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An updated account of *Fagales*-inhabiting Italian *Ascomycota* and mycogeography, with additions to *Pezizomycotina*

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Abstract

Studies of plant-associated *Ascomycota* are topical, as they have varied life modes depending on their hosts in different ecosystems. In Italy, *Fagales* are economically and ecologically important plants, especially in the Alps and Apennine mountain ranges. *Fagales* species host numerous ascomycetous species, comprising endophytes, saprobes, or pathogens. We retrieved data from 308 publications from 1873 to 2021 and listed 776 *Ascomycota* on *Fagales* in Italy. Among these, 696 were identified at the species level and 80 at the genus level. Documented taxa belong to *Pezizomycotina* (746), *Saccharomycotina* (2), *Taphrinomycotina* (5), and *Ascomycota* genera *incertae sedis* (23). *Sordariomycetes* are dominant (34%), followed by *Dothideomycetes* (24%), *Lecanoromycetes* (16%), and *Leotiomycetes* (11%). Distribution maps were provided for the occurrence of *Fagales* trees and *Dothideomycetes*, *Eurotiomycetes*, *Leotiomycetes*, *Pezizomycetes*, and *Sordariomycetes* taxa. Lichenized taxa were excluded from the mapping. We provided additions to *Valsariaceae* (*Valsaria rudis*) in *Dothideomycetes*, *Coryneaceae* (*Coryneum modonium*), *Melanconiellaceae* (*Melanconiella flavovirens* and *M. meridionalis*), and *Woswasiaceae* (*Woswasia atropurpurea*) in *Sordariomycetes*. These taxa represent a novel host record, a provincial record, and four regional records in Italy. Species boundaries were defined using polyphasic approaches. In addition, taxonomic notes were provided for each reported class, including *incertae sedis* genera. The study provides information on the taxonomy, hosts, and

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distribution of *Ascomycota* in Italy to encourage further research related to important plant species.

Keywords – checklist – host-fungal distribution – morphology – phylogeny – taxonomy

Introduction

Ascomycota

Fungi are one of the largest eukaryotic kingdoms, with a current estimate of 1.5–12 million species, and this diversity is highly uncertain (Hyde et al. 2020a, Lücking et al. 2021). Fungal species represent an extremely heterogeneous group, and *Ascomycota* is the largest phylum, comprising around 92,700 extant species (Bánki et al. 2022), with an estimated origin of 650–550 million years ago (Saitta et al. 2011, Taylor et al. 2015, Bennett & Turgeon 2016, Senanayake et al. 2021). Some are cosmopolitan and often specialize in specific habitat requirements (Eriksson 2009). Many are plant-associated and microscopic but include some larger cup fungi, morels, and truffles (Senn-Irlet et al. 2007, Saitta et al. 2011).

The classification of *Ascomycota* has been updated several times. Periodic outlines of *Ascomycota* were published by Lumbsch & Huhndorf (2010) and Wijayawardene et al. (2018, 2020, 2022). Wijayawardene et al. (2022) accepted three subphyla in *Ascomycota*, viz., *Pezizomycotina*, *Saccharomycotina*, and *Taphrinomycotina*. *Pezizomycotina* is the largest subphylum and includes a majority of the filamentous, fruiting body producing species (James et al. 2006, Saitta et al. 2011, Wagensommer et al. 2018). *Ascomycota* genera *incertae sedis* is an unclassified group that comprises approximately 1,544 genera and requires molecular analyses to stabilize their taxonomic placements (Wijayawardene et al. 2021).

Italian *Ascomycota* and *Fagales* community

Mycology has a long tradition in Europe, where G. De Notaris (1805–1877), V. Cesati (1806–1883), and P. A. Saccardo (1845–1920) were some of the most famous Italian mycologists (Phukhamsakda et al. 2020, Wijesinghe et al. 2021a). Knowledge of fungal taxonomy, distribution, ecology, and status in Europe is extensive (Saitta et al. 2011). In earlier treatments, considerable attention was given to macrofungal *Ascomycota* studies such as truffles (Ciccarelli 1564), while microfungal studies were concerned with only a few taxa (Venturella 1991, Bernardin 2019, Wijesinghe et al. 2021a). The majority of *Ascomycota* studies were started in the early 19th century in Italy based on morphological observations (Zucconi 1988, Graniti 1991). In the last few years, many microfungi have been recorded in different Italian habitats (Jensen et al. 2010, Rodolfi et al. 2016, Thambugala et al. 2017a, b, Jayawardena et al. 2018, Wanasinghe et al. 2018, Liu et al. 2019, Marin-Felix et al. 2019, Hyde et al. 2020b, Abeywickrama et al. 2022). Current fungal taxonomy benefits from a combination of morphology, DNA-based molecular analyses, ecology, and chemical profiles to resolve species limits (Alors et al. 2016, Skrede et al. 2017, Haelewaters & De Kesel 2020, Maharachchikumbura et al. 2021, Wijesinghe et al. 2021a, b). Medardi (2006) published the atlas of Italian *Ascomycota* with 400 illustrated taxa. This atlas provides morphology, anatomy, biology, ecology, a glossary, and numerous identification keys (Medardi 2006). However, all these data are available in Italian, and only identification keys were provided in English.

Italy lies in south-central Europe with a continental landmass in the north, a central-southern peninsular landmass, and two main islands. It encompasses a wide variety of different biomes with a high number of species and a high rate of endemism (Abbate et al. 2015, Nimis 2016). Italy hosts the majority of the European vascular flora due to its latitudinal extension from the Alps to the Mediterranean Basin (Cristofolini 1998). According to Nimis (2016), Italy can be subdivided into biogeographic regions, namely the Alps, high Mediterranean mountains, montane beech forests, sub-mediterranean deciduous forests, and the Mediterranean biome. *Fagales* species play an important role at higher elevations. The native and foreign taxa of Italian *Fagales* belong to four families, viz., *Betulaceae* (birch), *Casuarinaceae* (she-oak), *Fagaceae* (oak), and *Juglandaceae* (walnut) (Bartolucci et al. 2018, Galasso et al. 2018). In this investigation, we aimed to re-organize and analyze information on the taxonomy, diversity, and ecology of *Fagales*-inhabiting *Ascomycota* in Italy. Italian *Fagales* species are listed in Table 1.

Table 1 Classification of *Fagales* species and their ecological status in Italy.

