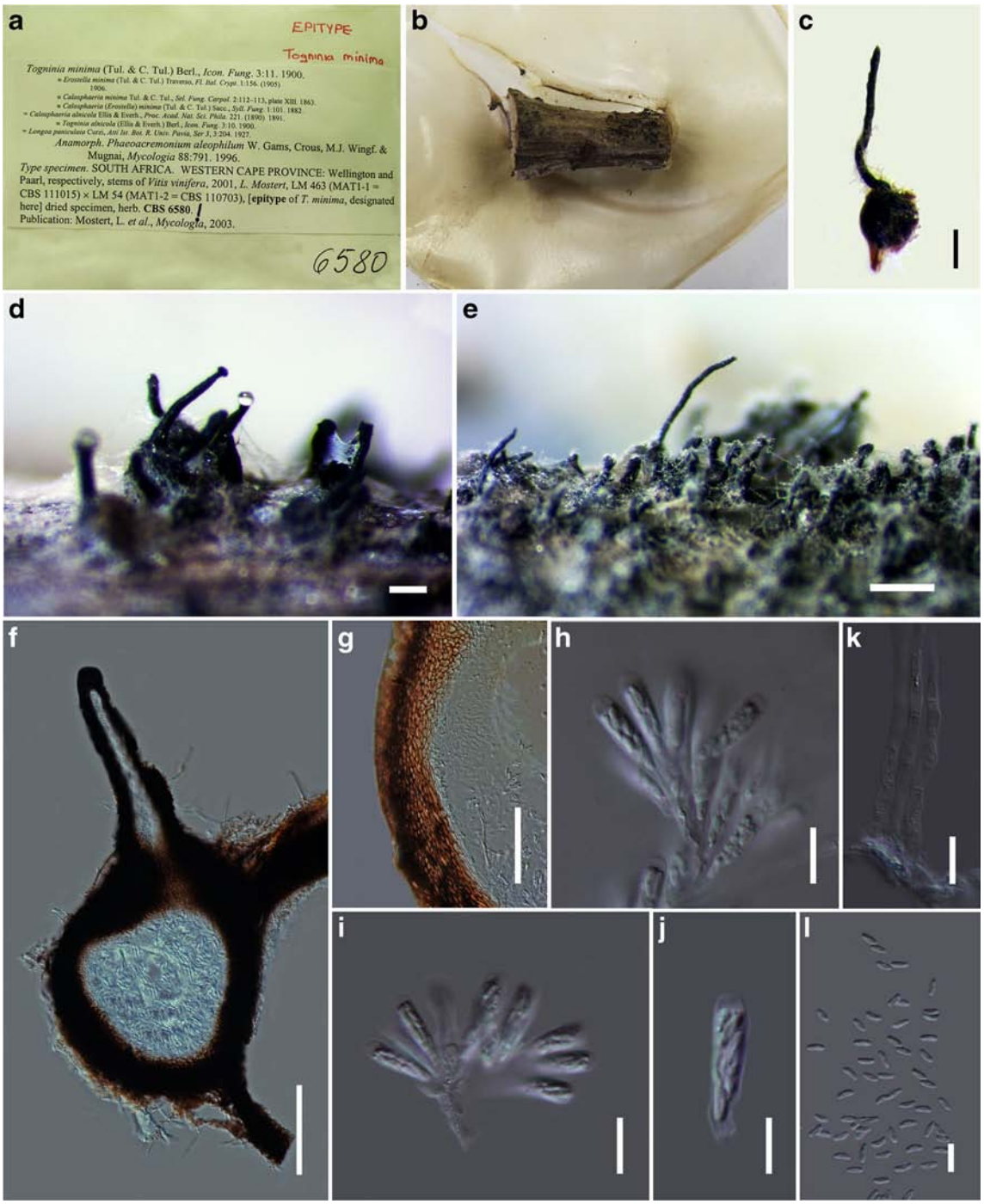


Fig. 145 ***Phaeoacremonium minima*** **- sexual morph** (Material examined: SOUTH AFRICA, Western Cape Province, Wellington and Paarl respectively, stems of *Vitis vinifera* L. (*Vitaceae*), 2001, L. Mostert, LM 463 CBS H 6580, **epitype**) **a**, **b** Herbarium packet and specimen **c–e** Ascomata on substrate **f** Cross section of ascoma **g** Three-layered peridium **h–j** Asci forming on ascogenous hyphae **k** Ascogenous hyphae **l** Ascospores. Scale bars: **c-d** = 200 μm, **e** = 500 μm, **f–g** = 100 μm, **h–l** = 10 μm

Phaeoacremonium was linked to the type species of *Togninia*, and sexual-asexual relationships between *Togninia* and *Phaeoacremonium* have been confirmed by mating experiments in culture and molecular sequence data (Mostert et al. 2003). The generic name *Phaeoacremonium* (1996) was accepted over *Togninia* (1900). *Togninia* presently comprises 26 epithets and 13 are not sufficiently reported and described. Nine *Togninia* species are already linked to *Phaeoacremonium* species. *Phaeoacremonium* has recently been monographed, and comprises 46 species; all they are known from culture and have been subjected to DNA sequence analysis.

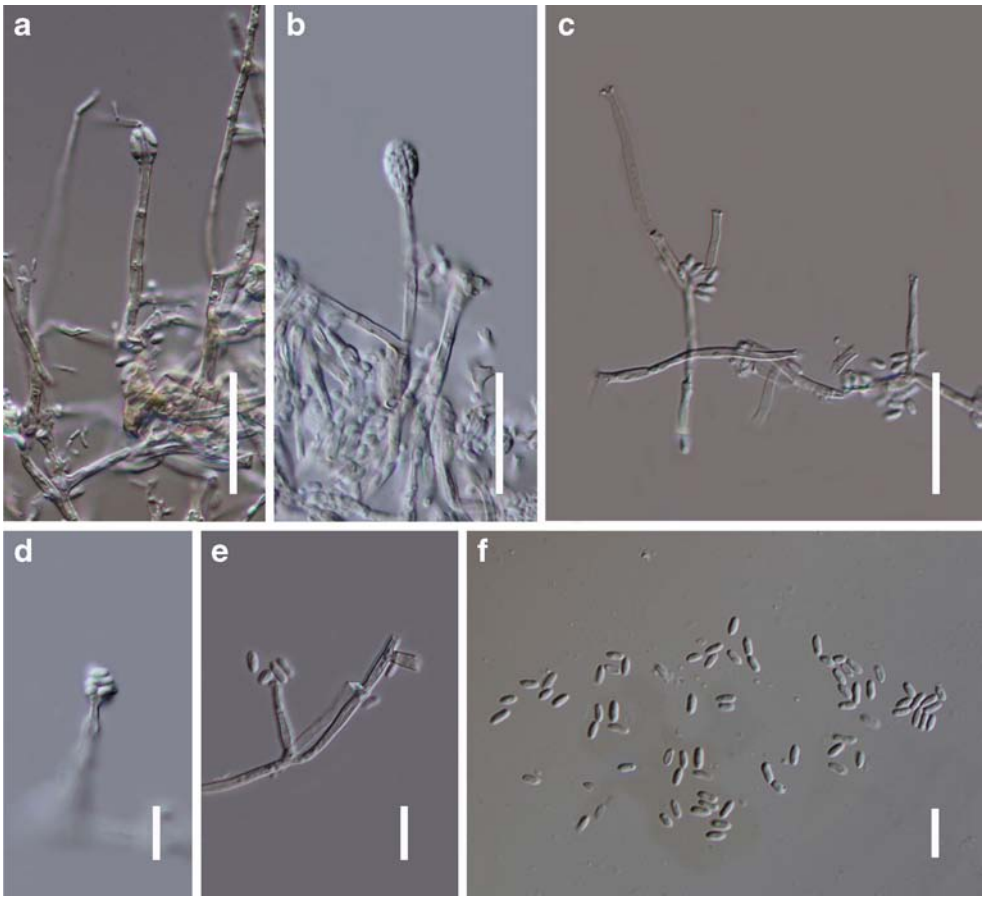


Fig. 146 ***Phaeoacremonium minima*** **- asexual morph** (CBS 110703, **ex-epitype**) **a–e** Conidiophores with attached conidia **f** Conidia. Scale bars: **a–f** = 10 μm

The genus name *Phaeoacremonium* is preferred by plant pathologists and medical mycologists, and it is the more common name used in recent publications (Gramaje and Di Marco 2015).

Other genus included

Conidiotheca Réblová & L. Mostert, Mycol. Res. 111(3): 305 (2007)

Type species: ***Conidiotheca tympanoides*** (M.E. Barr) Réblová & L. Mostert, Mycol. Res. 111(3): 305 (2007)

Key to genera of *Togniniaceae*

1. Ascomata subglobose to broadly conical, ascospores subglobose to ellipsoid, 0–1-septate. . . . . ***Conidiotheca***
   1. Ascomata globose to subglobose, ascospores allantoid, unicellular . . . . . ***Phaeoacremonium***

Torpedosporaceae E.B.G. Jones & K.L. Pang, in Jones et al., Cryptog. Mycol. 35(2): 135 (2014)

Facesoffungi number: FoF 01099

Saprobic on intertidal or mangrove wood and roots, bark and leaves, in marine habitats. **Sexual morph**: *Ascomata* perithecial, hyaline, immersed or superficial, subglobose, ostiolate, papillate, subcarbonaceous to coriaceous. *Paraphyses* narrow, irregular, persistent or early deliquescing. *Asci* 8-spored, unitunicate, thin-walled, clavate to ellipsoidal, short pedicellate, lacking an apical ring, early deliquescing. *Ascospores* fasciculate, hyaline, cylindrical to ellipsoidal, 3–5-septate, with several radiating appendages at one or both ends. **Asexual morph**: *Hyphae* septate, branched, hyaline. *Conidiophores* present or obsolete, cylindrical, clavate, septate or aseptate, acrogenous or laterally on the hyphae, hyaline to light brown. *Conidia* holoblastic, irregularly helicoid, muriform, cells of the conidia tightly fused, more or less similar in size and colour, acrogenous, solitary, constricted at the septa, yellow to brown. Conidial cells up to 50 in number.

Type: ***Torpedospora*** Meyers

Notes: *Torpedosporaceae* was introduced by Jones et al. (2014) with two *Torpedospora* species and *Glomerulispora mangrovis* Abdel-Wahab & Nagah.

(asexual morph), based on molecular analysis of partial sequences of the nuclear SSU and LSU sequence data. Jones et al. (2014) showed that four strains of *Torpedospora radiata* formed a monophyletic clade with *Glomerulispora mangrovis*, while *Torpedospora ambispinosa* Kohlm. was placed in a lower sub-clade. Sexual morphs of the family *Torpedosporaceae* produce perithecial ascomata and ascospores that possess 3–5 radiating appendages at one or both ends, while *G. mangrovis* produces helicoid conidia. The family groups in Hypocreomycetidae, order *incertae sedis* (Jones et al. 2014) and this was followed by Maharachchikumbura et al. (2015). Subsequently, Jones et al. (2015) have referred the family to a new order *Torpedosporales*.

Torpedospora Meyers, Mycologia 49: 496 (1957)

Facesoffungi number: FoF 02141; Fig. 147

Saprobic on wood and roots, bark and leaves. **Sexual morph**: *Ascomata* perithecial, superficial to immersed, hyaline, membranous, collapsing on drying, subglobose to globose, ostiole central, papillate. *Peridium* 2-layered, with an outer layer of cells of *textura angularis*, and inner layer of elongated cells. *Paraphyses* present. *Asci* 8-spored, elongate-clavate, short pedicellate, with an apical ring, thin walled, early deliquescent. *Ascospores* fasciculate, hyaline, elongate, tapering, 3–5-septate, with radiating appendages at one or both ends. **Asexual morph**: Undetermined.

Type species: ***Torpedospora radiata*** Meyers, Mycologia 49: 496 (1957)

Notes: The genus *Torpedospora* was introduced by Meyers (1957) and is distinguished from other genera with appendaged spores by the characteristic torpedo-like shape of the ascospores, together with the radiating appendages at one or both ends. Ascospores of *T. radiata* (type species), possess 3–5, radiating, sub-terminal appendages at one end, that appear to be fibrillar (Jones and Moss 1978), whereas *T. ambispinosa* has sub-terminal appendages at both ends, that are rigid, straight or curved. Ascospores of *T. ambispinosa* in mass are bright orange, but are hyaline in *T. radiata*. Molecular studies showed that they group in the same clade with high bootstrap support, which suggest that they are congeneric (Sakayaroj et al. 2005; Schoch et al. 2007). Schoch et al. (2007) suggested that the monophyly of the genus *Torpedospora* should be further evaluated with a wider range of taxa. The marine hyphomycete *Glomerulispora mangrovis*, with irregularly helicoid conidia with muriform spores, groups with *Torpedospora radiata* with variable support (Abdel-Wahab et al. 2010; Jones et al. 2014). Depending on molecular and morphological data, Jones et al. (2014) included the genera *Torpedospora* and *Glomerulispora* in a new family *Torpedosporaceae*. However, it remains unresolved whether *Glomerulispora mangrovis* is the asexual morph of *T. radiata* (Abdel-Wahab et al. 2010). The genus *Torpedospora* is worldwide in distribution and *T. radiata* a common species.

Other genus included

Glomerulispora Abdel-Wahab & Nagah., in Abdel-Wahab et al., Mycol. Progr. 9(4): 552 (2010)

Type species: ***Glomerulispora mangrovis*** Abdel-Wahab & Nagah., in Abdel-Wahab et al. (2010) Mycol. Progr. 9(4): 553 (2010)

Key to the genera of *Torpedosporaceae*

1. Hyphomycete with irregularly helicoid, muriform, yellow to brown conidia with tightly fused conidial cells, more or less similar in size and colour, constricted at the septa . . . . . .***Glomerulispora***
   1. Ascomycete, perithecioid, with fasciculate, hyaline, cylindrical to ellipsoidal, 3–5-septate ascospores with several radiating appendages at one or both ends . . . . . .***Torpedospora***

Trichosphaeriaceae G. Winter [as 'Trichosphaerieae'], Rabenh. Krypt.-Fl., Edn 2 (Leipzig) 1.2: 191 (1885)

Facesoffungi number: FoF 01809

Saprobic or *pathogenic* on plant materials, commonly isolated from herbivore dung. **Sexual morph**: *Ascomata* superficial, immersed or semi-immersed, ostiolate, subglobose to pyriform, dark brown to black. *Ostiole* situated in a small papilla, with bristles, in most genera setose-like hairs present. *Peridium* carbonaceous or sub-carbonaceous, coriaceous or membranaceous, brown to dark brown, cells of *textura angularis*. *Hamathecium* comprising simple, hyaline, guttulate, septate, thin-walled, paraphyses. *Asci* 4–8-spored, unitunicate, cylindrical-clavate, gradually tapering below into a short pedicel, with rounded apex, sometimes curved, rounded above, some genera have a distinct apical ring. *Ascospores* uniseriate-overlapping uniseriate, ellipsoidal-fusiform, hyaline or brown-dark brown, aseptate or 1–3-sepate, some genera (*Trichosphaeria*) with rounded apices, smooth-walled, guttulate. **Asexual morph**: Hyphomycetous. *Conidiophores* macronematous or some genera (*Fluviostroma*) synnematous, unbranched or infrequently branched, flexuous and often circinate, septate or aseptate, dematiaceous, hyaline to brown-yellow. *Conidiogenous cells* monophialidic, each immediately subtending a septum, forming a chain,