Family	**Genus**	**Species**[a]	**Status**[b]	**Reference**
Betulaceae	*Alnus*	*Alnus alnobetula* (Ehrh.) K.Koch	N	Bartolucci et al. (2018)
		A. cordata (Loisel.) Duby*	E, N	
		A. glutinosa (L.) Gaertn.	N	
		A. incana (L.) Moench	N	
	Betula	*Betula aetnensis* Raf.[T]	E, N	Bartolucci et al. (2018)
		B. nana L. subsp. *nana*	N	
		B. pendula Roth	N	
		B. pubescens Ehrh.	N	
	Carpinus	*Carpinus betulus* L.	N	Bartolucci et al. (2018)
		C. orientalis Mill. subsp. *orientalis*	N	
	Corylus	*Corylus avellana* L.	N	Bartolucci et al. (2018), Galasso et al. (2018)
		C. colurna L.	CA	
		C. maxima Mill.	CA	
	Ostrya	*Ostrya carpinifolia* Scop.	N	Bartolucci et al. (2018)
Fagaceae	*Castanea*	*Castanea sativa* Mill.	N	Bartolucci et al. (2018)
	Fagus	*Fagus sylvatica* L. subsp. *sylvatica*	N	Bartolucci et al. (2018)
	Quercus	*Quercus cerris* L.	N	Bartolucci et al. (2018)
		Q. coccifera L.	N	
		Q. congesta C. Presl[T]	N	
		Q. crenata Lam. [H] (*Q. cerris* × *Q. suber*)	N	Pignatti (1982), Cristofolini & Crema (2005)
		Q. dalechampii Ten.[T]	N	Bartolucci et al. (2018)
		Q. frainetto Ten.	N	
		Q. ichnusae Mossa, Bacch. & Brullo[T]	E, N	Bartolucci et al. (2018), Galasso et al. (2018)
		Q. ilex L. subsp. *ilex*	N	Bartolucci et al. (2018)
		Q. ithaburensis Decne. subsp. *macrolepis* (Kotschy) Hedge & Yalt.[C]	N	
		Q. leptobalana Guss.	E, N	Bartolucci et al. (2018), Peruzzi et al. (2015)
		Q. petraea (Matt.) Liebl.		Portal of the Flora of Italy (2021)
		Q. petraea (Matt.) Liebl. subsp. *austrotyrrhenica* Brullo, Guarino & Siracusa	E, N	Bartolucci et al. (2018), Peruzzi et al (2015)
		Q. petraea (Matt.) Liebl. subsp. *petraea*	N	Bartolucci et al. (2018)
		Q. pubescens Willd. subsp. *pubescens*	N	
		Q. pyrenaica Willd.	N	Bartolucci et al. (2018)
		Q. robur L.		Portal of the Flora of Italy (2021)
		Q. robur L. subsp. *brutia* (Ten.) O.Schwarz	N	Bartolucci et al. (2018)
		Q. robur L. subsp. *robur*	N	
		Q. rubra L.	IA	Galasso et al. (2018)
		Q. shumardii Buckley	CA	
		Q. suber L.	N	Bartolucci et al. (2018)
		Q. trojana Webb subsp. *trojana*	N	
Juglandaceae	*Juglans*	*Juglans cinerea* L.	CA	Galasso et al. (2018)
		J. nigra L.	IA	
		J. regia L.[C]	N	Bartolucci et al. (2018)
	Pterocarya	*Pterocarya fraxinifolia* (Lam.) Spach	NA	Galasso et al. (2018)
Casuarinaceae	*Allocasuarina*	*Allocasuarina verticillata* (Lam.) L.A.S. Johnson	CA	Galasso et al. (2018)
	Casuarina	*Casuarina cunninghamiana* Miq. subsp. *cunninghamiana*	CA	Galasso et al. (2018)
		C. equisetifolia L.	NA	

[a]* *Alnus cordata* (= *Betula cordata*), [b] E**:** Italian endemic, N: native, CA: casual alien, NA: naturalized alien, IA**:** invasive alien, [C] cryptogenic**:** a doubtfully native taxon, whose origin of occurrence in Italy is unknown, [H] hybrid species, [T] taxonomically doubtful.

Beech forests (*Fagus sylvatica*) are the main characteristic of the Italian mountains, except in the Sardinia region (Nocentini et al. 2009). *Fagus sylvatica* is found prevalently in the northern Apennines and montane beech forests from the Mediterranean region to the beginning of boreal forests at the southern latitudinal limit, at elevations ranging from 300 to 2,000 msl (Pignatti 1998, Luchi et al. 2015, Nimis 2016). The alder plants occur in the Mediterranean sub-mountain and mountain belt, including *Alnus cordata* (Italian alder) in the southern hills and mountains (Caudullo & Mauri 2016), while birch trees, including *Betula pendula* (silver birch) and *B*. *pubescens* (downy birch), are typical at the higher elevational limit because of their cold hardiness (Beck et al. 2016). The Mediterranean belt and Sicilian vegetation mainly consist of *Quercus ilex* and *Q*. *suber* woodlands, and to a lesser extent, *Q*. *petraea* and *Betula aetnensis* (Venturella & Saitta 2005). Also, sub-mediterranean deciduous forests are dominated by *Carpinus*, *Fraxinus*, *Ostrya*, and *Quercus* (Nimis 2016). *Carpinus betulus* (common hornbeam), *C*. *orientalis* (oriental hornbeam), and *Ostrya carpinifolia* (European hop-hornbeam) mainly occur in southern Italy but are absent in Sicily and Sardinia (Pasta et al. 2016, Sikkema et al. 2016, Sikkema & Caudullo 2016, Acta Plantarum website, accessed on September 2021). *Corylus avellana* (European or common hazel) is economically important for hazelnuts that are traditionally cultivated in Campania, Lazio, Piedmont, and Sicily in Italy, which is the second-largest producer of hazelnuts after Turkey (Santori et al. 2010, Me & Valentini 2006, Enescu et al. 2016, Linaldeddu et al. 2016a). *Castanea*, *Fagus*, and *Quercus* species also have economic importance as timber (Simpson 2019). Some Italian sites with mixed *Fagales* vegetation and *Fagaceae* forests are shown (Figs 1, 2). The different leaf structures of some *Fagales* trees, including *Fagus* and *Quercus* (*Fagaceae*) as well as *Carpinus* and *Ostrya* (*Betulaceae*) are also shown (Fig. 3).

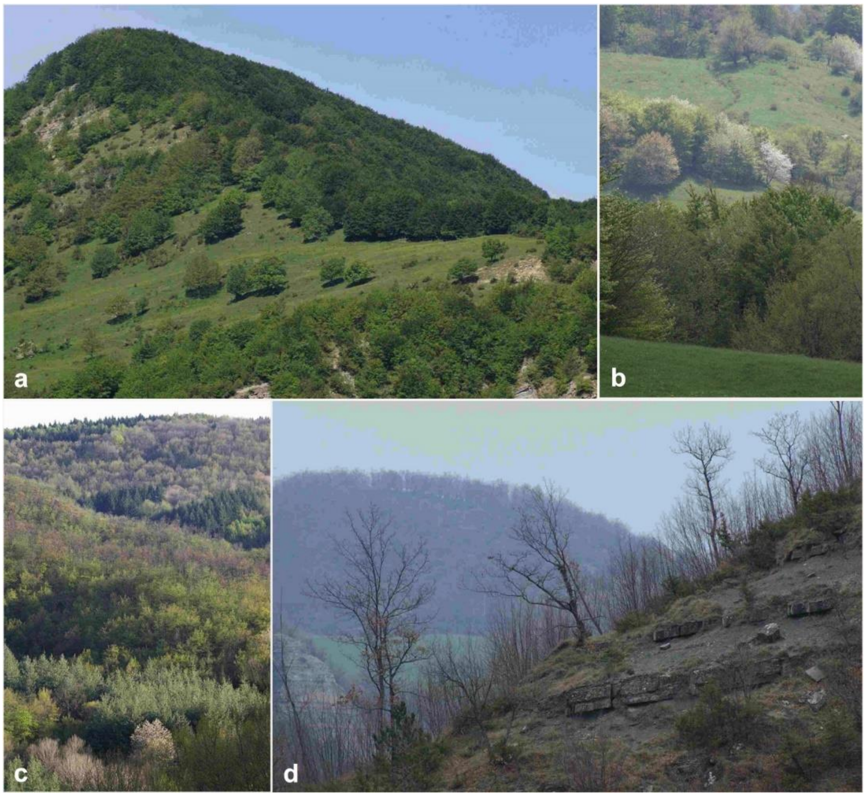

Fig. 1 – Landscapes of mixed vegetation with *Fagales* trees in Forlì-Cesena Province. a, b. *Corylus*, *Fagus*, *Ostrya*, and *Quercus* species, c. *Ostrya*, *Fagus*, *Quercus*, *Corylus* and *Alnus cordata*, d. *Quercus pubescens* and *Ostrya carpinifolia* (Apennine Mountains at the back). Photos by E. Camporesi.

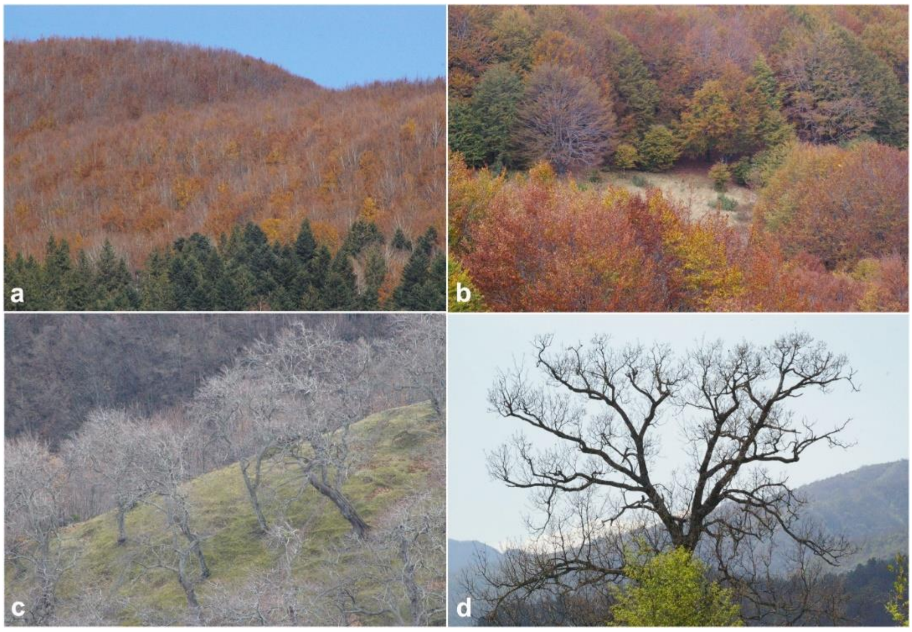

Fig. 2 – Italian sites of *Fagaceae* in different seasons. a, b. *Fagus* spp. in autumn, b. Prevalence of *Fagus* sp. in autumn, c. *Castanea sativa* in winter, d. *Quercus* sp. in winter. Photos by E. Camporesi.

Fig. 3 – Broad leaves. a. *Quercus petraea*, b. *Ostrya carpinifolia*, c. *Fagus sylvatica*, d. *Carpinus betulus*. Photos by E. Camporesi.

Fungi interact with plants in terrestrial ecosystems, contributing to their functioning and stability (Lutzoni 2018). Parasitism, mutualism, and saprotrophy are considered critical to the success of fungal-plant interactions and their respective macroevolutionary processes (Lutzoni 2018). Studies on the diversity of plant-associated Italian fungi are in progress (Medardi 2006, Saitta et al. 2011). The biodiversity in the Italian mountains changes along altitudinal gradients with significant vegetational changes (Marignani & Blasi 2012, Granito et al. 2015). The effects of elevations and vegetational changes on wood-inhabiting fungi have rarely been studied (Granito et al. 2015). However, a few studies suggested that species richness increases with elevation, due to the higher water resources and less human influence in the mountains, by affirming the significant amounts of dead wood mass at higher elevations (Küffer & Senn-Irlet 2005, Pouska et al. 2010, Ziaco et al. 2012, Granito et al. 2015).

Several mycological studies were conducted on *Quercus* species in Italy during the last decades. Nearly half of the *Fagales* belong to *Fagaceae*, including many *Quercus* species. Saitta et al. (2004) and Venturella et al. (2007) reported several lignicolous ascomycetes on *Quercus ilex* woods growing up to 1,550 msl in Sicily. Ragazzi et al. (2003) investigated the endophytic fungal communities in *Quercus cerris*, *Q*. *pubescens*, and *Q*. *robur* at different sites in central Italy. Host-specificity, host preference, and pathogenicity of some fungal taxa on *Quercus* spp. were discussed (Butin & Kowalski 1983, Kowalski & Kehr 1996, Ragazzi et al. 1999a, b, Ragazzi et al. 2003). Important plant pathogens such as *Tubakia dryina* (Harrington & McNew 2018), *Taphrina caerulescens* (Spooner 2007), *Microsphaera alni* (Spaulding 1961), and *Diplodia mutila* (Alves et al. 2004) have been reported to cause oak tree diseases.

Deadwood represents approximately 20–30% of the total biomass of native forests in Italy and provides carbon and nutrients required for ecosystem functioning (Boddy & Watkinson 1995, Saitta et al. 2011). Decaying trees, snags, fallen branches, and logs are significant for nutrient recycling and are primarily affected by fungi. Among wood-inhabiting *Ascomycota*, many *Sordariomycetes,* such as *Xylariales,* were reported as the most dominant fungal taxa associated with decaying wood (Spatafora et al. 2006, Saitta et al. 2011). The first comprehensive study of wood-decaying Italian *Ascomycota* and *Basidiomycota* was provided by Saitta et al. (2011). They have listed 341 *Pezizomycotina* (24 orders, 57 families, and 138 genera) in *Ascomycota* and 1,241 taxa in *Basidiomycota*. The highest number of taxa recorded was from *Fagus sylvatica* (73 taxa) (around 70% are from beech forests in Italian protected areas), followed by *Quercus* spp. (70 taxa) and *Alnus* spp. (42 taxa). Saitta et al. (2011) provided the foundation for future studies to survey *Ascomycota* on woody plants in Italy and proposed to expand the knowledge of *Pezizomycotina* on decaying wood with regional and national checklists. Studies related to *Fagales*-inhabiting *Ascomycota* were published in different provinces of Italy (Lunghini et al. 2013, Dissanayake et al. 2016a, b, 2017a, b, Hyde et al. 2017, 2019, 2020b, Tibpromma et al. 2017, Gheza 2019, Morales-Rodriguez et al. 2019, Li et al. 2020, Shang et al. 2020).

Leaf litter-inhabiting microfungi are another significant group in Italian forest ecosystems. According to Maggi et al. (2005) and Zucconi & Pasqualetti (2007), the diversity of soil and litter microfungi and their decomposition in the Mediterranean region are strongly affected by climate. However, only a few studies have been carried out on leaf litter decomposition and fungal taxonomy in Mediterranean environments. Zucconi & Pasqualetti (2007) investigated the microfungal assemblage in *Quercus ilex* leaf litter in selected coastal stands in Tuscany during the spring and autumn. In this study, 115 fungal taxa were identified, among which *Beltrania rhombica* and *B. querna* were the dominant colonizers (Zucconi & Pasqualetti 2007).

Pardatscher & Schweigkofler (2009) investigated the endophytic and epiphytic microbial diversity associated with *Juglans regia* in South Tyrol (northern Italy). Of the 3,742 isolates obtained from leaves, fruits, and wooden twigs, 3,233 were classified under 25 ascomycetous genera in 15 families, viz., *Aspergillaceae*, *Botryosphaeriaceae*, *Cladosporiaceae*, *Diaporthaceae*, *Didymellaceae*, *Glomerellaceae*, *Melanconidaceae*, *Mycosphaerellaceae*, *Nectriaceae*, *Plectosphaerellaceae*, *Pleosporaceae*, *Ploettnerulaceae*, *Saccotheciaceae*, *Sclerotiniaceae*, and *Torulacea* (Pardatscher & Schweigkofler 2009). Gargano et al. (2009) investigated the *Ascomycota* and *Basidiomycota* diversity in Sicily, and more than 500 taxa were reported predominantly from *Quercus ilex* and more than 300 taxa from *Fagus sylvatica* woods. In addition, 200 taxa were reported from *Q. suber* and *Castanea sativa*. These data, however, are scattered among different scientific sources.

Key morphologies of *Ascomycota* on *Fagales*

The members of *Fagales* are broadly distributed in Italy and provide multiple substrates to be richly colonized by *Ascomycota*. The sexual morph and the coelomycetous or hyphomycetous asexual morphs are physically differentiated by the fruiting bodies on hosts and substrates. Some fruiting structures are superficial on the host surface, while others are immersed, semi-immersed, or erumpent. Sometimes, ascomata or ascostromata vary from separated to aggregated on the substrate, with or without ostioles. The peridium can be evenly or unevenly thickened from top to bottom and on both sides, with several cell layers. Some key morphological characteristics of the fruiting bodies of *Ascomycota*, such as shapes, positions, and distribution on their host substrates, are illustrated in Fig. 4.