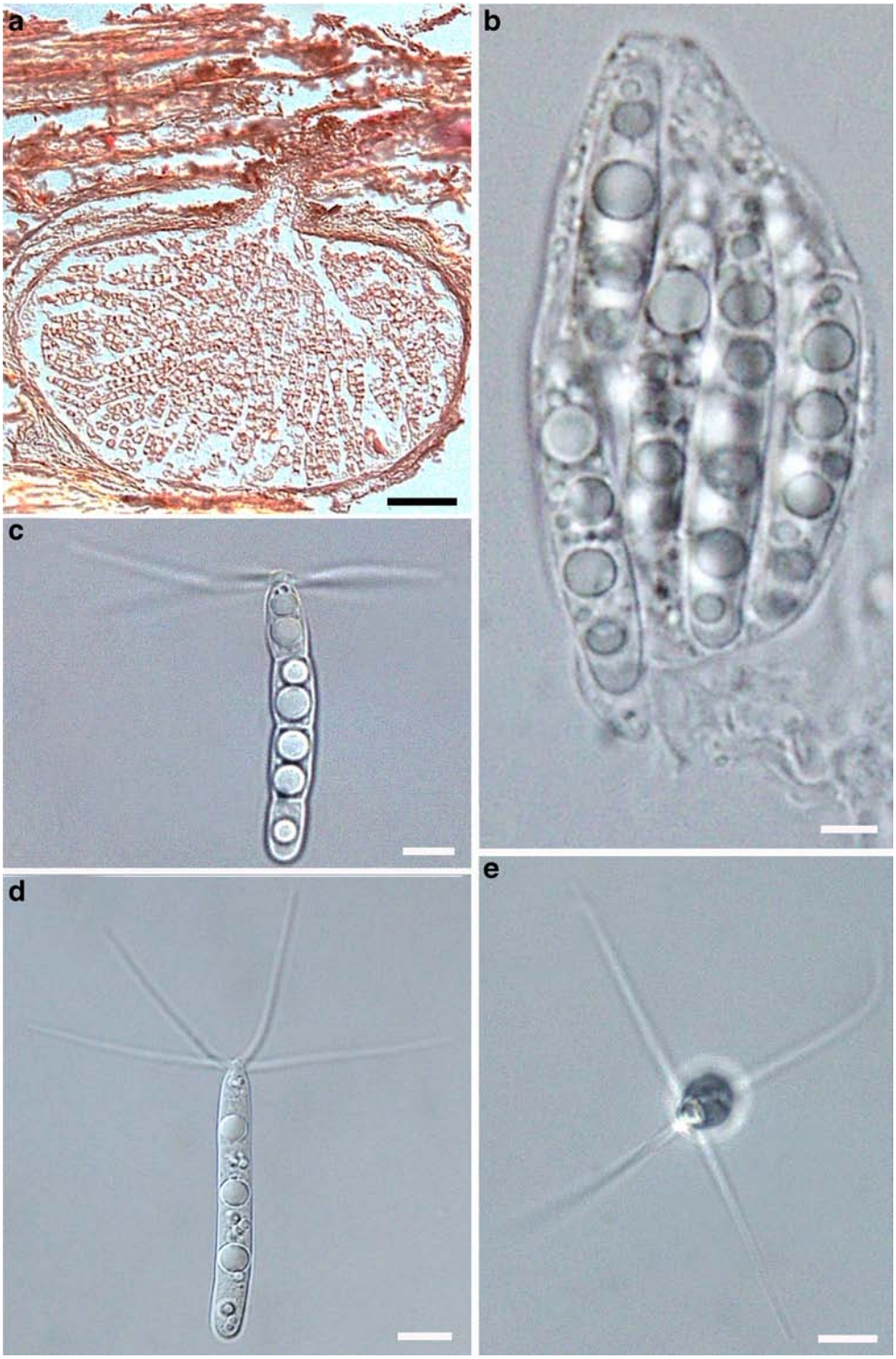


Fig. 147 *Torpedospora radiata* (Material examined: TAIWAN, Keelung City, Chaojing Park, rocky shore, on driftwood, 03 October 2014, K.L. Pang) **a** Section of immersed ascoma **b** Clavate ascus **c** Cylindrical ascospore with unipolar appendages and three septa **d**, **e** Ascospore showing four appendages at one end. Scale bars: **a** = 20 μm, **b**–**e** = 5 μm

terminal, cylindrical or subcylindrical, solitary, hyaline. *Conidia* ellipsoid to oblong, cylindrical to filiform, subglobose, hyaline, brown, aseptate or 1–3-septate, some genera (*Koorchaloma*) producing aggregated conidia in slimy masses, with mucoid appendages at both ends.

Type: ***Trichosphaeria*** Fuckel

Notes: The family *Trichosphaeriaceae* was established invalidly by Winter (1885) to accommodate the type *Trichosphaeria pilosa* (Pers.) Fuckel. Barr (1983) introduced the order *Trichosphaeriales* to accommodate the family *Trichosphaeriaceae*. In the multi-gene (LSU, SSU, TEF and RPB2) phylogenetic analysis by Maharachchikumbura et al. (2015) *Trichosphaeriaceae*

has affinities with *Papulosporaceae* and *Thyridiaceae*. However, Maharachchikumbura et al. (2015) maintained *Trichosphaeriaceae* as a separate family until fresh collections and molecular data become available. Certain species in this family are coprophilous, while other members are known as saprobic or pathogenic on plant materials including *Chrysopogon zizanioides* L., *Arenga engleri* Becc. and *Ulmus minor* Mill. (Hudson 1963; Calatayud and Aguirre-Hudson 2001).

Trichosphaeria Fuckel, Jb. nassau. Ver. Naturk. 23–24: 144 (1870) [1869–70]

Facesoffungi number: FoF 01810; Fig. 148

Saprobic or *pathogenic* on plant materials. **Sexual morph**: *Ascomata* perithecial, small, globose to subglobose with a flattened base, superficial, amphigenous, dark brown, setose, aggregated in to groups, scattered. *Setae* numerous, pale brown, septate, smooth, up to 600 μm long and 7 μm wide, giving a star-like appearance to the ascoma. *Peridium* comprising a single layer of thick-walled, polygonal to angular, dark brown, cells of *textura angularis*. *Hamathecium* comprising simple, hyaline, guttulate, septate, thin-walled, paraphyses. *Asci* 4–8 spored, unitunicate, cylindrical to clavate, with a non-amyloid apical ring. *Ascospores* obliquely uniseriate to biseriate, ellipsoidal, narrowly elliptical to fusiform, hyaline, aseptate, smooth, sometimes slightly curved, lacking germ pores. **Asexual morph**: Undetermined.

Type species: ***Trichosphaeria pilosa*** (Pers.) Fuckel, Jb. nassau. Ver. Naturk. 23–24: 145 (1870) [1869–70]

Notes: The genus *Trichosphaeria* was introduced by Fuckel (1870) with *T. pilosa* (Pers.) Fuckel as the type species on rotten wood from Germany. *Trichosphaeria* is characterized with superficial, small, setose perithecia sitting in a subiculum with cylindrical to oblong, 8-spored asci bearing hyaline, aseptate, rarely appendiculate ascospores (von Arx and Müller 1954; Réblová and Seifert 2004). Sivanesan and Shivas (2002) accepted 25 species of *Trichosphaeria*, which were isolated mostly from woody substrates. There are 62 epithets for *Trichosphaeria* recorded in Index Fungorum (2016).

Other genera included

Acanthosphaeria Kirschst., Annls mycol. 37(1/2): 91 (1939)

Type species: Kirschstein gave no clue for the choice of a type species

Brachysporium Sacc., Syll. fung. (Abellini) 4: 423 (1886)

Type species: ***Brachysporium obovatum*** (Berk.) Sacc., Syll. fung. (Abellini) 4: 427 (1886)

Collematospora Jeng & Cain, Can. J. Bot. 54(21): 2429 (1976)

Type species: ***Collematospora venezuelensis*** Jeng & Cain, Can. J. Bot. 54(21): 2430 (1976)

Coniobrevicolla Réblová, Mycotaxon 70: 422 (1999)

Type species: ***Coniobrevicolla larsenii*** Réblová, Mycotaxon 70: 424 (1999)

Cresporhaphis M.B. Aguirre, in Tibell, Bull. Br. Mus. nat. Hist., Bot. 21(2): 146 (1991)

Type species: ***Cresporhaphis wienkampii*** (J. Lahm ex Hazsl.) M.B. Aguirre, Bull. Br. Mus. nat. Hist., Bot. 21(2): 154 (1991)

Cryptadelphia Réblová & Seifert, Mycologia 96(2): 348 (2004)

Type species: ***Cryptadelphia groenendalensis*** (Sacc. et al.) Réblová & Seifert, Mycologia 96(2): 352 (2004)

Eriosphaeria Sacc., Atti Soc. Veneto-Trent. Sci. Nat., Padova, Sér. 4 4: 86 (1875)

Type species: ***Eriosphaeria vermicularia*** (Nees) Sacc., Atti Soc. Veneto-Trent. Sci. Nat., Padova, Sér. 4 4: 86 (1875)

Fluviostroma Samuels & E. Müll., Sydowia 33: 283 (1980)

Type species: ***Fluviostroma wrightii*** Samuels & E. Müll., Sydowia 33: 284 (1980)

Kananascus Nag Raj, Mycotaxon 19: 201 (1984)

Type species: ***Kananascus verrucisporus*** Nag Raj, Mycotaxon 19: 207 (1984)

Khuskia H.J. Huds., Trans. Br. mycol. Soc. 46(3): 358 (1963)

Type species: ***Khuskia oryzae*** H.J. Huds., Trans. Br. mycol. Soc. 46(3): 358 (1963)

Koorchaloma Subram., J. Indian bot. Soc. 32: 124 (1953)

Type species: ***Koorchaloma madreeya*** Subram., J. Indian bot. Soc. 32: 124 (1953)

Neorehmia Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 111: 988 [2 repr.] (1902)

Type species: ***Neorehmia ceratophora*** Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 111: 988 [2 repr.] (1902)

Oplothecium Syd. & P. Syd., Annls mycol. 21(1/2): 97 (1923)

Type species: ***Oplothecium arecae*** Syd. & P. Syd., Annls mycol. 21(1/2): 97 (1923)

Rizalia Syd. & P. Syd., Annls mycol. 12(6): 546 (1914)

Type species: ***Rizalia fasciculata*** Syd. & P. Syd., Annls mycol. 12(6): 546 (1914)

Schweinitziella Speg., Anal. Soc. cient. argent. 26(1): 45 (1888)

Type species: ***Schweinitziella styracum*** Speg., Anal. Soc. cient. argent. 26(1): 45 (1888)

Setocampanula Sivan. & W.H. Hsieh, Mycol. Res. 93(1): 87 (1989)

Fig. 148 ***Trichosphaeria pilosa*** (Material examined: SWITZERLAND, Kt. Graubunden: S of Schiers, Furna, on *Alnus* (*Betulaceae*), 3 Sept. 1971, R.F. Cain, TRTC 48286) **a**, **b** Herbarium packets **c** Ascomata on substrate **d** Ascoma **e** Cross section of ascoma **f** Peridium **g**, **h**, **i**, **j** Asci **k** Paraphyses **l**, **m**, **n**, **o** Ascospores. Scale Bars: **c** = 400 μm, **d**, **e** = 50 μm, **f**–**k** = 10 μm, **l**–**o** = 5 μm

Type species: ***Setocampanula taiwanensis*** Sivan. & W.H. Hsieh, Mycol. Res. 93(1): 88 (1989)

Unisetosphaeria Pinnoi et al., in Pinnoi et al., Mycoscience 44(5): 377 (2003)

Type species: ***Unisetosphaeria penguinoides*** Pinnoi et al., Mycoscience 44(5): 378 (2003)

Key to the sexual genera of *Trichosphaeriaceae*

1. Ascomata aggregated 2
   1. Ascomata solitary. 3
   2. Ascospores uniseriate, fusiform, 3–5-septa . ***Fluviostroma***
   2. Ascospores biseriate, granulose, curved, aseptate . . . . . ***Khuskia***
   3. Ascomata superficial or semi-immersed with/without multi-setae. 4
   3. Ascomata immersed or semi-immersed, with a single long seta arising from the ostiole . . . . ***Unisetosphaeria***
   4. Ascomata carbonaceous or sub-carbonaceous. 5
   4. Ascomata coriaceous or membranaceous 6
   5. Asci cylindrical 7
   5. Asci clavate . . . . . ***Schweinitziella***
   6. Asci cylindrical 8
   6. Asci clavate 9
   7. Ascomata superficial . . . . . ***Cryptadelphia***
   7. Ascomata semi-immersed, with hispid setae . . . . . ***Eriosphaeria***
   8. Ascospores septate. 10
   8. Ascospores aseptate 11
   9. Perithecial setae with an apical cell 12
   9. Perithecial setae without an apical cell . ***Cresporhaphis***
   10. Ascospores ellipsoidal, narrowly rounded ends, 3-septate. . . . . ***Coniobrevicolla***
   10. Ascospores oblong, 0–1-septate . . . . ***Setocampanula***
   11. Ascospores not fused 13
   11. Ascospores fusing vertically in groups of two to four ascospores . . . . . ***Collematospora***
   12. Ascospores fusiform. . . . . ***Kananascus***
   12. Ascospores elongate. . . . . ***Rizalia***
   13. Ascospores broadly ellipsoidal . . . . ***Acanthosphaeria***
   13. Ascospores narrowly ellipsoidal to fusiform . . . . . ***Trichosphaeria***

Key to the asexual genera of *Trichosphaeriaceae*

1. Conidiomata macronematous or synnematous. 2
   1. Conidiomata pycnidial . . . . . ***Cresporhaphis***
   2. Conidiomata macronematous 3
   2. Conidiomata synnematous . . . . . ***Fluviostroma***
   3. Conidia aseptate. 4
   3. Conidia with 1–3 septa. . . . . ***Brachysporium***
   4. Conidia fusiform with narrow apex, hyaline, with mucoid appendages at both ends. . . . . ***Koorchaloma***
   4. Conidia egg-shaped to flattened-spherical, black, without mucoid appendages . . . . . ***Khuskia***

Valsaceae Tul. & C. Tul. [as 'Valsarum'], Select. fung. carpol. (Paris) 1: 180 (1861)

Facesoffungi number: FoF 01415

Pathogenic or *saprobic* on plant tissues. **Sexual morph**: *Stromata* present or absent. If present, *Ectostroma* circular or irregular, usually well developed in the upper regions. *Entostroma* normally limited to the region near the perithecial walls. *Ascomata* perithecia, immersed to erumpent, solitary or 6–10 ascomata aggregated together in valsoid configuration, globose to oblong, coriaceous, black to brown, with or without long neck which is swollen at the tip, ostiolate. *Ostiole* periphysate, open through the neck. *Peridium* thin, comprising outer, dark brown, thick-walled, 4–6 *textura angularis* cells and inner, small, hyaline, thin-walled, 5–7 *textura angularis* cells. *Hamathecium* comprising few, hyaline paraphyses. *Asci* unitunicate, 8-spored, clavate, short-stalked, apex round, with apical ring. *Ascospores* uniseriate to biseriate, 0–1-septate, allantoid, fusiform or ellipsoid, hyaline, smooth-walled. **Asexual morph**: *Stromata* uniloculate, black, circular in shape. *Locule* composed of numerous interconnecting chambers arranged radially or irregularly within a continuous mass of ectostromatic tissue, one conidiomata per locule. *Conidiomata* pyriform in section, brown, divided into compartments by bending of peridium. *Peridium* consists of brown, 5–7 layers of *textura angularis* cells. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* arising from conidiomatal wall, phialidic, simple or branched, hyaline, cylindrical. *Conidia* unicellular, allantoid, hyaline, smooth-walled.

Type: ***Cytospora*** Fr. (=*Valsa* Fr.)

Notes: The family *Valsaceae* was introduced by Tulasne and Tulasne (1861). This family comprises both phytopathogenic species and saprobes. The type genus *Cytospora* was typified by *Cytospora chrysosperma* (Pers.) Fr. and *Cytospora* species have been reported as the asexual morph of most taxa in *Valsaceae*. Currently this family comprises 13 genera: *Amphicytostroma*, *Chadefaudiomyces*, *Cryptascoma*, *Cytospora*, *Ditopellina*, *Durispora*, *Harpostroma*, *Hypospilina*, *Kapooria*, *Leptosillia*, *Maculatipalma*, *Pachytrype* and *Paravalsa* (Maharachchikumbura et al. 2015).