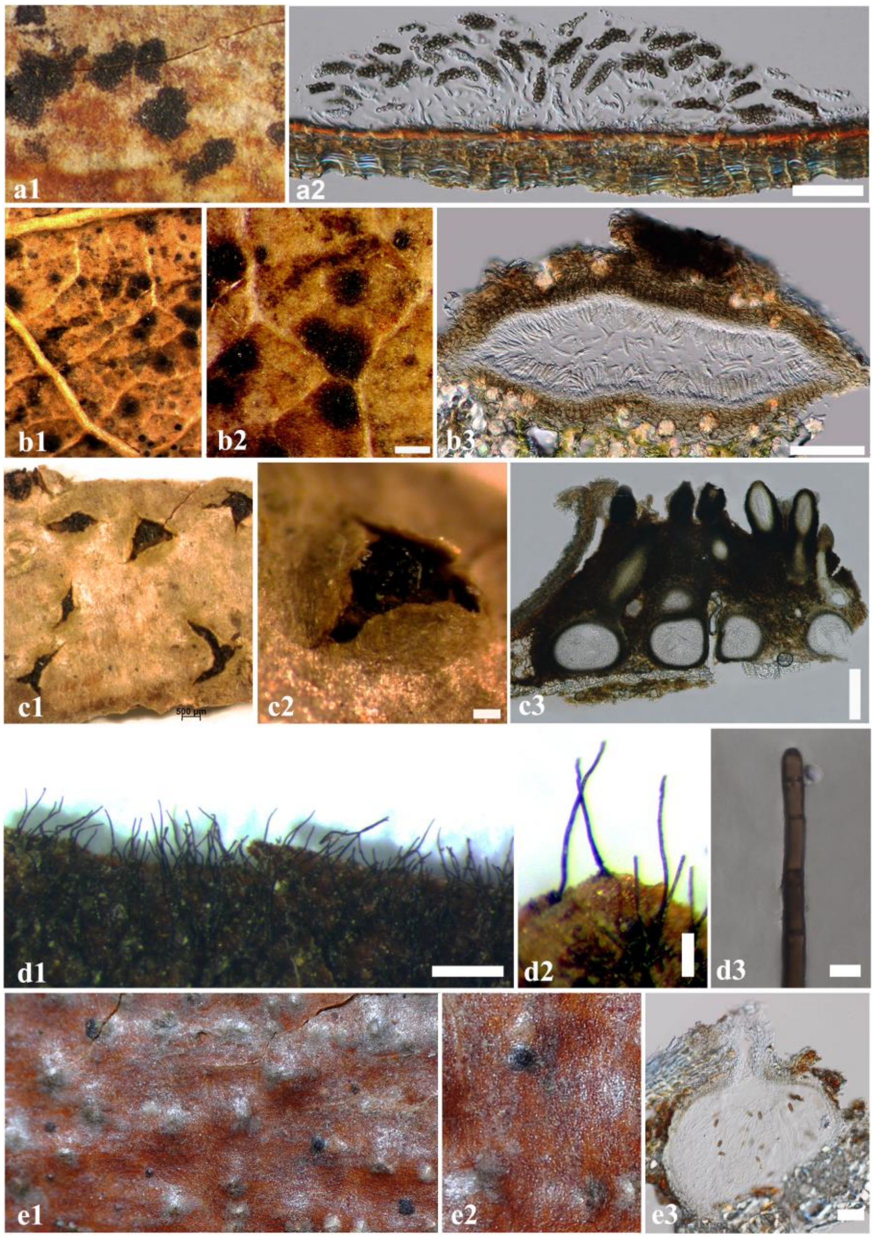

Fig. 4 – Host specimens with ascomata and their vertical sections. a1, a2. Superficially distributed, raised mass of hyphae or sporodochium of *Patellariopsis atrovinosa* on the woody surface

(Karunarathna et al. 2020); b1–b3. Semi-immersed conidiomata of *Immersidiscosia eucalypti* on the leaf surface (Hyde et al. 2017); c1–c3. Semi-immersed ascostromata of *Sillia italica* that erumpent through surface cracks with well-developed ostioles (Tibpromma et al. 2017); d1–d3. Dark-colored colonies stand on the woody surface with partly immersed mycelia of hyphomycetous *Helminthosporium italicum* (Tian et al. 2018); e1–e3. Immersed or erumpent ascomata of *Montagnula jonesii* that scattered on the woody substrate with short ostiole (Tennakoon et al. 2016). Scale bars: b2 = 1 mm, d1, c1–c2 = 500 μm, c3 = 200 μm, d2 = 100 μm, a2, e3 = 50 μm, b3 = 20 μm.

The fungal spores are differentiated mainly by their shape, septation, and pigmentation. For some taxa, spore color ranges from hyaline to strongly pigmented at maturity. Spores of some taxa are hyaline throughout their life cycles. Some spores are aseptate, while some vary from uni- to multiseptated. In addition, some are muriform and have longitudinal and transverse septa. Examples of spore morphologies are illustrated in Fig. 5.

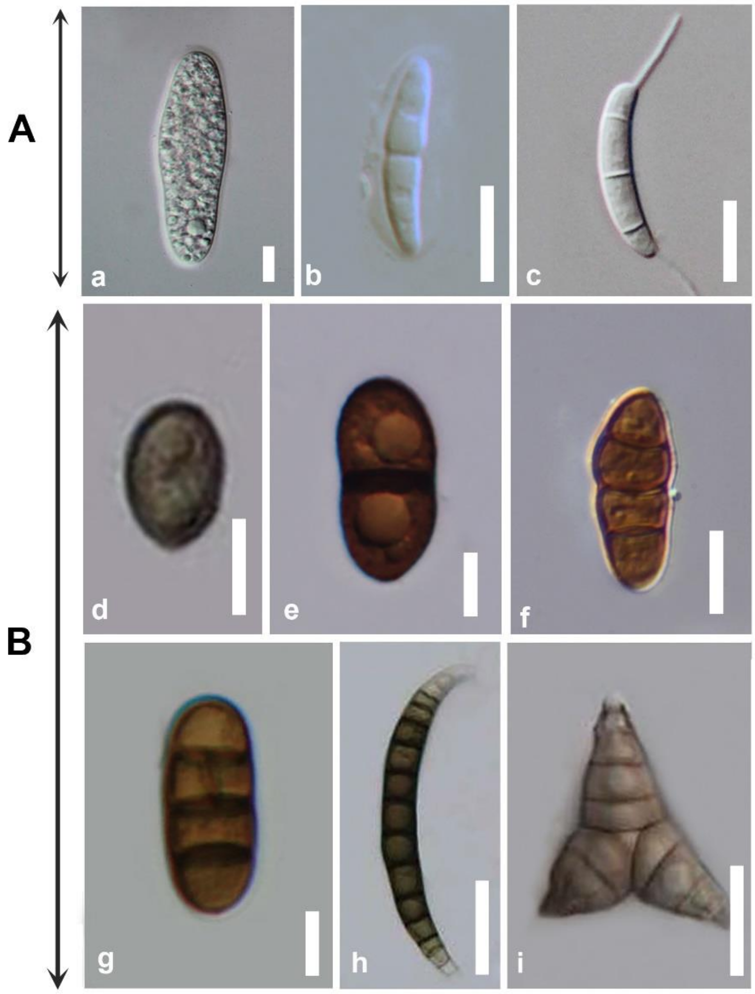

Fig. 5 – Spores of Italian *Ascomycota*: A. Hyaline spores: a. aseptate spores of *Melanops fagicola* (Li et al. 2020); b. uniseptate spores of *Angustimassarina sylvatica* (Hyde et al. 2019); c. 3-septate spores of *Immersidiscosia eucalypti* (Hyde et al. 2017); B. Pigmented spores: d. aseptate spores of *Melanconium capinicola* (Wijayawardene et al. 2016b); e. uniseptate spores of *Valsaria rudis* (this study); f. 3-septate spores of *Montagnula jonesii* (Tennakoon et al. 2016); g–i. multi-septate spores of g. *Pseudocamarosporium camporesii* (Hyde et al. 2020b), h. *Scolicosporium macrosporium* (Wijayawardene et al. 2016b) and i. *Asterosporium asterospermum* (Wijayawardene et al. 2016b). Scale bars: h = 50 μm, b–c, e–g = 10 μm, a, d, i = 5 μm.