Cytospora Ehrenb., Sylv. mycol. berol. (Berlin): 2 (1818)

= *Valsa* Fr., Summa veg. Scand., Section Post. (Stockholm): 410 (1849)

= *Valsella* Fuckel, Jb. nassau. Ver. Naturk. 23–24: 203 (1870) [1869–70]

= *Leucostoma* (Nitschke) Höhn., Ber. dt. bot. Ges. 35: 637 (1917)

= *Valseutypella* Höhn., Annls mycol. 16(3/6): 224 (1919) [1918]

Facesoffungi number: FoFxxxxx; Figs 148, 149, 150

Pathogenic or *saprobic* on plant tissues. **Sexual morph**: *Ectostroma* circular or irregular, usually well developed in the upper regions. *Entostroma* normally limited to the region near the perithecial walls. *Ascomata* perithecia, immersed, aggregated 6–10 ascomata together in valsoid configuration, globose to oblong, coriaceous, black, with long neck swollen at the tip, ostiolate. *Ostiole* periphysate, open through the neck. *Peridium* thin, consist of outer, dark brown, thick-walled, 4–6 *textura angularis* cells and inner, small, hyaline, thin-walled, 5–7 *textura angularis* cells. *Hamathecium* comprising few paraphyses occurring only in young stage. *Asci* unitunicate, 8-spored, clavate, short-stalked, apex round, with apical ring. *Ascospores* biseriate, unicellular, allantoid or ellipsoid, hyaline, smooth-walled. **Asexual morph**: *Stromata* one locule in a stroma, black, circular in shape. *Locule* composed of numerous interconnecting chambers arranged radially or irregularly within a continuous mass of ectostromatic tissue, one conidiomata per locule. *Conidiomata* pyriform in section, brown, divided into compartments by bending of peridium. *Peridium* consists of brown, 5–7 layers of *textura angularis* cells. *Conidiophore* reduced to conidiogenous cells. *Conidiogenous cell* arising from conidiomatal wall, phialidic, simple or branched, hyaline, cylindrical. *Conidia* unicellular, allantoid, hyaline, smooth-walled.

Notes: The genus *Cytospora* was introduced in 1818, typified by *Cytospora chrysosperma*. (Adams et al. 2006) Maharachchikumbura et al. (2015) and Rossman et al. (2015) proposed to conserve the older name *Cytospora* suppressing *Leucostoma* (Nitschke) Höhn., *Valsa* Fr., *Valsella* Fuckel, and *Valseutypella* Höhn. *Cytospora* is a plant pathogen forming diseases on various tree species and recently Liu et al. (2015) and Ariyawansa et al. (2015) introduced few new *Cytospora* species from Russia.

Type species: ***Cytospora chrysosperma*** (Pers.) Fr., Syst. mycol. (Lundae) 2(2): 542 (1823)

Other genera included

Amphicytostroma Petr., Annls mycol. 19(1/2): 63 (1921)

Type species: ***Amphicytostroma tiliae*** (Sacc.) Petr., Annls mycol. 19(1/2): 63 (1921)

Chadefaudiomyces Kamat et al., in Ullasa et al., Revue Mycol., Paris 38(1–2): 19 (1974) [1973]

Type species: ***Chadefaudiomyces indicus*** Kamat et al., Revue Mycol., Paris 38(1–2): 20 (1974) [1973]

Cryptascoma Ananthap., Trans. Br. mycol. Soc. 90(3): 479 (1988)

Type species: ***Cryptascoma bisetula*** Ananthap., Trans. Br. mycol. Soc. 90(3): 479 (1988)

Ditopellina J. Reid & C. Booth, Can. J. Bot. 45: 1481 (1967)

Type species: ***Ditopellina saccardiana*** (Traverso & Spessa) J. Reid & C. Booth [as 'Ditopellina saccardoana'], (1967), Can. J. Bot. 45: 1481 (1967)

Durispora K.D. Hyde, Sydowia 46(2): 315 (1994)

Type species: ***Durispora elaeidicola*** K.D. Hyde, Sydowia 46(2): 316 (1994)

Harpostroma Höhn., in Weese, Mitt. bot. Inst. tech. Hochsch. Wien 5: 112 (1928)

Type species: ***Harpostroma notha*** (Sacc.) Höhn., in Weese, Mitt. bot. Inst. tech. Hochsch. Wien 5: 112 (1928)

Hypospilina (Sacc.) Traverso, Fl. ital. crypt., Pyrenomycetae (Florence): 495 (1913)

Type species: ***Hypospilina bifrons*** (DC.) Traverso, Fl. ital. crypt. (Florence) 1: 495 (1913)

Kapooria J. Reid & C. Booth, Can. J. Bot. 67(3): 898 (1989)

Type species: ***Kapooria musarum*** (J.N. Kapoor) J. Reid & C. Booth, Can. J. Bot. 67(3): 898 (1989)

Leptosillia Höhn., Mitt. bot. Inst. tech. Hochsch. Wien 5: 111 (1928)

Type species: ***Leptosillia notha*** Höhn., Mitt. bot. Inst. tech. Hochsch. Wien 5: 111 (1928)

Maculatipalma J. Fröhl. & K.D. Hyde, Mycol. Res. 99(6): 727 (1995)

Type species: ***Maculatipalma frondicola*** J. Fröhl. & K.D. Hyde [as 'fronsicola'], Mycol. Res. 99(6): 727 (1995)

Pachytrype Berl. ex M.E. Barr et al., Mycotaxon 48: 530 (1993)

Type species: ***Pachytrype princeps*** (Penz. & Sacc.) M.E. Barr et al., Mycotaxon 48: 530 (1993)

Paravalsa Ananthap., Mycol. Res. 94(2): 275 (1990)

Type species: ***Paravalsa indica*** Ananthap., Mycol. Res. 94(2): 275 (1990)

Key to genera of *Valsaceae*

1. Asexual morph common in nature; sexual morph undetermined. . . . . ***Amphicytostroma***
1. Asexual morph not common in nature 2
2. Stromata absent 3
2. Stromata present 7
3. Ascospores apiosporous 4
3. Ascospores not apiosporous 5
4. Perithecia erect. . . . . ***Maculatipalma***
4. Perithecia horizontal. . . . . ***Chadefaudiomyces***
5. Ascospores fusiform, with polar spines or appendages 6
5. Ascospores allantoid, without polar spines . . ***Paravalsa***
6. Ascospores with apical and basal appendages ***Durispora***
6. Ascospores without apical and basal appendages ***Cryptascoma***
7. Stromatic capsules pustuliform (composed of 1, rarely 2 ascomata). . . . . ***Hypospilina***

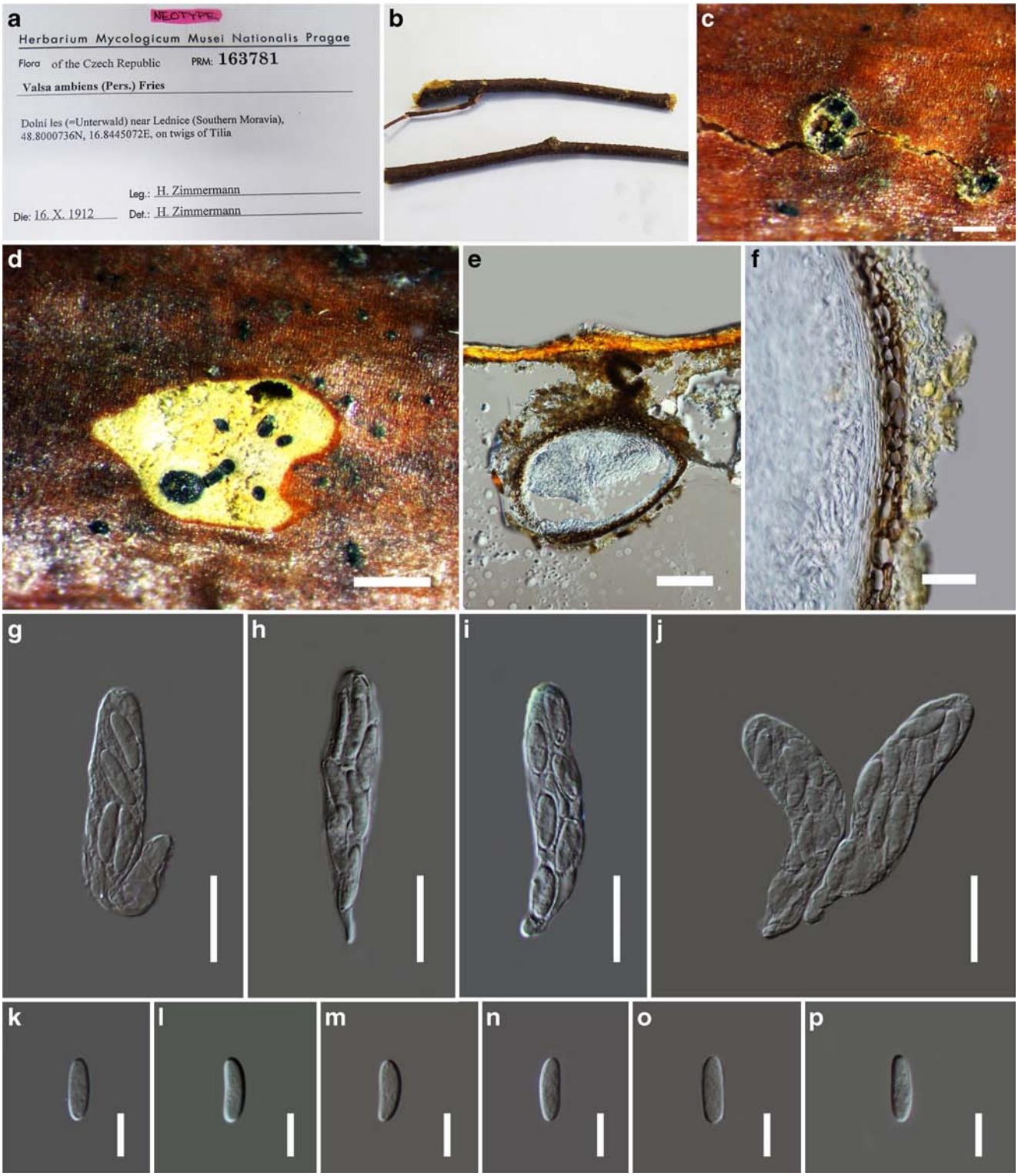


Fig. 149 *Cytospora chrysosperma* – **sexual morph** (Material examined: SOUTHERN MORAVIA, near Lednice, Dolniles, 48.8000736N, 16.8445072E, on twigs of *Tilia* sp., 16 October 1912, H. Zimmermann, PRM: 163781, **neotype**) **a**, **b** Herbarium specimen **c**, **d** Ascomata on substrate **e** Cross section of ascomata **f** Peridium **g–j** Asci **k-p** Ascospores. Scale bars: **c**, **d** = 500 μm, **e** = 100 μm, **f–j** = 20 μm, k–p = 10 μm

7. Stromatic capsules non-pustuliform (composed of more than 2 ascomata) 8
8. Stromata prosenchymatous. 9
8. Stromata pseudoparenchymatous 10
9. Ascospores apiosporous . . . . . ***Harpostroma***
9. Ascospores not apiosporous . . . . . ***Leptosillia***

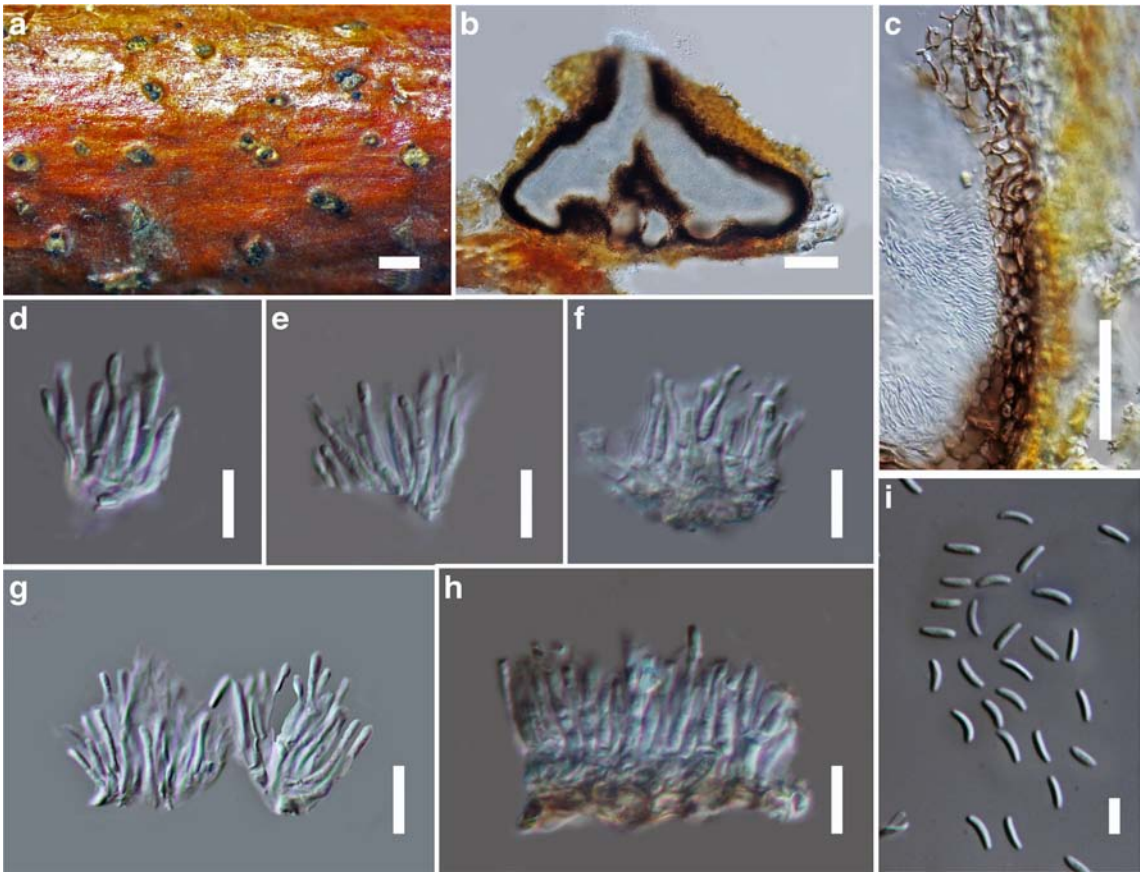


Fig. 150 ***Cytospora chrysosperma*** – asexual morph (Material examined: SOUTHERN MORAVIA, near Lednice, Dolniles, 48.8000736N, 16.8445072E, on twigs of *Tilia* sp., 16 October 1912, H. Zimmermann, PRM: 163781, neotype) a Conidiomata on substrate b Cross section of conidiomata c Peridium d-h Conidiophore with conidia i Conidia. Scale bars: a = 500 μm, b = 100 μm, c = 50 μm, d–h = 10 μm, i = 5 μm

10. Ascospores ellipsoid to more or less allantoid 11
10. Ascospores fusoid but with sharply pointed ends . . . . . ***Kapooria***
11. Perithecia in groups with convergent beaks; asci clavate to fusoid . . . . . ***Cytospora***
11. Perithecia in groups with non-convergent beaks; asci more or less rectangular . . . . . ***Pachytrype***

Vialaeaceae P.F. Cannon, Mycol. Res. 99(3): 368 (1995)

Facesoffungi number: FoF 01914

Parasitic, *endophytic* or *saprobic* on dead plant matter. **Sexual morph**: *Pseudostromata* appear as ellipsoidal, black, slightly raised dots on substrate. *Ascomata* perithecial, solitary or aggregated, immersed, globose, subglobose to ellipsoidal, coriaceous, black to brown, papillate, ostiolate. *Papilla* long, straight or curved, periphysate. *Periphyses* hyaline, filamentous. *Peridium* thick, composed of outer, dark brown, thick-walled cells of *textura angularis* and inner, hyaline, thick-walled cells of *textura angularis*. *Hamathecium* comprising filiform, rarely branched, septate paraphyses, sometimes apex slightly swollen. *Asci* 8-spored, unitunicate, cylindrical, sometimes tapering towards the apex or base, sessile, thin-walled except at the apex, apex obtuse or truncate, with subconical or subapical, J+ apical ring. *Ascospores* biseriate, triseriate to fasciculate, sometimes weakly helically coiled, strongly isthmoid, ends fusiform to rhombic, apical portion sometimes slightly larger than the basal part, 1–3-septate, hyaline, smooth-walled. **Asexual morph**: Coelomycetous. *Conidiomata* pycnidia, superficial, solitary, scattered, globose, with slimy, shining spore mass and basal mycelium forming thick, black strands. *Conidiophores* erect, branched, septate, hyaline. *Conidiogenous cells* phialidic, discrete or in small whorls, lageniform to cylindrical, hyaline. *Conidia* oblong to ellipsoidal, one-celled, hyaline, smooth, with truncate abscission scar.

Type genus: ***Vialaea*** Sacc.

Notes: *Vialaeaceae* was formally established by Cannon (1995). *Vialaea* is the type genus of this family and is typified by *Vialaea insculpta* (Fr.) Sacc. The phylogenetic placement of this monotypic family was confirmed by LSU sequence data (Shoemaker et al. 2013), combined LSU and ITS sequence data (Senanayake et al. 2014) and combined LSU,

SSU, TEF1 and RPB2 sequence data (Maharachchikumbura et al. 2015).

Vialaea Sacc., Bull. Soc. mycol. Fr. 12: 66 (1896)
Facesoffungi number: FoF 000011; Figs 151, 152

Parasitic, *endophytic* or *saprobic* on twigs of trees. **Sexual morph**: *Pseudostromata* (pseudoclypeus) absent or if present, immersed in host tissues, with brown to black tissues around immersed neck, containing 1–9 ascomata. *Ascomata* perithecial, immersed solitary or aggregated in circular groups, with

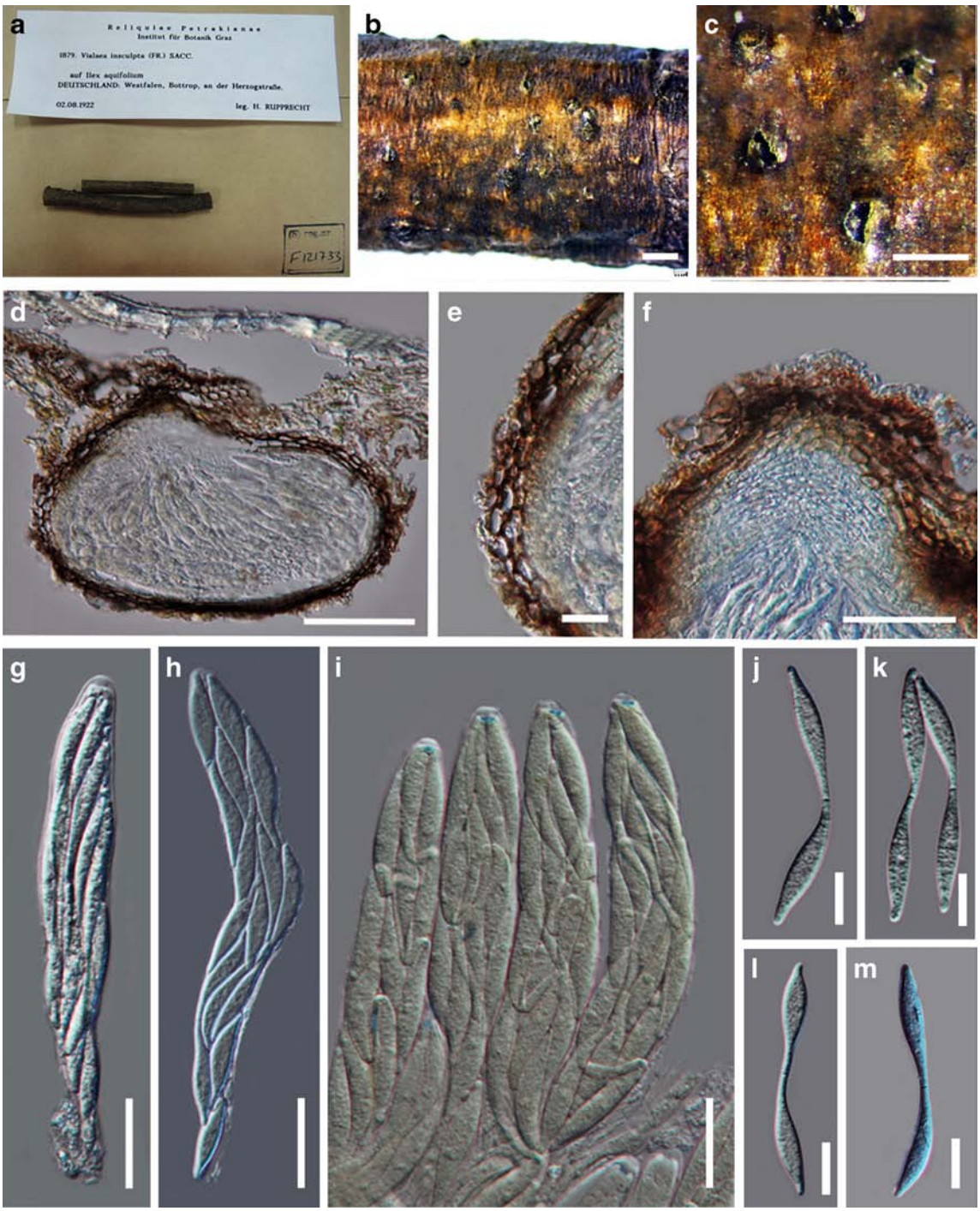


Fig. 151 ***Vialaea insculpta*** (Material examined: GERMANY, North Rhine-Westphalia, Westfalen, Bottrop, at the zerzogstrasse, on twigs of *Ilex aquifolium* L. (*Aquifoliaceae*), 2 August 1922, H. Rupprecht, S-F121733). a Herbarium packet b, c Pseudostroma on host d Vertical section of ascoma e Peridium f Periphyses in ostiolar canal g, h Asci i Apical ring bluing in Melzer's reagent j-l Ascospores m Ascospores in cotton blue reagent. Scale bars: b = 1 cm, c = 500 μm, d, f = 100 μm, e = 20 μm, g–I = 50 μm, j–m = 20 μm

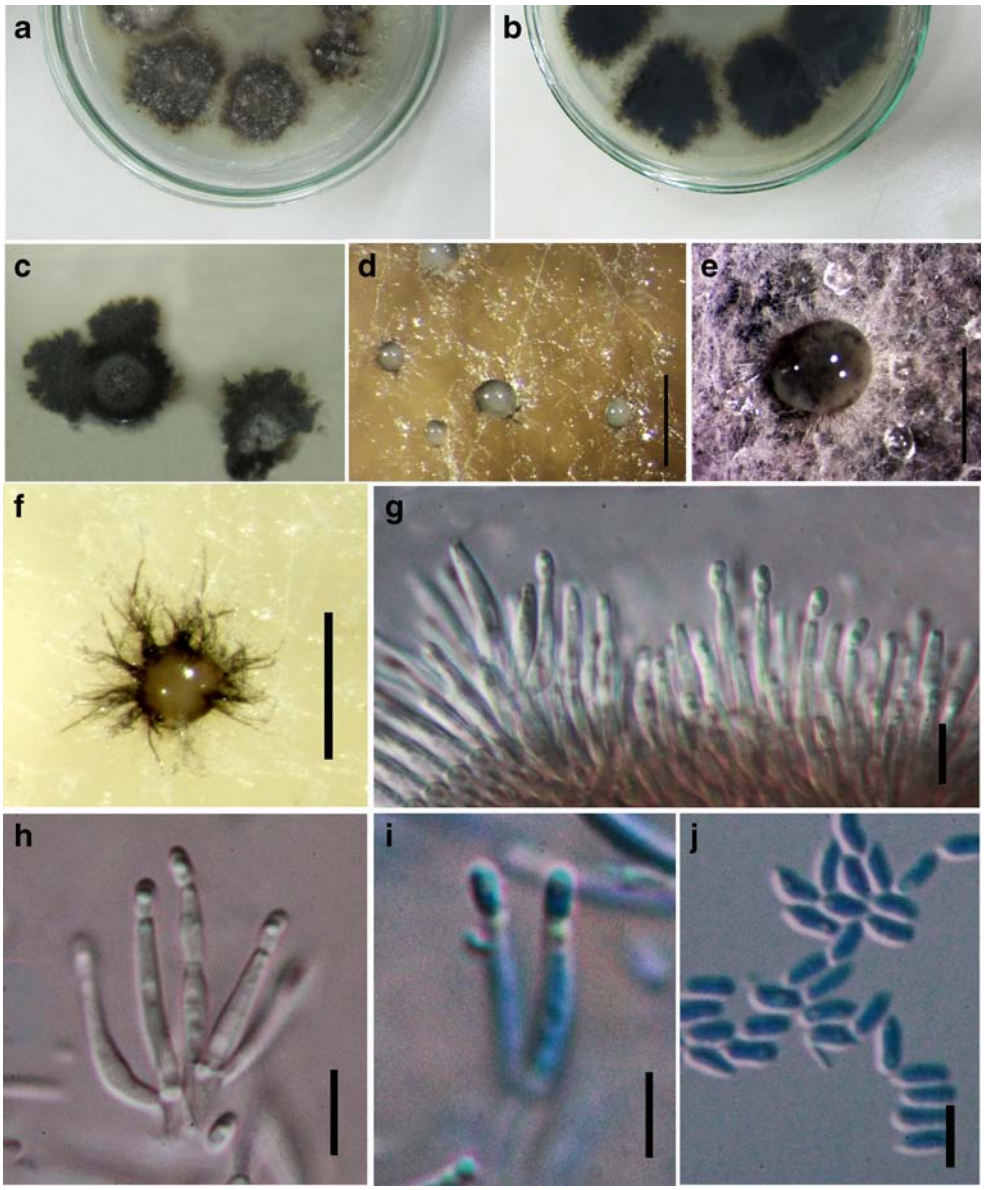


Fig. 152 Asexual morph of ***Vialaea mangiferae*** (Material examined: THAILAND, Chiang Rai Province, Muang District, near Bandu, Baan Khuakhae, at 31 M. 17, (19° 59′ 52.05″ N; 99° 49′ 25.15″ E), on twigs of *Mangifera indica* L. (*Anacardiaceae*), 15 November 2012, K.D. Hyde, CHUNI001, MFLU13-0342, holotype). a Culture from above b, c Culture from below d-f Conidiomata forming on water agar g Conidia forming on phialides attached to conidiophores h, i Conidia attached to lageniform intercalary cells j Conidia. Note: Conidia, conidiogenous cells, conidiophores are *arrowed* in g from up to down. Scale bars: d = 1 mm, e–f = 500 μm, g–j =10 μm

ostioles converging in their center, globose or subglobose, coriaceous, black to brown, papillate, ostiolate. *Papilla* elongate, dark brown to black, internal wall covered by periphyses. *Peridium* comprising several layers of slightly flattened, strongly melanized, thick-walled cells of *textura globulosa* or *textura angularis* with peridial pores between cells. *Hamathecium* comprising poorly developed, thin-walled, septate or aseptate, sparse paraphyses, sometimes deliquescent at maturity, much shorter than the asci. *Asci* 8-spored, unitunicate, cylindrical, sometimes tapering towards the apex or base, short pedicellate or sessile, thin-walled except at the apex, apex obtuse or truncate, with subconical or subapical, J+ apical ring. *Ascospores* biseriate, triseriate to fasciculate, sometimes weakly helically coiled, strongly isthmoid, ends fusiform to rhombic, apical portion sometimes slightly larger than the basal part, 1–3-septate, hyaline, smooth-walled. **Asexual morph**: Coelomycetous. *Conidiomata* pycnidial, superficial, solitary, globose. *Conidiophores* erect, branched, septate, hyaline. *Conidiogenous cells* proliferating percurrently conidia. *Conidia* oblong to fusiform, one-celled, hyaline, smooth-walled.

Type species: ***Vialaea insculpta*** (Fr.) Sacc., Bull. Soc. mycol. Fr. 12: 66 (1896).

Notes: *Vialaea* is typified by *Vialaea insculpta* (Fr.) Sacc. (Saccardo 1896) and was placed in *Amphisphaeriaceae* (*Xylariales*) based on the J+ apical ring, and Cannon (1995) placed the genus in *Vialaeaceae*. LSU sequence analysis showed that *Vialaeaceae* is a distinct monotypic family in the order *Xylariales* (Shoemaker et al. 2013). A new species, *Vialaea mangiferae* Senan. & K. D. Hyde was introduced in the genus by Senanayake et al. (2014).

Xylariaceae Tul. & C. Tul. [as 'Xylariei'], Select. fung. carpol. (Paris) 2: 3 (1863)

= *Graphostromataceae* M.E. Barr et al., Mycotaxon 48: 533 (1993)

Facesoffungi number: FoF 00070

Saprobic, *pathogenic*, or *endophytic* in wood, leaves and fruits, dung inhabitants or associated with insect vectors, in terrestrial and aquatic habitats. **Sexual morph**: *Stromata* if present extremely variable in size, shape and colour, erect or applanate or effuse-pulvinate or sometimes rudimentary, arising singly or aggregated, with 1 to many ascomata, ostiolate, with or without extractable stromatal pigments, bipartite or unipartite. *Ascomata* variable in size and shape, globose-pyriform, embedded in the stroma, single or multi-layered. *Hamathecium* comprising hyphoid, filamentous, septate paraphyses, embedded in a gelatinous matrix. *Asci* 4–8-spored, unitunicate, cylindrical to clavate, pedicellate, apically rounded, with or without a J+, or J–, apical ring, or with apical thickenings. *Ascospores* uniseriate-biseriate (except for the genera *Phylacia* and *Pyrenomyxa* which are produced in spherical or oval clusters), brown to black, rarely hyaline, 1–2-celled, variously-shaped, mostly with a germ slit. *Perispore* dehiscent or lacking, smooth or with patterns. **Asexual morph**: Hyphomycetous. Two major types of asexual morph reported are nodulisporium-like and geniculosporium-like as defined by Bitzer et al. (2008), featuring hyaline to light brown, smooth, branched conidiophores, bearing hyaline, roughened or smooth, ellipsoidal conidia. Several other hyphomycetous and coelomycetous genera have been linked to *Xylariaceae* (Stadler et al. 2013, Senanayake et al. 2015).

Type: ***Xylaria*** Hill ex Schrank

Notes: The family *Xylariaceae* was introduced by Tulasne and Tulasne (1863b) using the term "Xylariei" and the rank of the name was not certain as it did not address the family concept (Stadler et al. 2013). Even though the exact number of currently accepted taxa varies, according to different authors, the recent outline of *Xylariaceae* (Maharachchikumbura et al. 2015) accepted 85 genera. The segregation of *Xylariaceae* into the subfamilies Hypoxyloideae and Xylarioideae has been supported by molecular data (Stadler et al. 2013; Daranagama et al. 2015; Maharachchikumbura et al. 2015). Xylariaceous members are well-known for their secondary metabolite production (Stadler 2011). Several studies have been carried out to determine the chemical composition of these secondary metabolites (Whalley and Edwards 1995; Mühlbauer et al. 2002; Quang et al. 2002, 2004, 2006; Hellwig et al. 2005). Chemotaxonomic data also play an important role in the identification and characterization of these stromatic *Xylariaceae* (Whalley and Edwards 1995; Stadler et al. 2001; Bitzer et al. 2008; Kuhnert et al. 2014). For example, Stadler et al. (2014a) used a polyphasic taxonomic approach in their world monograph of *Daldinia*.

Based on the asexual morphs and their characters, *Xylariaceae* has been traditionally classified into two subfamilies (Chesters and Greenhalgh 1964; Ju and Rogers 1996; Bitzer et al. 2008; Stadler et al. 2010). However this grouping of taxa with geniculosporium-like (Xylarioideae) and nodulisporium-like (Hypoxyloideae) conidiophores, was not formerly introduced by the authors. Most subsequent studies based on phylogenetic analyses have strongly supported this separation of subfamilies within the *Xylariaceae*.