Rationale

The biodiversity of wood-decaying fungi in Italy is still being evaluated, and published data still need to be compiled. Documenting these scientific data on a single platform is highly informative and user-friendly, but it is challenging to record unpublished data (Wijesinghe et al. 2021a). Currently, the online databases for plant-associated Italian microfungi and lichens (https://italianmicrofungi.org/ and https://italic.units.it/) are being implemented, respectively (Wijesinghe et al. 2021a, Nimis & Martellos 2022). Additionally, regional or national atlases, monographs, and checklists with ecology and distribution data offer a precise assessment of species richness in Italy (Saitta et al. 2011, Wagensommer et al. 2018). Among these, a checklist can be considered a useful tool to evaluate species diversity and a precious source of ecological information to understand threats and manage protected areas and forests (Compagno et al. 2011). Many checklists of fungi are available in Europe, including Italy. These include the checklists of *Ascomycota* in Sicily produced by Venturella and Greuter (1991) and Compagno et al. (2011), a checklist of *Ascomycota* with 106 taxa by Angelini et al. (2016), a checklist of 108 *Pezizomycotina* taxa including red list data by Wagensommer et al. (2018), and a checklist of seven families of *Ascomycota* by Venanzoni et al. (2019) from Umbria. Furthermore, a checklist of macromycetes with 99 ascomycetous taxa was published by Illice et al. (2015) for Bologna in Emilia-Romagna. Saitta et al. (2011) provided a host-based updated checklist for 341 Italian *Ascomycota*. However, an updated *Fagales*-inhabiting fungal checklist is still unavailable, even though *Fagales* species cover a considerable landmass and provide high economic value. A fungal checklist with updated taxonomic placements can be used as a handy guide for mycologists.

Historical *Ascomycota* studies were based completely on morphology, and the accurate taxonomic placements of some taxa would need to be validated by adding their DNA sequence data. Therefore, re-collecting fungal specimens from their type localities or elsewhere can be useful to stabilize their taxonomic placements. Also, additional collections will be served as epitypes and authentic herbarium materials of extant species when original materials have been lost or are available in poor condition (Wijesinghe et al. 2021a). Accurate species identification based on morpho-molecular phylogeny will expand the knowledge of host-fungal relationships in terms of host recurrence in Italian *Ascomycota*.

Despite the taxonomy, the ecology and geography of fungi are prerequisites to understanding fungal diversity and conservation. Wagensommer et al. (2018) mentioned that the main reason for the lack of fungal conservation protocols is the challenge of collecting data on fungal populations and geographic distributions. Many past studies on fungal taxonomy lacked geographical data, and sometimes only the country or part of the continent was given. Hence, mycogeographical knowledge is incomplete and scattered. However, in recent decades, many studies reported the GPS (Global Positioning System) positioning data to overcome this issue (Danti et al. 2002, Lunghini et al. 2013, Montecchio & Faccoli 2014, Raimondo et al. 2016, Panzavolta et al. 2018, Nascimbene et al. 2021). Gathering scattered geographical data into a comprehensive mapping database will support minimizing the knowledge gaps in mycogeography.

The aim of the study

The main objective of this study is to understand the context of *Fagales*-inhabiting *Ascomycota* in Italy. We surveyed the scattered scientific data from published sources (scientific journals, books, book chapters, and databases) on *Ascomycota* and provided an updated checklist with current taxonomic resolutions by following the accepted outlines. In addition, we collected distribution data for species in the checklist and expanded our knowledge of host-fungal distribution. In addition, we performed taxonomic studies based on morpho-molecular and phylogenetic analyses of five extant taxa in *Sordariomycetes* (*Coryneaceae*, *Melanconiellaceae*, and *Woswasiaceae*) and in *Dothideomycetes* (*Valsariaceae*) described as the new host, provincial, and regional records from Italy. We presented morphological illustrations, comprehensive descriptions, and multi-gene phylogenetic analyses to delimit the collected fungal taxa. This study will serve as a baseline data source for future studies to compile scattered mycological data on important plant species and encourage taxonomic studies on *Fagales*-inhabiting fungi in different Italian regions.

Materials & Methods

Checklist: Data recording

The checklist data were retrieved from published articles, books, and online databases such as the USDA database (Farr & Rossman 2022) and the Italian microfungi web page (Wijesinghe et al. 2021a). Fungal classes, orders, families, genera, species, and their associated hosts were listed in alphabetical order. *Ascomycota* classification is arranged according to Hongsanan et al. (2020a, b) and Wijayawardene et al. (2020, 2021, 2022). The Index Fungorum (2022), the Catalogue of Life Annual Checklist in 2018 and 2019 (Roskov et al. 2018, 2019), MycoBank (https://www.mycobank.org/) database and the latest taxonomic studies were referred to the current names of some species. The synonyms were provided according to the most recent taxonomic updates.

Mapping: Spatial distribution of *Ascomycota* and *Fagales* hosts

The distribution data for *Fagales* in Italy were derived from the Global Biodiversity Information Facility (GBIF) (https://www.gbif.org/). Biodiversity data for the four *Fagales* families were downloaded, viz., *Betulaceae*, https://doi.org/10.15468/dl.9be3ks, *Casuarinaceae*, https://doi.org/10.15468/dl.kypyrv, *Fagaceae* https://doi.org/10.15468/dl.54wc2t and *Juglandaceae* https://doi.org/10.15468/dl.nc2cea, on 17 August 2021 (CC BY-NC 4.0). Based on data availability, the distribution data for Italian *Ascomycota* were extracted from published sources. For records without exact collection data, provincial or regional distribution was considered. Mycogeographical data have been recorded for all administrative regions in Italy. ArcGIS 10.7 software was used for mapping and analyses.

Taxonomy and phylogenetic analyses

Sample collection, morphological studies and isolation

Decaying branches and stems of *Fagaceae* (*Castanea sativa*, *Quercus* spp.) and *Betulaceae* (*Corylus avellana*, *Ostrya carpinifolia*) were randomly collected from Arezzo [AR] and Forlì-Cesena [FC] provinces, Italy in 2017, 2018, and 2019. The specimens were examined by following the methods described by Senanayake et al. (2020). The measurements of macro and microscopic structures were taken using Tarosoft (R) Image Framework version 0.9.7. Images were processed with Adobe Photoshop CS6 Extended version 13.0.1 software (Adobe Systems, San Jose, California).

Single spore isolation was conducted according to the methods described by Senanayake et al. (2020). For some taxa, we were unable to obtain cultures, therefore, fruiting bodies were used for DNA extraction (Wanasinghe et al. 2018). The herbarium specimens were preserved and deposited in the herbarium of Mae Fah Luang University, Chiang Rai, Thailand (MFLU). The living cultures were deposited at the Mae Fah Luang University Culture Collection, Chiang Rai, Thailand (MFLUCC). Both Facesoffungi and Index Fungorum numbers were obtained as outlined in Jayasiri et al. (2015) and Index Fungorum (2022).

DNA extraction, Polymerase Chain Reaction (PCR) and sequencing

Fungal DNA extraction, PCR, gel electrophoresis, and sequencing were performed according to the methods detailed in Dissanayake et al. (2020). The primers and protocols used for the amplification were provided (Table 2). The sequencing of amplified PCR products is outsourced to the SinoGenoMax Sanger sequencing laboratory (Beijing, China).

Table 2 Gene regions, primers, and PCR thermal cycle programmes were used in this study, with relative reference(s).

Genes/loci	PCR primers (forward/reverse)	PCR conditions	Reference(s)
ITS and LSU	ITS5/ITS4 and LR0R/LR5	94 °C; 2 min (95 °C; 30 s, 55 °C; 50 s, 72 °C; 90 s) × 35 thermal cycles, 72 °C; 10 min.	White et al. (1990), Vilgalys & Hester (1990), Rehner & Samuels (1994)
*rpb*2	fRPB2-5F/ fRPB2-7Cr	94 °C; 2 mins; (95 °C; 45 s, 57 °C; 50 s, 72 °C; 90 s) × 35 thermal cycles, 72 °C; 10 min.	Liu et al. (1999)
*tef*1-α	EF1-983F/ EF1-2218R	95 °C; 5 mins; (94 °C; 30 s, 55 °C; 45 s, 72 °C; 90 s) × 35 thermal cycles, 72 °C; 10 min.	Rehner (2001)

Molecular data analyses

Sequences with high similarity indices were selected for the phylogenetic analyses based on the BLASTn searches of NCBI and relevant literature. Contig sequences were analyzed with other sequences downloaded from GenBank. Each gene matrix was aligned with MAFFT version 7 (Katoh & Standley 2013, Katoh et al. 2019) with default parameters. The trimAl v1.4 software was used for the automated removal of spurious sequences or poorly aligned regions in each single gene alignment, and *gappyout* was selected as the automated trimming method (Capella-Gutiérrez et al. 2009). Maximum likelihood (ML) and Bayesian inference (BI) phylogenetic analyses were conducted based on the concatenated sequence datasets with their best substitution models (Table 3). MrModeltest v.2.3 (Nylander 2004) was used under the Akaike Information Criterion (AIC) implemented in PAUP v.4.0b10 (Swofford & Sullivan 2003) to estimate the best substitution models for each gene region.

Table 3 Sequence datasets used for ML and BI analyses with the best fit models and respective generations.

Family	Gene regions in datasets	Best fit model for each gene region	No. of generations	Reference(s) for Sequence datasets
Coryneaceae	ITS, LSU, *tef*1-α	ITS and *tef*1-α: GTR+G, LSU: GTR+I+G	1,000,000	Rathnayaka et al. (2020)
Melanconiellaceae	ITS, LSU, *rpb*2	LSU and *rpb*2: GTR+I+G, ITS: SYM+I+G	1,500,000	Phookamsak et al. (2019)
Valsariaceae	LSU, ITS, *rpb*2, *tef*1-α	LSU and *tef*1-α: GTR+I+G, ITS: GTR+G, *rpb*2: SYM+I+G	1,500,000	Pem et al. (2019)
Woswasiaceae	LSU, SSU, ITS, *rpb*2	GTR+I+G	5,000,000	Jaklitsch et al. (2013)

Phylogenetic analyses were performed on the CIPRES Science Gateway portal (Miller & Pfeiffer 2012). The ML trees were generated from the final concatenated alignment using RAxMLHPC2 on the XSEDE (v. 8.2.10) tool (Stamatakis 2014) with 1,000 replicates of bootstrapping. The BI analyses were computed with MrBayes version 3.2.6 (Ronquist et al. 2012). Six simultaneous Markov chains were run for different generations (Table 3). Trees were sampled at every 1000 generations, ending the run automatically when the standard deviation of split frequencies dropped below 0.01. For both ML and BI, MrModeltest version 2.3 (Nylander 2004) was run under the Akaike Information Criterion implemented in PAUP version 4.0b10 (Swofford & Sullivan 2003) to estimate the best evolutionary model (Table 3). Phylogenetic trees were visualized with FigTree version 1.4.0 (Rambaut 2012) and edited in Adobe Illustrator (Adobe Inc.).

Results

Updated checklist

Mycological data extraction

Seven hundred and seventy-six records of *Fagales*-inhabiting *Ascomycota* in Italy have been comprehensively reported in 308 publications, other resources (1873–2021), and our fungal collection. In the late 20th century, journal articles, books, book chapters, theses, and websites gained prominence as mycological contributions. In the majority of historical studies, species identification was mainly based on morphology, and their descriptions were not in English. Morphology-based taxonomic revisions, checklists, and monographs for different systematic groups of fungi were carried out. Even though most of these publications mentioned hosts and substrates, ecological and geographical data were poorly reported. Over time, both morphology and molecular data were used to avoid incorrect identifications and update the accurate taxonomic placement of the species.

Recent studies provide accurate taxonomic updates in different sources to understand fungal diversity and this fragmented knowledge still needs to be aggregated. The number of publications in *Fagales*-inhabiting *Ascomycota* used to produce our checklist, is shown in Fig. 6. Though fewer studies reported on *Fagales*-inhabiting *Ascomycota* from the late 19th to mid-20th century, rapid growth is seen during 1961–2020. Starting with a smaller number of (five) publications from 1961 to 1970, the number of publications reached 172 from 2011–2020. Hence, the study weight of *Fagales*-inhabiting *Ascomycota* is currently reaching a golden era with a higher number of mycological studies in different Italian habitats.

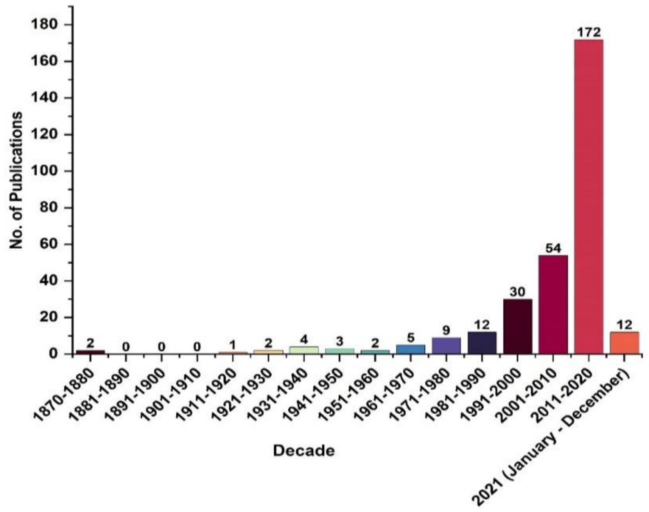

Fig. 6 – Number of taxonomic publications of *Fagales*-inhabiting *Ascomycota* (1873–2021).

A checklist of *Ascomycota* associated with *Fagales* in Italy

An updated list of *Ascomycota* associated with *Fagales* species is provided in Table 4, with their updated taxonomic placements. Taxa with available sequence data are marked with an asterisk "*". The taxa accepted in *incertae sedis* are marked with a hash "#". The doubtful taxonomic ranks and taxa are marked with a dot "•" sign. Location data available for *Ascomycota* (excluding lichen-associated taxa) are indicated with a square bracket "[ ]", with the Italian administrative region(s) in abbreviated form: Abruzzo [Abr], Apulia [Apl], Basilicata [Bas], Calabria [Cal], Campania [Camp], Emilia-Romagna [Emi], Friuli-Venezia Giulia [Fri], Lazio/Latium [Laz], Liguria [Lig], Lombardy [Lom], Marche [Mar], Piedmont [Pie], Sardinia [Sar], Sicily [Sic], Trentino-Alto Adige [Tre], Tuscany [Tus], Umbria [Umb], Aosta Valley [Aos] and Veneto [Ven]. The records identified at the genus level are classified as "spp. or sp." according to the original publication.

Table 4 *Ascomycota* associated with *Fagales* trees in Italy (776 taxa)