Pirozynski (1974) found that *Sphaeria platystoma* Schwein. resembled *Diatrype stigma* (Hoffm.) Fr. and placed it in a new monotypic genus *Graphostroma*. *Graphostroma platystomum* (Schwein.) Piroz. 1974 was associated with a nodulisporium-like asexual morph, which was identical to most of the hypoxyloid *Xylariaceae*. Therefore, Pirozynski (1974) placed *Graphostroma platystomum* in *Xylariaceae*. Later, Barr et al. (1993) introduced a new monotypic family *Graphostromataceae* to accommodate the genus *Graphostroma*. This segregation was based on the combination of its nodulisporium-like conidial morph and a sexual morph similar to that of the *Diatrypaceae*, in having allantoid ascospores (Barr et al. 1993). Phylogenetic studies (Stadler et al. 2013; Maharachchikumbura et al. 2015) placed *Graphostromataceae* close to *Xylariaceae*, while in Daranagama et al. (2015) and Senanayake et al. (2015) *Graphostroma platystomum* clusters with xylariaceous genera with bipartite stromata, such as *Biscogniauxia* and *Camillea* within the *Xylariaceae* clade. Thus the position of the *Graphostromataceae* as a separate family has been shown to be doubtful with the available molecular data. Considering these molecular studies, as well as the morphological characters, especially the asexual morph which is nodulisporium-like, we believe that *Graphostroma* should be considered as a genus in *Xylariaceae*. Therefore, we have synonymized *Graphostromataceae* and consider *Graphostroma* as a genus of *Xylariaceae*.

Fassia was introduced by Dennis (1964) with *Fassia scabrosa* Dennis as the type species. This monotypic genus is characterized by superficial stromata with long, slender, protruding, ostiolar necks (Dennis 1964). According to Dennis (1964), Müller observed part of the type species collection and suggested a relationship with *Wawelia*. Læssøe (1994), however, suggested that *Fassia scabrosa* should be placed in *Diatrypaceae*, based on its morphological similarity to *Echinomyces*, which is accepted in *Diatrypaceae*. Rappaz (1987) had not compared *Echinomyces* with *Fassia* when describing the new genus. The clavate asci with allantoid ascospores are characters of diatrypaceous taxa, rather than xylariaceous taxa, therefore we prefer to exclude *Fassia* from *Xylariaceae* and place it in *Xylariales* genera *incertae sedis* until the phylogenetic position is established by fresh collections and molecular data.

The genus *Muscodor* was introduced by Worapong et al. (2001) for an endophytic fungus, *Muscodor albus* Worapong et al., which produces volatile antibiotics. Since then 16

species of *Muscodor* have been described by various authors (Kirk et al. 2008), based on the differences in their chemical profiles of volatile compounds. However, when describing this genus, Worapong et al. (2001) used only a few reference DNA sequences representing only four genera of *Xylariaceae*, which were not derived from type species strains. Furthermore, they did not compare the morphology when discussing the current status of *Muscodor* and presented arguments as to why it cannot be recognized as a typical *Xylariaceae* member. The concept of this genus is incongruent with other concepts of *Xylariaceae*, thus in this study *Muscodor* is placed in *Xylariales* genera *incertae sedis*, until it can be studied in relation to xylarioid *Xylariaceae* with molecular data.

Xylaria Hill ex Schrank, Baier. Fl. (München) 1: 200 (1789)

Facesoffungi number: FoF 00696; Figs 153, 154

Saprobic on deciduous dead wood or endophytes of various plants. **Sexual morph**: *Stromata* extremely variable in size and shape, simple to branched from the base, nearly sessile or arising from long rooting stipes, always with flattened to mucronate sterile apices, whitish when immature, gradually turning silvery grey and eventually black, longitudinally furrowed delimiting narrow strips, perithecial contours most often inconspicuous in well-developed stromata; leathery, black, homogeneous, white to cream, with a slightly darker core, stipes cylindrical to strap-like, longitudinally puckered, black, with a hairy-tomentose, broadened base. *Perithecia* subglobose, immersed to slightly exposed. *Ostioles* if present raised-discoid, grey brown to black, with a low conical papilla at the center. *Asci* (6–)8-spored, unitunicate, cylindrical, long-pedicellate, with tubular, apical ring, bluing in Melzer's reagent. *Paraphyses* sparse, hypha-like, hyaline, septate. *Ascospores* overlapping uniseriate in the ascus, medium brown, most often ellipsoid-inequilateral, with narrow to broadly rounded ends, smooth-walled, with a fugacious cellular appendage, usually disappearing at maturity, containing two large guttules, with a conspicuous straight germ slit, 1/2–4/5 spore-length on the flattened side. Atypical ascospores may have acute ends, slightly oblique or sinuous germ slits located next to one end, or on the convex side. **Asexual morph**: Where known geniculosporium–like, hyaline–light brown, smooth, branched conidiophores bearing hyaline, roughened or smooth, ellipsoidal conidia (Ju and Rogers 1996; Stadler et al. 2014b).

Type species: ***Xylaria hypoxylon*** (L.) Grev., Fl. Edin.: 355 (1824)

Notes: *Xylaria* is the type genus in the family *Xylariaceae* with more than 700 epithets listed in Index Fungorum (2016). Many *Xylaria* species possess massive stromata, which can vary in colour, shape and size, cylindrical asci, a J+ apical ring and ellipsoidal, dark ascospores, as well as geniculosporium-like asexual morphs (Ju and Rogers 1996; Stadler et al. 2013, 2014b). Most *Xylaria* species are saprobic, growing on moist, decayed dicotyledonous wood, less on monocotyledons, fruits, seeds and fallen leaves. Interestingly the subgenus *Pseudoxylaria*, which is associated with termite nests (Visser et al. 2009; Hsieh et al. 2010) are also commonly endophytes mainly from tropical plants (Petrini and Petrini 1985; Bills et al. 2012).

Other genera included

Amphirosellinia Y.M. Ju et al., Mycologia 96(6): 1393 (2004)

Type species: ***Amphirosellinia nigrospora*** Y.M. Ju et al., Mycologia 96(6): 1397 (2004)

Annulohypoxylon Y.M. Ju et al., in Hsieh et al., Mycologia 97(4): 855 (2005)

Type species: ***Annulohypoxylon truncatum*** (Schwein.) Y.M. Ju et al. Mycologia 97(4): 861 (2005)

Anthocanallis Daranagama et al., Fungal Diversity 73:203–238 (2015)

Type species: ***Anthocanalis sparti*** Daranagama et al., Fungal Diversity 73:203–238 (2015)

Anthostomella Sacc., Atti Soc. Veneto-Trent. Sci. Nat., Padova, Sér. 4 4: 84 (1875)

Type species: ***Anthostomella tomicoides*** Sacc., Atti Soc. Veneto-Trent. Sci. Nat., Padova, Sér. 4 4: 101 (1875)

Appendixia B.S. Lu & K.D. Hyde, Fungal Diversity Res. Ser. 4: 224 (2000)

Type species: ***Appendixia closterium*** (Berk. & M.A. Curtis) B.S. Lu & K.D. Hyde, Fungal Diversity Res. Ser. 4: 225 (2000)

Areolospora S.C. Jong & E.E. Davis, Norw. Jl Bot. 21(1): 28 (1974)

Type species: ***Areolospora terrophila*** S.C. Jong & E.E. Davis, Norw. Jl Bot. 21(1): 28 (1974)

Arthroxylaria Seifert & W. Gams, in Seifert, Gams & Louis-Seize, Czech Mycol. 53(4): 299 (2002)

Type species: ***Arthroxylaria elegans*** Seifert & W. Gams, in Seifert, Gams & Louis-Seize, Czech Mycol. 53(4): 299 (2002)

Ascotricha Berk., Ann. nat. Hist., Mag. Zool. Bot. Geol. 1: 257 (1838)

Type species: ***Ascotricha chartarum*** Berk., Ann. nat. Hist., Mag. Zool. Bot. Geol. 1: 257 (1838)

Astrocystis Berk. & Broome, J. Linn. Soc., Bot. 14(no. 74): 123 (1873) [1875]

Type species: ***Astrocystis mirabilis*** Berk. & Broome, J. Linn. Soc., Bot. 14(no. 74): 123 (1873) [1875]

Barrmaelia Rappaz, Mycol. helv. 7(1): 130 (1995)

Type species: ***Barrmaelia rhamnicola*** Rappaz, Mycol. helv. 7(1): 130 (1995)

Biscogniauxia Kuntze, Revis. gen. pl. (Leipzig) 2: 398 (1891)

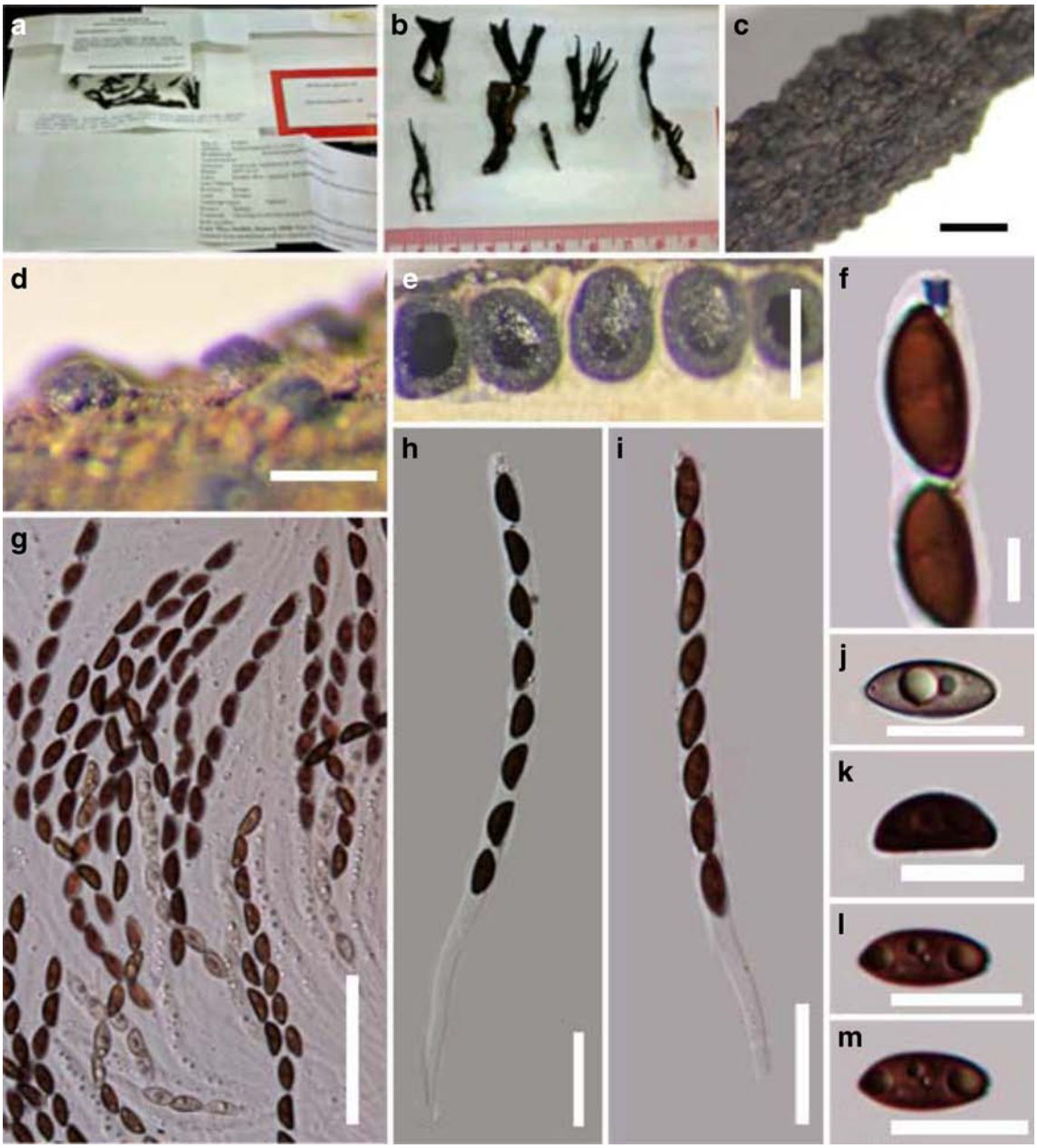


Fig. 153 ***Xylaria hypoxylon*** (SWEDEN, Uppland, Stockholm, Vällingby, Grimsta Nature Reserve, near Lake Mälaren, on *Sorbus aucuparia* L. (*Rosaceae*), 21 October 2007, A.-L. & A. Anderberg G07-1 (S-F72430, epitype) a Herbarium packet b Stromata c Furrowed stromatal surface d Black ostioles in stromatal surface e Cross section of stromata showing perithecia encased in stromatal tissue f Asci with J+, apical ring, bluing in Melzer's reagent g Cluster of asci and paraphyses h, i Mature asci j–m Ascospores. Scale bars: c = 5 mm d = 150 μm, e = 0.5 mm, f, g, h = 20 μm, g = 30 μm, j–m = 10 μm

Type species: ***Biscogniauxia nummularia*** (Bull.) Kuntze, Revis. gen. pl. (Leipzig) 2: 398 (1891)

Brunneiperidium Daranagama et al., Fungal Diversity 73:203–238 (2015)

Type species: ***Brunneiperidium gracilentum*** Daranagama et al., Fungal Diversity 73:203–238 (2015)

Calceomyces Udagawa & S. Ueda, Mycotaxon 32: 448 (1988)

Type species: ***Calceomyces lacunosus*** Udagawa & S. Ueda, Mycotaxon 32(1): 448 (1988)

Camillea Fr., Summa veg. Scand., Section Post. (Stockholm): 382 (1849)

Type species: ***Camillea leprieurii*** (Mont.) Mont., Summa veg. Scand., Section Post. (Stockholm): 382 (1849)

Cannonia Joanne E. Taylor & K.D. Hyde, Mycol. Res. 103(11): 1398 (1999)

Type species: ***Cannonia australis*** (Speg.) Joanne E. Taylor & K.D. Hyde, Mycol. Res. 103(11): 1398 (1999)

Chaenocarpus Rebent., Prodr. fl. neomarch. (Berolini): 350 (1804)

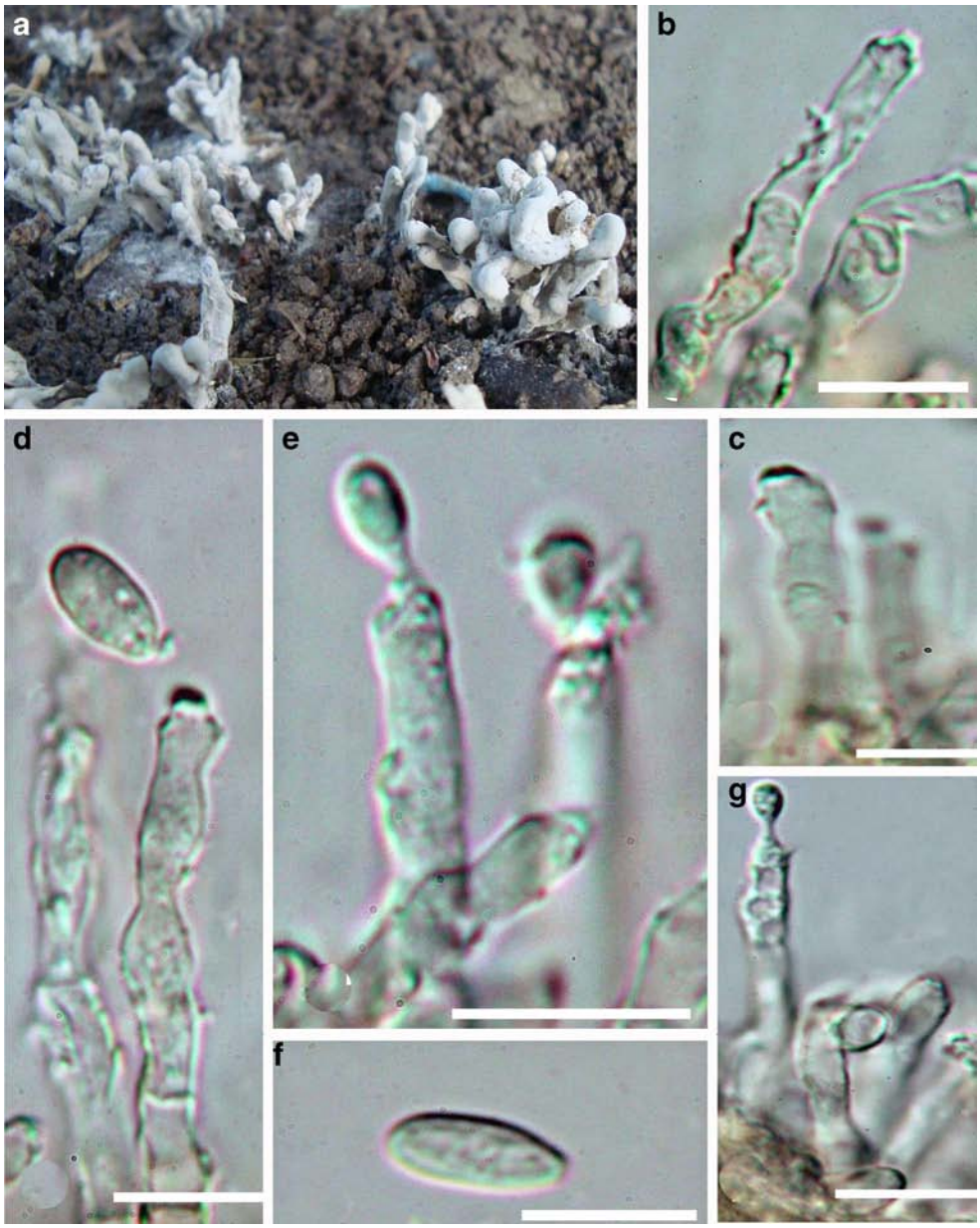


Fig. 154 *Xylaria* sp. with geniculosporium–like asexual morph a Macroscopic features on natural habitat b, c Conidiophores d, e Conidiophores with spores f Conidia g Conidiogenous cells at the apex of conidiophores. Scale bars: b–e, g = 10 μm, e = 5 μm

Type species: ***Chaenocarpus setosus*** (Roth) Rebent., Prodr. fl. neomarch. (Berolini): 350, tab. 3:12a-b (1804)

Chlorostroma A.N. Mill. et al., Sydowia 59(1): 142 (2007)

Type species: ***Chlorostroma subcubisporum*** A.N. Mill et al., Sydowia 59(1): 142 (2007)

Collodiscula I. Hino & Katum., Bull. Faculty of Agriculture, Yamaguchi University 6: 55 (1955)

Type species: ***Collodiscula japonica*** I. Hino & Katum., Bull. Faculty of Agriculture, Yamaguchi University 6: 55 (1955)

Coniolariella Dania García et al., in García et al., Mycol. Res. 110(11): 1285 (2006)

Type species: ***Coniolariella gamsii*** (Asgari & Zare) Dania García et al., in García et al., Mycol. Res. 110(11): 1285 (2006)

Creosphaeria Theiss., Beih. bot. Zbl., Abt. 2 27: 396 (1910)

Type species: ***Creosphaeria sassafras*** (Schwein.) Y.M. Ju et al. Mycotaxon 47: 223 (1993)

Cyanopulvis J. Fröhl. & K.D. Hyde, Fungal Diversity Res. Ser. 3: 308 (2000)

Type species: ***Cyanopulvis australiensis*** J. Fröhl. & K.D. Hyde, Fungal Diversity Res. Ser. 3: 308 (2000)

Daldinia Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 197 (1863)

Type species: ***Daldinia concentrica*** (Bolton) Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 197 (1863)

Durotheca Læssøe et al. IMA Fungus 4(1): 62 (2013)

Type species: ***Durotheca depressa*** Læssøe & Srikitik., IMA Fungus 4(1): 62 (2013)

Emarcea Duong et al. Stud. Mycol. 50(1): 255 (2004)

Type species: ***Emarcea castanopsidicola*** Duong et al., in Duong et al., Stud. Mycol. 50(1): 255 (2004)

Engleromyces Henn., Bot. Jb. 28(3): 327 (1900)

Type species: ***Engleromyces goetzei*** Henn., Bot. Jb. 28(3): 327 (1900)

Entoleuca Syd., Annls mycol. 20(3/4): 186 (1922)

Type species: ***Entoleuca callimorpha*** Syd., in Sydow & Petrak, Annls mycol. 20(3/4): 186 (1922)

Entonaema A. Möller, Bot. Mitt. Trop. 9: 306. (1901) emend. in Stadler et al. Mycol Prog 7:53–73 (2008)

Type species: ***Entonaema liquescens*** Möller, Bot. Mitt. Trop. 9: 307 (1901)

Euepixylon Füisting, Bot. Ztg. 25(no. 39): 309 (1867)

Type species: ***Euepixylon udum*** (Pers.) Füisting, Bot. Ztg. 25(no. 39): 305, 309 (1867)

Fasciatispora K.D. Hyde, Trans. Mycol. Soc. Japan 32(2): 265 (1991)

Type species: ***Fasciatispora nypae*** K.D. Hyde, Trans. Mycol. Soc. Japan 32(2): 267 (1991)

Gigantospora B.S. Lu & K.D. Hyde, Nova Hedwigia 76(1–2): 202 (2003)

Type species: ***Gigantospora gigaspora*** B.S. Lu & K.D. Hyde, Nova Hedwigia 76(1–2): 202 (2003)

Graphostroma Piroz., Can. J. Bot. 52(10): 2131 (1974)

Type species: ***Graphostroma platystoma*** (Schwein.) Piroz., Can. J. Bot. 52(10): 2131 (1974)

Guestia G.J.D. Sm. & K.D. Hyde, Fungal Diversity 7: 107 (2001)

Type species: ***Guestia gonetropospora*** G.J.D. Sm. & K.D. Hyde, Fungal Diversity 7: 109 (2001)

Halorosellinia Whalley et al., in Whalley et al., Mycol. Res. 104(3): 368 (2000)

Type species: ***Halorosellinia oceanica*** (S. Schatz) Whalley et al., Mycol. Res. 104(3): 370 (2000)

Helicogermslita Lodha & D. Hawksw., in Hawksworth & Lodha, Trans. Br. mycol. Soc. 81(1): 91 (1983)

Type species: ***Helicogermslita celastri*** (S.B. Kale & S.V.S. Kale) Lodha & D. Hawksw., in Hawksworth & Lodha, Trans. Br. mycol. Soc. 81(1): 91 (1983)

Hypocopra (Fr.) J. Kickx f., Fl. Crypt. Flandres (Paris) 1: 362 (1867)

Type species: ***Hypocopra merdaria*** (Fr.) J. Kickx f., Fl. Crypt. Flandres (Paris) 1: 362 (1867)

Hypocreodendron Henn., Hedwigia 36: 223 (1897)

Type species: ***Hypocreodendron sanguineum*** Henn., Hedwigia 36(4): 223 (1897)

Hypoxylon Bull., Hist. Champ. Fr. (Paris) 1: 168 (1791); Fig. 155

Type species: ***Hypoxylon fragiforme*** (Pers.) J. Kickx f., FI. crypt. Louvain (Bruxelles): 116 (1835)

Induratia Samuels et al. Mycotaxon 28(2): 482 (1987)

Type species: ***Induratia apiospora*** Samuels et al., Mycotaxon 28(2): 484 (1987)

****Jumillera*** J.D. Rogers et al. Mycotaxon 64: 41 (1997)

Type species: ***Jumillera mexicana*** J.D. Rogers et al., Mycotaxon 64: 46 (1997)

Kretzschmaria Fr., Summa veg. Scand., Section Post. (Stockholm): 409 (1849)

Type species: ***Kretzschmaria clavus*** (Fr.) Sacc., Syll. fung. (Abellini) 2: XXIX (1883)

Kretzschmariella Viégas, Bragantia 4(1–6): 105 (1944)

Type species: ***Kretzschmariella culmorum*** (Cooke) Y.M. Ju & J.D. Rogers, Mycotaxon 51: 242 (1994)

Leprieuria Læssøe et al., Mycol. Res. 93(2): 152 (1989)

Type species: ***Leprieuria bacillum*** (Mont.) Læssøe et al., Mycol. Res. 93(2): 152 (1989)

Leptomassaria Petr., Annls mycol. 12(5): 474 (1914)

Type species: ***Leptomassaria simplex*** (Nitschke ex G.H. Otth) Petr., Annls mycol. 12(5): 474 (1914)

Libertella Desm., Annls Sci. Nat., Bot., sér. 1 19: 275 (1830)

Type species: ***Libertella betulina*** Desm., Annls Sci. Nat., Bot., sér. 1 19: 276 (1830)

Lunatiannulus Daranagama et al., Fungal Diversity 73:203–238 (2015)

Type species: ***Lunatiannulus irregularis*** Daranagama et al., Fungal Diversity 73:203–238 (2015)

Myconeesia Kirschst., Annls mycol. 34(3): 200 (1936)

Type species: ***Myconeesia formosa*** (Kirschst.) Kirschst., Annls mycol. 34(3): 200 (1936)

Nemania Gray, Nat. Arr. Brit. Pl. (London) 1: 508, 516 (1821)

Type species: ***Nemania serpens*** (Pers.) Gray, Nat. Arr. Brit. Pl. (London) 1: 508, 516 (1821)

Nipicola K.D. Hyde, Cryptog. bot. 2(4): 330 (1992)

Type species: ***Nipicola carbospora*** K.D. Hyde, Cryptog. bot. 2(4): 330 (1992)

Nodulisporium Preuss, in Rabenhorst, Klotzschii Herb. Viv. Mycol.: no. 1272 (1849)

Type species: ***Nodulisporium ochraceum*** Preuss [as 'ocheraceum'], Klotzschii Herb. Viv. Mycol.: no. 1272 (1849)

Obolarina Pouzar, Česká Mykol. 40(1): 7 (1986)

Type species: ***Obolarina dryophila*** (Tul. & C. Tul.) Pouzar, Česká Mykol. 40(1): 7 (1986)

Occultitheca J.D. Rogers & Y.M. Ju, Sydowia 55(2): 359 (2003)

Type species: ***Occultitheca costaricensis*** J.D. Rogers & Y.M. Ju, Sydowia 55(2): 360 (2003)

Ophiorosellinia J.D. Rogers et al., in Rogers et al., Mycologia 96(1): 172 (2004)

Type species: ***Ophiorosellinia costaricensis*** J.D. Rogers et al., in Rogers et al., Mycologia 96(1): 172 (2004)

Pandanicola K.D. Hyde, Sydowia 46(1): 35 (1994)

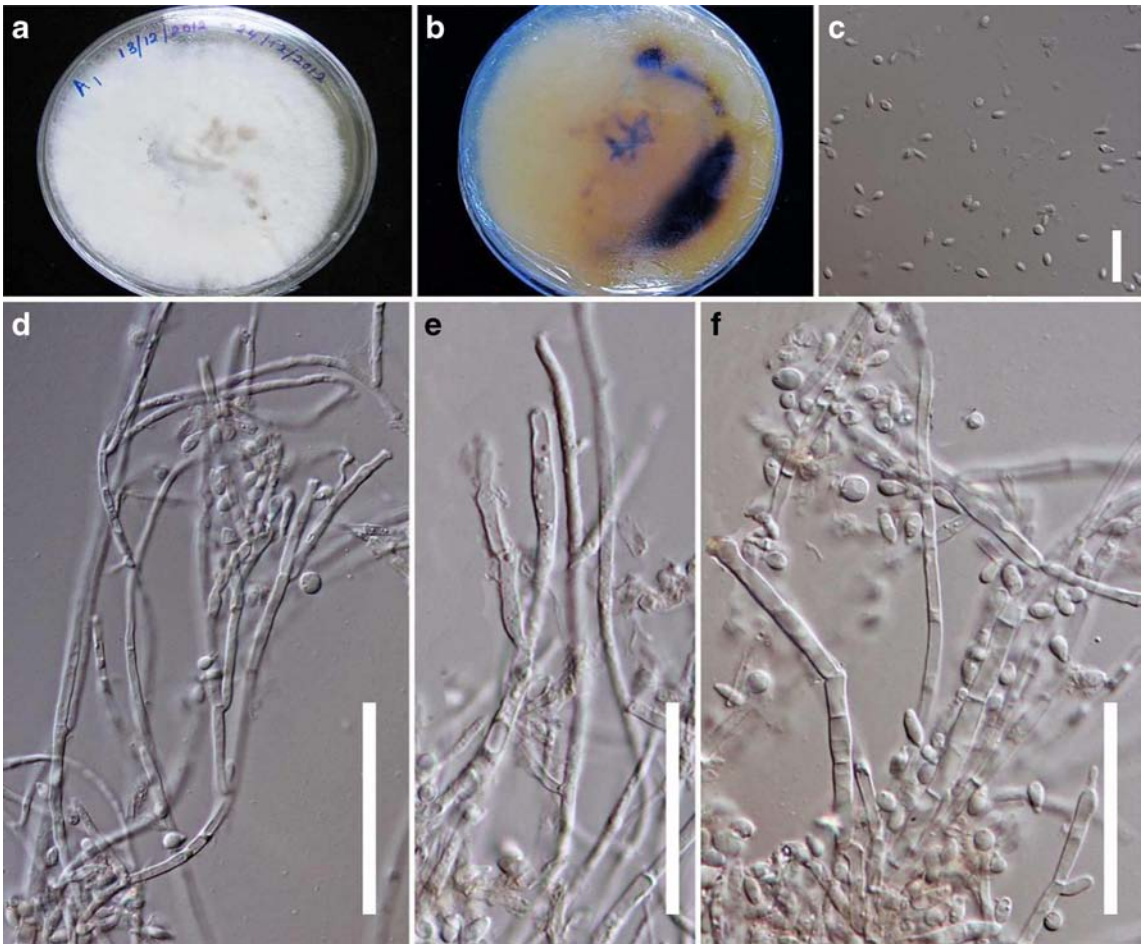


Fig. 155 ***Hypoxylon fendleri*** with nodulisporium–like asexual morph (Material examined: THAILAND, Chiang Rai, Doi Mae Saloung on dead bamboo clumps, 12 December 2012, D. A. Daranagama and K. D. Hyde, AXL 055 (MFLU 12-0823, living cultures, MFLUCC 13-0104, ICMP). asexual morph a Culture from above b From below c Conidia d-f Conidiophores with spores. Scale bars: c = 20 μm, d–f = 40 μm

Type species: ***Pandanicola calocarpa*** (Syd. & P. Syd.) K.D. Hyde, Sydowia 46(1): 36 (1994)

Paramphisphaeria F.A. Fernández et al., Mycologia 96(1): 175 (2004)

Type species: ***Paramphisphaeria costaricensis*** F.A. Fernández et al., Mycologia 96(1): 175 (2004)

Paucithecium Lloyd, Mycol. Notes (Cincinnati) 7(4): 1200 (1923)

Type species: ***Paucithecium rickii*** Lloyd, Mycol. Notes (Cincinnati) 7(4): 1200 (1923)

Phylacia Lév., Annls Sci. Nat., Bot., sér. 3 3: 61 (1845)

Type species: ***Phylacia globosa*** Lév., Annls Sci. Nat., Bot., sér. 3 3: 61 (1845)

Pidoplitchkoviell*a* Kiril., Mikrobiol. Zh. 37(5): 603 (1975)

Type species: ***Pidoplitchkoviella terricola*** Kiril., Mikrobiol. Zh. 37(5): 603 (1975)

Podosordaria Ellis & Holw., Bot. Gaz. 24: 37 (1897)

Type species: ***Podosordaria mexicana*** Ellis & Holw., Bot. Gaz. 24: 37 (1897)

Poroleprieuria M.C. González et al. Aguirre, Mycologia 96(3): 676 (2004)

Type species: ***Poroleprieuria rogersii*** M.C. González et al., Mycologia 96(3): 676 (2004)

Poronia Willd., Fl. berol. prodr.: 400 (1787)

Type species: ***Poronia gleditschii*** Willd., Fl. berol. prodr.: 400 (1787)

Pyrenomyxa Morgan, J. Cincinnati Soc. Nat. Hist. 18: 42 (1895)

Type species: ***Pyrenomyxa invocans*** Morgan, J. Cincinnati Soc. Nat. Hist. 18: 42 (1895)

Pyriformiascoma Daranagama et al., Fungal Diversity 73:203–238 (2015)

Type species: ***Pyriformiascoma trilobatum*** Daranagama et al., Fungal Diversity 73:203–238 (2015)

Rhopalostroma D. Hawksw., Kew Bull. 31(3): 422 (1977)

Type species: ***Rhopalostroma indicum*** D. Hawksw. & Muthappa, in Hawksworth, Kew Bull. 31(3): 426 (1977)

Rosellinia De Not., G. bot. ital. 1(1): 334 (1844)

Type species: ***Rosellinia aquila*** (Fr.) Ces. & De Not., G. bot. ital. 1(1): 334 (1844)