Family	Species	Host plant(s)	Reference(s)
Phylum: *Ascomycota*			
Subphylum: *Pezizomycotina* (746)			
Class: *Arthoniomycetes* (20)			
Order: *Arthoniales* (20 taxa)			
Arthoniaceae	**Arthonia mediella* Nyl. [L]	*Fagus* spp.	Nimis (2016)
	A. granosa B. de Lesd. [E, L]	*Quercus ilex*	Nimis (2016)
	**A. hypobela* Nyl. [E, L]	*Quercus pubescens*, *Q. suber*	Nimis (2016)
	A. reniformis (Pers.) Röhl. [E, L]	*Carpinus* spp., *Corylus* spp., *Fagus* spp.	Nimis (2016)
	**A. ruana* A. Massal. [E, L]	*Alnus* spp., *Corylus* spp., *Fagus* spp.	Nimis (2016)
	A. stellaris Kremp. [E, L]	*Corylus* spp., *Fagus* spp.	Nimis (2016)
	A. subastroidea Anzi [E, L]	*Fagus* spp.	Nimis (2016)
	**A. vinosa* Leight. [E, L]	*Quercus* spp.	Nascimbene et al. (2021)
	**Coniocarpon cinnabarinum* DC. [L]	*Carpinus* spp., *Fagus* spp., *Quercus ilex*	Nimis (2016)
	C. elegans (Ach.) Duby [E, L]	*Corylus* spp.	Nimis (2016)
	**Reichlingia zwackhii* (Sandst.) Frisch & G. Thor [E, L]	*Carpinus* spp.	Nimis (2016)
Arthoniales genera *incertae sedis*	**Bactrospora patellarioides* (Nyl.) Almq. var. *patellarioides* [L]	*Quercus* spp.	Nimis (2016)
Chrysotrichaceae	**Chrysothrix caesia* (Flot.) Ertz & Tehler [L]	*Carpinus* spp.	Nimis (2016)
Opegraphaceae	**Opegrapha corticola* Coppins & P. James [E, L]	*Q. ilex*	Nimis (2016)
	**O. vermicellifera* (Kunze) J.R. Laundon [L]	*Carpinus betulus*, *Juglans regia*,	Nascimbene et al. (2021)
Roccellaceae	**Dendrographa latebrarum* (Ach.) Ertz & Tehler [L]	*Quercus* spp.	Nimis (2016)
	**Diromma dirinellum* (Nyl.) Ertz & Tehler [L]	*Quercus cerris*	Nascimbene et al. (2021)
	**Lecanactis abietina* (Ach.) Körb. [E, L]	*Quercus* spp.	Nimis (2016)
	**Ocellomma picconianum* (Bagl.) Ertz & Tehler [L]	*Q. ilex*	Nimis (2016)
	**Schismatomma ricasolii* (A. Massal.) Egea & Torrente [E, L]	*Fagus* spp.	Nimis (2016)
Class: *Candelariomycetes* (5)			
Order: *Candelariales* (5 taxa)			
Candelariaceae	**Candelaria concolor* (Dicks.) Stein [L]	*Alnus alnobetula*, *Juglans regia*	Gheza (2019)
	**Candelariella faginea* Nimis, Poelt & Puntillo [L]	*Fagus sylvatica*	Nimis (2016)
	**C. lutella* (Vain.) Räsänen [E, L]	*Alnus* spp.	Nimis (2016)
	**C. subdeflexa* (Nyl.) Lettau [E, L]	*Juglans* spp.	Nimis (2016)
	**C. xanthostigma* (Pers. ex Ach.) Lettau [L]	*Quercus* sp.	Nimis (2016)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Class: *Coniocybomycetes* (7)			
Order: *Coniocybales* (7 taxa)			
Coniocybaceae	**Chaenotheca brunneola* (Ach.) Müll. Arg. [E, L]	*Castanea sativa*, *Quercus ilex*	Nimis (2016), Nascimbene et al. (2021)
	**C. ferruginea* (Sm.) Mig. [L]	*Castanea* spp., *Quercus* spp.,	Nimis (2016)
	**C. phaeocephala* (Turner) Th. Fr. [L]	*Quercus* spp., *Castanea sativa*	Nascimbene et al. (2021)
	**C. stemonea* (Ach.) Müll. Arg. [E, L]	*Betula* spp., *Quercus* spp.	Nimis (2016)
	**C. subroscida* (Eitner) Zahlbr. [E, L]	*Betula* spp.	Nimis (2016)
	**C. trichialis* (Ach.) Th. Fr. [L]	*Quercus ilex*	Nimis (2016)
	•*Embolus clavus* Sacc. & Speg. [S]	*Castanea vesca*	Saccardo (1877), Farr (1973)
Class: *Dothideomycetes* (189)			
Order: *Asterinales* (1 taxon)			
Asterinaceae	*Asterostomella* sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: *Botryosphaeriales* (33 taxa)			
Aplosporellaceae	*Aplosporella coryli* (Ellis & Everh.) H. Ruppr. [[Cam]] = *Sphaeropsis coryli* Ellis & Everh. [P]	*Corylus avellana*	Minutolo et al. (2016)
Botryosphaeriaceae	**Botryosphaeria corticola* A.J.L. Phillips, A. Alves & J. Luque [P, [Sar]]	*Quercus suber*	Linaldeddu et al. (2010), Hanifeh et al. (2019)
	**B. dothidea* (Moug.) Ces. & De Not. [En, P, S, [Emi, Lom, Sar, Tre, Ven]] = **B. quercus* Wijayaw., A.J.L. Phillips, Camporesi & K.D. Hyde [S]	*Ostrya carpinifolia*, *Quercus ilex*, *Q. robur*¸ *Q. rubra*, *Quercus* sp.	Turco et al. (2006), Piskur et al. (2011), Linaldeddu et al. (2014), Wijayawardene et al. (2016b), Scala et al. (2019), Zhang et al. (2021)
	**B. quercuum* (Schwein.) Sacc. [En, S, [Lom, Tus]] = *Botryosphaeria hoffmanni* Höhn. [S]	*Fagus sylvatica*, *Quercus* spp.	Danti et al. (2002), Saitta et al. (2011)
	Botryosphaeria spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	**Diplodia africana* Damm & Crous [P, [Sar, Tus]]	*Quercus ilex*	Seddaiu et al. (2019)
	D. amphisphaerioides Pass.	*Quercus ilex*	Petri (1932, 1933)
	D. castaneae Sacc.	*Castanea* sp.	Sibilia (1929)
	**D. corticola* A.J.L. Phillips, A. Alves & J. Luque [P, [Sar]]	*Quercus ilex*, *Q. suber*, *Quercus* spp.	Lynch et al. (2013, 2014), Alves et al. (2014), Linaldeddu et al. (2014, 2016b), Giambra et al. (2016), Moricca et al. (2016), Panzavolta et al. (2018)
	**D. coryli* Fuckel	*Corylus avellana*	Poyronel (1915)
	**D. juglandis* (Fr.) Fr. [P]	*Juglans nigra*, *J. regia*	Belisario (1996)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	•**D. mutila* (Fr.) Mont. P, En, [Tus]	*Quercus cerris*, *Q. robur* *Q. suber*, *Quercus* sp.	Ragazzi & Mesturino (1987), Venturella (1991), Ragazzi et al. (2003), Zhang et al. (2021)
	**D. sapinea* (Fr.) Fuckel P, [Sar]	*Corylus avellana*	Linaldeddu et al. (2016a, b)
	**D. seriata* De Not. P, [Sar, Tus]	*Corylus avellana*, *Q. ilex*, *Quercus* spp.	Linaldeddu et al. (2014, 2016a), Panzavolta et al. (2018)
	Diplodia spp. [Tre]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	Dothiorella fructicola Scalia	*Quercus* sp.	Venturella (1991)
	**D. guttulata* Qing Tian, Camporesi & K.D. Hyde S, [Emi]	*Alnus glutinosa*	Tian et al. (2018)
	**D. iberica* A.J.L. Phillips, J. Luque & A. Alves P, [Sar]	*Corylus avellana*, *Ostrya carpinifolia*, *Ostrya* spp., *Quercus suber*	Lynch et al. (2014), Linaldeddu et al. (2016a), Dissanayake et al. (2016a)
	**D. omnivora* Linald., Deidda & Scanu P, [Sar]	*Corylus avellana*, *Quercus ilex*	Dissanayake et al. (2016a), Linaldeddu et al. (2016a), Lawrence et al. (2017), Vaczy et al. (2018), Tan et al. (2019)
	* *Dothiorella ostryae* Manawasinghe, Camporesi & K.D. Hyde P, [Emi]	*Ostrya carpinifolia*	Hongsanan et al. (2020b)
	**D. parva* Abdollahz., Zare & A.J.L. Phillips En, P, [Sar, Tre]	*Corylus avellana* *Ostrya carpinifolia*	Abdollahzadeh et al. (2014), Pavlic-Zupanc et al. (2015), Dissanayake et al. (2016a, b), Linaldeddu et al. (2016a), Vaczy et al. (2018), Scala et al. (2019)
	D. sarmentorum (Fr.) A.J.L. Phillips, A. Alves & J. Luque P, [Tus]	*Quercus* spp.	Panzavolta et al. (2018)
	**D. symphoricarposicola* W.J. Li, Jian K. Liu & K.D. Hyde P, [Sar]	*Corylus avellana*	Linaldeddu et al. (2016a)
	Dothiorella sp. [Emi, Tre]	*Ostrya carpinifolia*	Piskur et al. (2011), Pavlic-Zupanc et al. (2015), Pitt et al. (2015), You et al. (2017)
	•*Fusicoccum juglandis* C. Massal.	*Juglans regia*	Venturella (1991)
	•*F. quercus* Oudem. En, [Tus]	*Quercus robur*	Ragazzi et al. (2003)
	**Lasiodiplodia mediterranea* Linald., Deidda & Berraf-Tebbal P, [Sar]	*Quercus ilex*	Linaldeddu et al. (2015), Dissanayake et al. (2016b), Coutinho et al. (2017), Cruywagen et al. (2017), Dou et al. (2017), Netto et al. (2017), Custodio et al. (2018), Li et al.