Rostrohypoxylon J. Fourn. et al. Fungal Diversity 40: 24 (2010)

Type species: ***Rostrohypoxylon terebratum*** J. Fourn. & M. Stadler, in Fournier, Stadler, Hyde & Duong, Fungal Diversity 40: 24 (2009)

Ruwenzoria J. Fourn. et al., in Stadler et al., Mycol. Progr. 9(2): 171 (2010)

Type species: ***Ruwenzoria pseudoannulata*** J. Fourn. et al., in Stadler et al., Mycol. Progr. 9(2): 171 (2010)

Sabalicol*a* K.D. Hyde, Nova Hedwigia 60(3–4): 596 (1995)

Type species: ***Sabalicola sabalensioides*** (Ellis & G. Martin) K.D. Hyde, Nova Hedwigia 60(3–4): 597 (1995)

Sarcoxylon Cooke, Grevillea 12(no. 62): 50 (1883)

Type species: ***Sarcoxylon compunctum*** (Jungh.) Cooke, Grevillea 13(no. 68): 107 (1885)

Seynesia Sacc., Syll. fung. (Abellini) 2: 668 (1883)

Type species: ***Seynesia nobilis*** (Welw. & Curr.) Sacc., Syll. fung. (Abellini) 2: 668 (1883)

Spirodecospora B.S. Lu et al., Fungal Diversity Res. Ser. 1: 170 (1998)

Type species: ***Spirodecospora bambusicola*** B.S. Lu et al., Fungal Diversity 1: 172 (1998)

Squamotubera Henn., Hedwigia 42(Beibl.): (308) (1903)

Type species: ***Squamotubera le-ratii*** Henn., Hedwigia 42(Beibl.): (308) (1903)

Steganopycnis Syd. & P. Syd., Annls mycol. 14(5): 370 (1916)

Type species: ***Steganopycnis oncospermatis*** Syd. & P. Syd., Annls mycol. 14(5): 337 (1916)

Stereosphaeria Kirschst., Annls mycol. 37(1/2): 96 (1939)

Type species: ***Stereosphaeria phloeophila*** Kirschst., Annls mycol. 37(1/2): 96 (1939)

Stilbohypoxylon Henn., Hedwigia 41: 16 (1902)

Type species: ***Stilbohypoxylon moelleri*** Henn., Hedwigia 41: 16 (1902)

Striatodecospora D.Q. Zhou et al., Mycotaxon 76: 142 (2000)

Type species: ***Striatodecospora bambusae*** D.Q. Zhou et al., Mycotaxon 76: 143 (2000)

Stromatoneurospora S.C. Jong & E.E. Davis, Mycologia 65(2): 459 (1973)

Type species: ***Stromatoneurospora phoenix*** (Kunze) S.C. Jong & E.E. Davis, Mycologia 65(2): 459 (1973)

Thamnomyces Ehrenb., in Nees von Esenbeck (ed.), Horae Phys. Berol.: 79 (1820)

Type species: ***Thamnomyces chamissonis*** Ehrenb., in Nees von Esenbeck (ed.), Horae Phys. Berol.: 79 (1820)

Theissenia Maubl., Bull. Soc. mycol. Fr. 30(1): 52 (1914)

Type species: ***Theissenia pyrenocrata*** (Theiss.) Maubl., Bull. Soc. mycol. Fr. 30(1): 52 (1914)

Thuemenella Penz. & Sacc., Malpighia 11(11–12): 518 (1898) [1897]

Type species: ***Thuemenella javanica*** Penz. & Sacc., Malpighia 11(11–12): 518 (1898) [1897]

Versiomyces Whalley & Watling, Notes R. bot. Gdn Edinb. 45(2): 401 (1989) [1988]

Type species: ***Versiomyces cahuchucosus*** Whalley & Watling, Notes R. bot. Gdn Edinb. 45(2): 401 (1989) [1988]

Virgaria Nees, Syst. Pilze (Würzburg): 54 (1816) [1816–17]

Type species: ***Virgaria nigra*** (Link) Gray, Nat. Arr. Brit. Pl. (London) 1: 553 (1817) [1816–17]

Vivantia J.D. Rogers, Y.M. Ju & Cand., Mycol. Res. 100(6): 672 (1996)

Type species: ***Vivantia guadalupensis*** J.D. Rogers, Y.M. Ju & Cand., Mycol. Res. 100(6): 672 (1996)

Wawelia Namysł., Bull. int. Acad. Sci. Lett. Cracovie, Cl. sci. math. nat. Sér. B, sci. nat. 2: 602 (1908)

Type species: ***Wawelia regia*** Namysł., Bull. int. Acad. Sci. Lett. Cracovie, Cl. sci. math. nat. Sér. B, sci. nat. 2: 597 (1908)

****Whalleya*** J.D. Rogers et al. Mycotaxon 64: 48 (1997)

Type species: ***Whalleya microplaca*** (Berk. & M.A. Curtis) J.D. Rogers et al. Mycotaxon 64: 48 (1997)

Xylotumulus J.D. Rogers et al. Sydowia 58(2): 291 (2006)

Type species: ***Xylotumulus gibbisporus*** J.D. Rogers et al. Sydowia 58(2): 291 (2006)

Xylocrea Möller, Bot. Mitt. Trop. 9: 397 (1901)

Type species: ***Xylocrea piriformis*** Möller, Bot. Mitt. Trop. 9: 397 (1901)

* *Jumillera* J.D. Rogers et al. and *Whalleya* J.D. Rogers et al. were introduced to encompass taxa removed from *Biscogniauxia*, based on morphological differences of their asexual morphs (Rogers et al. 1997). Both *Jumillera* and *Whalleya* have xylariaceous sexual morphs with conspicuous, bipartite stromata and asci with an amyloid apical ring, containing dark, ellipsoidal ascospores (Rogers et al. 1997). However, both genera produce scolecosporous conidia, which is a characteristic feature of *Lopadostomataceae*. Some *Jumillera* species produce libertella-like asexual morphs and species such as *J. cinerea* (Ellis & Everh.) J.D. Rogers et al. produce geniculosporium-like synanamorphs in culture (Rogers et al. 1997). *Whalleya microplaca* (Berk. & M.A. Curtis) J.D. Rogers et al. produced a similar asexual morph to *Lopadostoma pouzarii* Granmo & L.E. Petrini (Granmo and Petrini 1996). Based on these facts *Jumillera* and *Whalleya* have similarities with both *Xylariaceae* and *Lopadostomataceae*. Therefore their phylogenetic placement remains to be established as fresh material and molecular data become available.

Key for asexual genera in *Xylariaceae*

1. Producing single, asexual morph in culture 2
1. Producing multiple, distinct, asexual morphs in culture. . . . . ***Arthroxylaria***
2. Conidiogenous cells produced in digitate configurations or false whorls, proliferating percurrently . . . . . ***Hypocreodendron***
2. Conidiogenous cells sympodial, with apically aggregated scars 3
3. Conidia hyaline . . . . . ***Nodulisporium***
3. Conidia brown ***Virgaria***

Key to sexual genera of *Xylariaceae*

1. With nodulisporium-like asexual morphs . . . . . **Section A**
1. With geniculosporium-like asexual morphs . **Section B**
1. With libertella-like or other unnamed asexual morphs . . . . . **Section C**

Section A – Hypoxyloideae group

1. Stromata reduced or absent. 2
1. Stromata present and well-developed 3
2. Ascospores "shoe"- shaped, tapered in side view, brown, reticulate with irregular ridges and shallow depressions. . . . . ***Calceomyces***
2. Ascospores ellipsoidal, olivaceous green, with hyaline appendage at one end . . . . . ***Anthocanalis***
3. Stromata bipartite. 4
3. Stromata unipartite. 9
4. Stromata in vertical position. . . . . ***Camellia***
4. Stromata in horizontal position. 5
5. Apical ring present. 6
5. Apical ring lacking. 8
6. Germ slit present 7
6. Germ slit lacking . . . . . ***Vivantia***
7. Ascospores unicellular 8
7. Ascospores 2-celled . . . . . ***Biscogniauxia***
8. Ascospores sub-allantoid and hyaline. . ***Graphostroma***
8. Ascospores ellipsoidal and brown . . . . . ***Obolarina***
9. Ascospores thick-walled, oblong to allantoid ***Durotheca***
9. Ascospores thin-walled, subglobose to ellipsoidal . . . . . ***Thisseina***
10. Apical ring present. 11
10. Apical ring lacking. 15
11. Stromata erumpent, in upright position. 12
11. Stromata effuse-pulvinate, spreading parallel to the host surface 13
12. Stromata hemisphaerical with hard, woody interior, with concentric zones . . . . . ***Daldinia***
12. Stromata hemisphaerical with gelatinous, soft, leathery interior, without concentric zones . . . . . ***Entonaema***
13. Stromata uniperitheciate. . . . . ***Induratia***
13. Stromata multi-peritheciate. 14
14. Ostioles with truncatum-type disc, with carbonaceous tissue encasing each individual perithecium, perispore with a thickened area, visible at the position of ca. 1/3 ascospore length . . . . . ***Annulohypoxylon***
14. Ostioles with bovei-type disc, with carbonaceous tissue, beneath surface and between perithecia, perispore without a thickened area . . . . . ***Hypoxylon***
15. Stromata in upright position to the substrate. 16
15. Stromata in parallel position to the substrate. 18
16. With KOH-extractable pigments. 17
16. Lacking KOH-extractable pigments 20
17. Stromata hemisphaerical to peltate, sessile, with annulate disks surrounding the ostioles . . . . . ***Ruwenzoria***
17. Stromata stipitate, head part subglobose to clavate, without conspicuous disks surrounding the ostioles . . . . . ***Rhopalostroma***
18. Asci globose to subglobose . . . . . ***Pyrenomyxa***
18. Asci cylindrical to clavate 19
19. Stromata pulvinate, with stout ostiolar necks and deep cylindrical holes. . . . . ***Rostrohypoxylon***
19. Stromata subglobose to cushion-like, with stromatal tissues with green tints. . . . . ***Thumnella***
20. Ascospores with germ slit . . . . . ***Thamnomyces***
20. Ascospores lacking germ slit . . . . . ***Phylacia***

Section B – Xylarioideae group

1. Stromata reduced or absent, immersed in substratum . . . 2
1. Stromata erumpent or superficial 8
2. Stromata associated with dung . . . . . ***Hypocopra***
2. Stromata associated with substrates other than dung 3
3. Apical ring present in asci 4
3. Apical ring lacking in asci 6
4. Apical ring cylindrical to barrel-shaped (length>width) 5
4. Apical ring discoid (length<width). . . . . ***Euepixylon***
5. Ascospores brown, unicellular . . . . . ***Halorosellinia***
5. Ascospores hyaline, 2-celled . . . . . ***Emarcea***
6. Ascomatal surface with dark brown to black hairs . . . . . ***Ascotricha***
6. Ascomatal surface not hairy 7
7. Ascospores with longitudinal germ slit. . ***Coniolariella***
7. Ascospores with helical germ slit. . . . ***Helicogermslita***
8. Stromata erect, usually several times higher than broad 9
8. Stromata effuse, pulvinate, conical, always broader than high 13
9. Apical ring present. 10
9. Apical ring lacking. 11

10. Stromata reaching 3.5 cm, apex begins to expand into a disc-shaped head, associated with dung .... ***Poronia***
10. Stromata with clavate-globose heads, associated with various substrates. ***Xylaria***
11. Ascospores reniform, with prominent germ slit ***Leprieuria***
11. Ascospores reniform, with prominent terminal germ pores ***Poroleprieuria***
12. Amyloid apical ring present 13
12. Inamyloid apical ring present ***Xylotumulus***
13. Ascospores with germ slit 15
13. Ascospores lacking germ slit 14
14. Ascospores scolecosporous with 6–7 septa ***Ophiorosellinia***
14. Ascospores inequilaterally fusoid with one median slightly constricted septum ***Collodiscula***
15. Stromata multi-peritheciate 16
15. Stromata uniperitheciate 19
16. Stromata effused-pulvinate, attached to the substrate by entire base 17
16. Stromata pulvinate, attached to the substrate by simple or branched stipes by narrow connectives 18
17. Stromata with coarsely papillate ostioles, containing few perithecia ***Entoleuca***
17. Stromata with finely papillate ostioles, containing several perithecia ***Nemania***
18. Stromata associated with dung ***Podosordaria***
18. Stromata associated with wood ***Kretzschmaria***
19. Mature stromata completely surrounded or covered by epidermal host tissue ***Amphirosellinia***
19. Mature stromata loosely covered by epidermal tissue and mostly epidermal tissue residues at base of stromata. 20
20. Stromata associated with ochraceous, short peg-like protuberances ***Stilbohypoxylon***
20. Stromata lacking protuberances 21
21. Stromata usually surrounded by a subiculum, superficial, never splitting, asci with long stipes ***Rosellinia***
21. Stromata not associated with subiculum, often splitting into an outer stromatic layer, developing beneath host epidermis, asci with short stipes ***Astrocystis***

Section C: Genera with libertella-like or unnamed asexual morphs

1. Stromata greatly reduced and immersed in substratum 2
1. Stromata erumpent or superficial 18
2. Apical ring amyloid 3
2. Apical ring not amyloid 14
3. Ascospores with germ slits or germ pores 4
3. Ascospores lacking germ slits or germ pores 9
4. Germ slit straight 5
4. Germ slit spiral ***Leptomassaria***
5. Mucilaginous sheath present and surrounding entire ascospores 6
5. Mucilaginous sheath lacking or restricted to ends, becoming appendages 8
6. Ascospores usually with a hyaline dwarf cell. ***Anthostomella***
6. Ascospores lacking dwarf cells 7
7. Stromata multi-peritheciate. ***Kretzschmariella***
7. Stromata uni-peritheciate ***Brunneiperidium***
8. Ascospores with polar, pad-like appendages. ***Gigantospora***
8. Ascospores with a hyaline, cellular appendage ***Occultitheca***
9. Ascospores with polar appendages 10
9. Ascospores lacking polar appendages. 12
10. Ascospores with central pallid band ***Fasciatispora***
10. Ascospores lacking central pallid band 11
11. Ascospores brown ***Appendixia***
11. Ascospores hyaline to yellowish. ***Sabalicola***
12. Ascospores with conspicuous, spirally arranged warts ***Spirodecospora***
12. Ascospores with striate ornamentations ***Striatodecospora***
13. Ascospores with hyaline dwarf cells. 14
13. Ascospores lacking hyaline dwarf cells 15
14. Ascospores with straight germ slit ***Myconeesia***
14. Ascospores lacking germ slit ***Pyriformiascoma***
15. Asci clavate, with ascospores always aggregated at the apex ***Lunatiannulus***
15. Asci broadly cylindrical, with ascospores uniseriately arranged. 16
16. Ascospores lunate, black, with straight germ slit ***Nipicola***
16. Ascospores elliptic-fusiform, at first hyaline, becoming yellowish brown, with polar germ pores ***Pandanicola***
17. Apical ring present 18
17. Apical ring lacking. 32
18. Apical ring amyloid 19
18. Apical ring not amyloid 27
19. Stromata erect, several times higher than broad ***Squamotubera***
19. Stromata pulvinate, hemisphaerical, globose, broader than high 20
20. Stromata hemisphaerical, soft interior, interior and exterior mostly light coloured 21
20. Stromata pulvinate, effuse, woody to hard, bright coloured to black 22
21. Perithecia with long ostiolar necks; Ostioles brown, punctuate scattered at the stromatal surface ***Engleromyces***
21. Perithecia with gelatinous zones beneath perithecial layer, covering with a whitish membrane, without long necks or visible ostioles ***Sarcoxylon***

22. Apical ring higher than wide 23
22. Apical ring wider than high 24
23. Ascomata with papillate ostioles, protruding through star-like cracks on host surface, hemisphaerical, with wart-like ornamentations . . . . . ***Guestia***
23. Ascospores with a central papillate ostiole, often covered with fine blue powder. . . . . ***Cyanopulvis***
24. Ascospores unicellular 25
24. Ascospores 2-celled . . . . . ***Steganopycnis***
25. Ascospores smooth-walled. 26
25. Ascospores roughened by small nodular-like or irregular warts . . . . . ***Areolospora***
26. Ascospores with mucilaginous sheath . . . . ***Jumillera***
26. Ascospores lacking mucilaginous sheath . . ***Whalleya***
27. Stromata dark coloured, lacking KOH extractable pigments 28
27. Stromata green, with KOH extractable pigments . . . . . ***Chlorostroma***
28. Stromata thread-like . . . . . ***Wawelia***
28. Stromata effuse 29
29. Ascospores lacking germ slit 30
29. Ascospores with germ slit . . . . . ***Paucithecium***
30. Ascospores elongated fusiform, with longitudinal, parallel to convergent ridges on the wall. . . . . .***Stromatoneurospora***
30. Ascospores not fusiform, with smooth walls. 31
31. Ascospores unicellular . . . . . ***Barrmaelia***
31. Ascospores bi-celled . . . . . ***Paramphisphaeria***
32. Ascospores ellipsoidal 33
32. Ascospores cylindrical . . . . . ***Chaenocarpus***
33. Ascomata embedded in host tissue with long cylindrical, slender necks erumpent from substrate surface . . . . . ***Cannonia***
33. Ascomata immersed in more or less solid, but gelatinous stromata, with short necks . . . . . ***Xylocrea***

Excluded, doubtful and rejected families

Obryzaceae Körb. [as 'Obryzeae'], Syst. lich. germ. (Breslau): 427 (1855)

Lichenicolous with green algae on rocks or bark, rarely on mosses or parasitic on cyanobacterial lichens, in temperate regions. **Sexual morph**: *Ascomata* astromatic, perithecial, immersed, pyriform, ostiolate, with a periphysate ostiolar region. *Asci* 4–8-spored, unitunicate, clavate, narrowly ellipsoid to ovoid, thin-walled, short- pedicellate, apical ring not apparent, evanescence. *Ascospores* aseptate, hyaline, smooth-walled, lacking appendages, without a gelatinous sheath. **Asexual morph**: Undetermined.

Type: ***Obryzum*** Wallr.

Notes: This is a poorly studied, monotypic family, for which no molecular data are available. *Obryzaceae* is coincident with *Gnomoniaceae* G. Winter, which is considered to be a well-known family name in plant pathology, while *Obryzaceae* was only recently reported in lichenological studies (McNeill et al. 2006). Hawksworth and Eriksson (1988) proposed that the name *Obryzaceae* should be rejected to conserve *Gnomoniaceae* and the proposal was accepted (McNeill et al. 2006). *Obryzaceae* was listed in *Sordariomycetes*, *families incertae sedis* by Lumbsch and Huhndorf (2010) and this was followed in Maharachchikumbura et al. (2015) and Index Fungorum (2016), indicative of the problems in picking up obscure literature.

It is obvious that *Obryzaceae* is distinct from *Gnomoniaceae* by their mode of life and morphological characters. Species of *Gnomoniaceae* are found in herbaceous plant material, in leaves, twigs or stems, and sometimes in bark or wood (Sogonov et al. 2008), have solitary, immersed astromatic ascomata, or ascomata aggregated with a rudimentary stroma and small, mostly less than 25 μm long, mainly aseptate to 1-septate, rarely multi-septate ascospores (Sogonov et al. 2008).

Type: ***Obryzum*** Wallr., Naturgesch. Flecht. 1: 253 (1825); Fig. 156

Lichenicolous on rocks or bark, rarely on mosses or parasitic on cyanobacterial lichens of the genus *Leptogium*. **Sexual morph**: *Ascomata* astromatic, perithecial, immersed, pyriform, ostiolate. *Ostiole* periphysate. *Peridium* colourless, but sometimes the ostiolar region lightly brown. *Asci* 4–8-spored, unitunicate, clavate, narrowly ellipsoid to ovoid, thin-walled, short-pedicellate, without an apical ring, evanescent. *Ascospores* aseptate, fusiform to limoniform or ellipsoid, hyaline, smooth-walled, lacking appendages, without a gelatinous sheath. **Asexual morph**: Undetermined.

Type species: ***Obryzum corniculatum*** (Hoffm.) Wallr., Naturgesch. Flecht. 1: 253 (1825)

Notes: This genus is poorly studied and lacks molecular data in GenBank. Six epithets are currently listed under *Obryzum* (Index Fungorum 2016).

Pleurotremataceae Walt. Watson, New Phytol. 28: 113 (1929)

= *Dyfrolomycetaceae* K.D. Hyde et al., in Pang et al., Cryptog. Mycol. 34(3): 227 (2013)

Facesoffungi number: FoF 01911

Saprobic on wood in terrestrial and aquatic habitat. **Sexual morph**: *Ascomata* perithecial, gregarious or solitary, immersed or erumpent through bark of host, black, ovoid to subglobose, carbonaceous to membranaceous, smooth, with ostioles. *Peridium* thick (60–120 μm), comprising of dark cells of *textura angularis*. *Hamathecium* composed of numerous, hyaline, septate, branched paraphyses. *Asci* 8-spored, unitunicate, clavate to cylindrical, short pedicellate, apical ring present, non-amyloid. *Ascospores* uni-seriate, hyaline, ellipsoidal to cylindrical, septate, smooth-walled, mostly with guttules. **Asexual morph**: Undetermined.

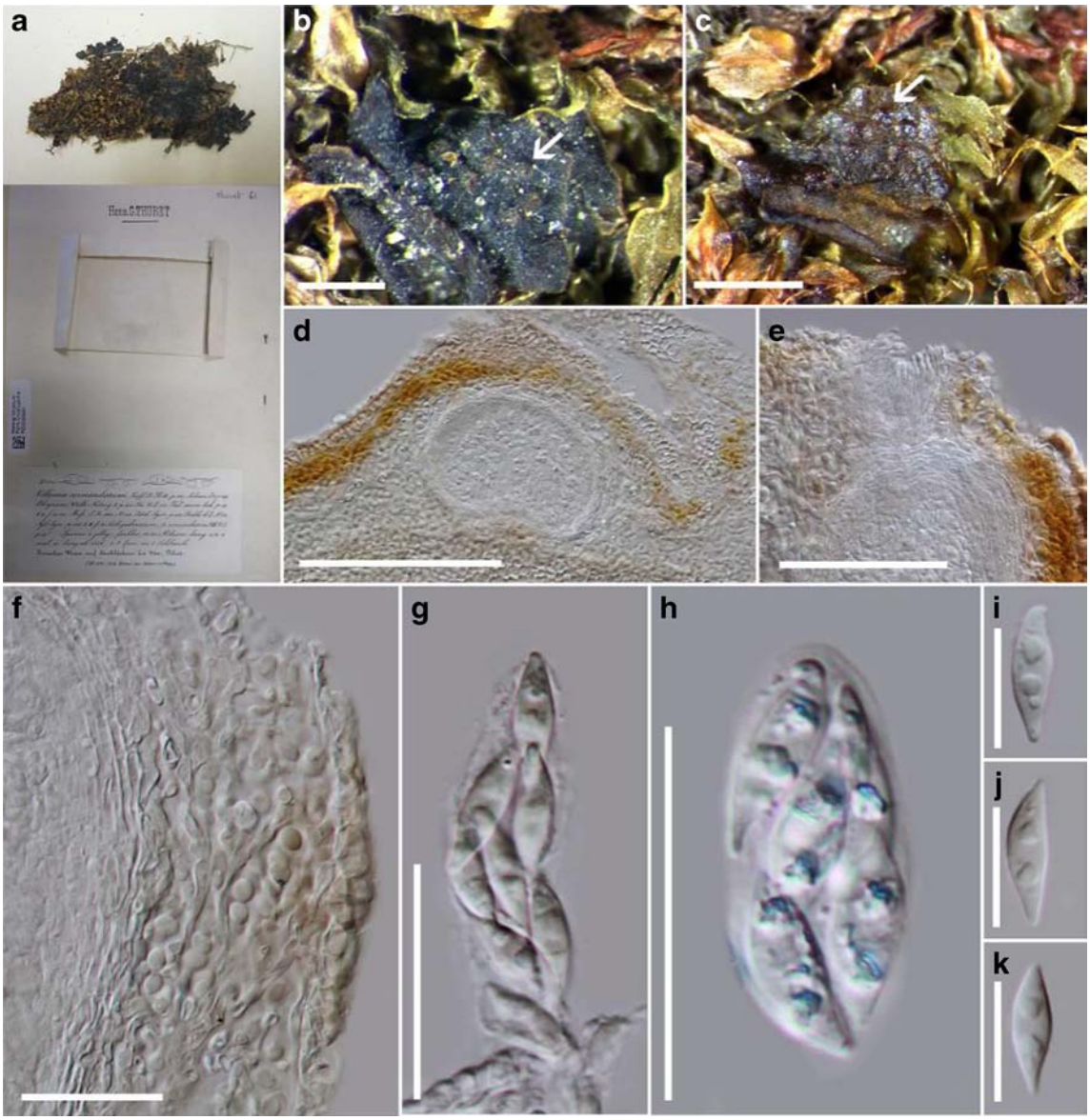
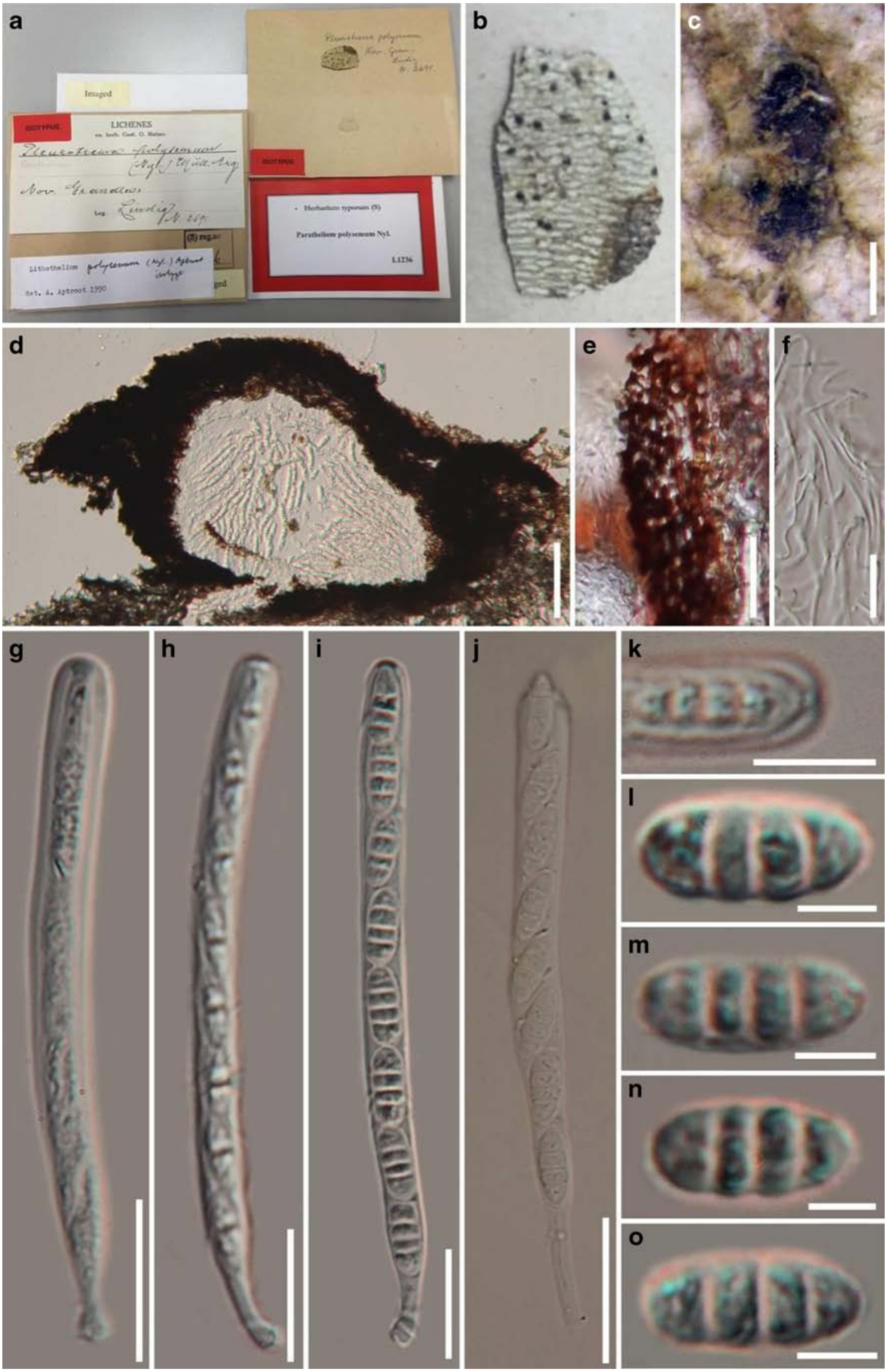


Fig. 156 ***Obryzum corniculatum*** (Material examined: PC 002061) a Herbarium specimen with the label b, c Appearance of ascomata on host substrate (see *arrows*, c in 5 % KOH). d Transverse section through ascoma e Transverse section through ostiole f Peridium g, h Mature asci i–k Ascospores. Scale bars: b = 500 μm, c = 1 mm, d = 100 μm, e–h = 20 μm, i–k = 10 μm

Pleurotrema Müll. Arg.

Notes: The family *Pleurotremataceae* was introduced by Watson (1929) based on *Pleurotrema polysemum* (Nyl.) Mull. Arg., the sole species. It is characterized by black ascomata and cylindrical asci, with septate, hyaline ascospores. This family was introduced as lichenized with bitunicate asci (Eriksson 1981). Eriksson and Hawksworth (1993) suspected *Pleurotremataceae* to be synonym of *Pyrenulaceae*. *Pleurotrema* was synonymized under *Lithothelium* as a member of *Pyrenulaceae* by Aptroot (1991). Later, Harris re-examined the isotype of *P. polysemum*, determined that it is closely related to *Melomastia* and *Saccardoella* (Barr 1994), and this species was not lichenized and with unitunicate asci (Barr 1994). However, Barr (1994) transferred *Pleurotremataceae* to *Xylariales* based on its cylindrical asci, with a non amyloid apical ring and hyaline, distoseptate ascospores. Five genera, *Phomatospora*, *Melomastia*, *Pleurotrema*, *Saccardoella*, *Daruvedia*, were included in *Pleurotremaceae* on account of their non-fissitunicate asci (Barr 1994). Hawksworth et al. (1995) disagreed with this justification and retained *Pleurotrema* in the order *Pyrenulales*. *Saccardoella* and *Melomastia* were placed in Ascomycota *genera incertae sedis* (Kirk et al. 2001; Lumbsch and Huhndorf 2010), but there are no phylogenic datasets. *Phomatospora* was found in freshwater and marine habitats and positioned in Ascomycota genera


a
b
c
Imaged
ISOTYPUS
LICHENES
Herbarium typorum (S)
Paratheliun polysemum Nyl.
L1236
Lithothelium polysemum (Nyl.) Aptroot
det. A. Aptroot 1990
d
e
f
g
h
i
j
k
l
m
n
o

◀ **Fig. 157** ***Pleurotrema polysemum*** (Material examined: COLOMBIA, Nov. Granada, on dead wood, Lindig A, S L1236, isotype). a Material label b Material c Ascomata d Ascoma cross section e Peridium f Paraphyses g–j Asci (j. ascus with ejected spores) k Apical part of ascus l–o Ascospores. Notes: Figs f-o soaked in 3 % KOH. Scale bars: c = 500 μm, d = 100 μm, g–j = 20 μm, e–f, k = 10 μm, l–o = 3 μm

incertae sedis based on phylogenic analysis (Vijaykrishna et al. 2006). *Pleurotremataceae* was accepted as monotypic via *Pleurotrema* and placed under *Chaetosphaeriales* without giving a reasons (Maharachchikumbura et al. 2015).

Pleurotrema Müll. Arg., Bot. Jb. 6: 388 (1885); Fig. 157

Type species: ***Pleurotrema polysemum*** (Nyl.) Müll. Arg., Bot. Jb. 6: 389 (1885)

We re-examined the isotype from S of *Pleurotrema polysemum*. It has what appears to be unitunicate asci, and septate ascospores and is similar to species of *Saccardoella* and *Dyfrolomyces* (Hyde et al. 2013). Thus this is an earlier family name for *Dyfrolomycetaceae* (Dothideomycetes). Fresh collections are needed to substantiate this.

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