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
			(2018), Santos et al. (2020)
	Neofusicoccum mangiferae (Syd. & P. Syd.) Crous, Slippers & A.J.L. Phillips [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**N. parvum* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips [P, [Lom, Sar, Tus]] = *Botryosphaeria parva* Pennycook & Samuels [P]	*Quercus ilex*, *Q. robur*, *Q. suber*, *Quercus* spp.	Crous et al. (2006), Linaldeddu et al. (2007), Moricca et al. (2012), Sakalidis et al. (2013), Linaldeddu et al. (2014), Mohammadi et al. (2014), Panzavolta et al. (2018), Zlatkovic et al. (2019)
	**N. ribis* (Slippers, Crous & M.J. Wingf.) Crous, Slippers & A.J.L. Phillips [[Apl]] = *Botryosphaeria ribis* Grossenb. & Duggar [P]	*Juglans* sp.	Frisullo et al. (1994), Crous et al. (2006)
	Sphaeropsis spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Melanopsaceae	**Melanops fagicola* W.J. Li, Camporesi & K.D. Hyde [S, [Emi]]	*Fagus sylvatica*	Li et al. (2020)
Phyllostictaceae	*Phyllosticta* spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Order: *Capnodiales* (14 taxa)			
Cladosporiaceae	*Acroconidiella* spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	Cladosporium alneum Pass. ex K. Schub. [P, [Emi]]	*Alnus glutinosa*	Schubert et al. (2006), Bensch et al. (2012)
	C. astroideum var. astroideum Ces. [S, [Emi, Tre, Ven]]	*Castanea sativa*, *Juglans regia*, *Quercus pubescens*	Bensch et al. (2012)
	**C. cladosporioides* (Fresen.) G.A. de Vries [En, S, [Cam, Tus]]	*Fagus sylvatica*¸ *Quercus cerris*, *Q. ilex*, *Q. pubescens*, *Q. robur*	Danti et al. (2002), Ragazzi et al. (2003), Zucconi & Pasqualetti (2007), Lunghini et al. (2013)
	•*C. epiphyllum* (Pers.) Nees	*Juglans regia*	Dugan et al. (2004)
	C. gracile Corda	*Quercus ilex*	Venturella (1991)
	**C. herbarum* (Pers.) Link	*Castanea vesca*	David (1997)
	**C. langeronii* (Fonseca, Leão & Nogueira) Vuill. [S]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
	**C. macrocarpum* Preuss [[Cam]] = *Davidiella macrocarpa* Crous, K. Schub. & U. Braun [S]	*Quercus ilex*	Lunghini et al. (2013), Roskov et al. (2019)
	**C. oxysporum* Berk. & M.A. Curtis [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	**C. sphaerospermum* Penz. [S]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
	**C. variabile* (Cooke) G.A. de Vries [[Cam]] = *Davidiella variabile* Crous, K. Schub. & U. Braun [S]	*Quercus ilex*	Lunghini et al. (2013), Roskov et al. (2019)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	Cladosporium spp. [S, [Tre, Tus]]	*Quercus ilex*, *Juglans regia*	Zucconi & Pasqualetti (2007), Pardatscher & Schweigkofler (2009)
	Cladosporium sp. [[Tus]]	*Quercus* spp.	Panzavolta et al. (2018)
Order: *Dothideales* (3 taxa)			
Dothideales genera *incertae sedis*	*Hormonema* sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
Saccotheciaceae	**Aureobasidium pullulans* (de Bary & Löwenthal) G. Arnaud [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002),
	Aureobasidium spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Order: *Eremithallales* (1 taxon)			
Melaspileaceae	**Melaspilea enteroleuca* (Ach.) Ertz & Diederich [E, L]	*Quercus* spp.	Nimis (2016)
Order: *Gloniales* (1 taxon)			
Gloniaceae	*Glonium lineare* (Fr.) De Not. [S, [Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
Order: *Hysteriales* (2 taxa)			
Hysteriaceae	**Hysterium angustatum* Alb. & Schwein [S, [Lom, Fri, Tus, Ven]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**H. pulicare* Pers. [S, [Lom]]	*Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
Order: *Kirschsteiniotheliales* (1 taxon)			
Kirschsteiniotheliales genera *incertae sedis*	*Taeniolella* sp. [En, S, [Tus]]	*Fagus sylvatica*, *Quercus ilex*	Danti et al. (2002), Zucconi & Pasqualetti (2007)
Order: *Microthyriales* (4 taxa)			
Microthyriaceae	*Microthyrium cytisi* Fuckel [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	**Microthyrium ilicinum* De Not. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	**M. microscopicum* Desm.	*Quercus* sp.	Venturella (1991)
	**M. versicolor* (Desm.) Höhn. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Order: •*Mycosphaerellales* (19 taxa)			
Dissoconiaceae	**Ramichloridium apiculatum* (J.H. Mill., Giddens & A.A. Foster) de Hoog [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Extremaceae	**Petrophila incerta* de Hoog & Quaedvl [S]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
Mycosphaerellaceae	*Asteromella quercifolii* C. Massal.	*Quercus robur*, *Q. ilex*	Venturella (1991), Vanev & Van (1998)
	Cercospora coryli Montemart.	*Corylus avellana*	Chupp (1954), Crous & Braun (2003)
	Cercospora sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**Exosporium stylobatum* Curzi & Barbaini [S]	*Juglans regia*	Curzi & Barbaini (1927), Voglmayr & Jaklitsch (2017)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	Passalora bacilligera (Mont. & Fr.) Mont. & Fr.	*Alnus glutinosa*	Crous & Braun (2003)
	Phaeoramularia sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	Ramularia alnicola Cooke = *Ramularia alnicola* var. *multiseptata* U. Braun [S]	*Alnus incana*	Braun (1998)
	•*R. endophylla* Verkley & U. Braun = •**Mycosphaerella punctiformis* (Pers.) Starbäck = *Asteromella maculiformis* (Sacc.) Petr. [P] = *Phyllosticta maculiformis* Sacc. = •**Mycosphaerella maculiformis* (Pers.) J. Schröt. [P]	*Castanea sativa*, *Fagus* sp., *Quercus robur*	Spaulding (1961), Venturella (1991), Vanev & Van (1998), Morales-Rodriguez et al. (2019)
	Ramularia spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	**Septoria alni* Sacc. [P, [Ven]]	*Alnus glutinosa*	Constantinescu (1984), Priest (2006)
	S. dryophila Sacc.	*Quercus ilex*	Venturella (1991)
	**Sphaerulina betulae* (Pass.) Quaedvl., Verkley & Crous [[Emi, Ven]] = *Septoria betulae* Pass. [P]	*Betula alba*, *B. pendula*	Constantinescu (1984), Priest (2006), Verkley et al. (2013)
	Stigmina carpophila (Lév.) M.B. Ellis	*Quercus ilex*	Venturella (1991)
	**Stromatoseptoria castaneicola* (Desm.) Quaedvl., Verkley & Crous [P, [Laz]]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
	**Zasmidium cellare* (Pers.) Fr. [[Tus]] = *Rhinocladiella ellisii* D. Hawksw. [S]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Neodevriesiaceae	**Neodevriesia fraserae* (Crous & R.G. Shivas) M.M. Wang & L. Cai = *Devriesia fraserae* Crous & R.G. Shivas [S]	*Castanea sativa*	Wang et al. (2017), Morales-Rodriguez et al. (2019)
Teratosphaeriaceae	*Stenella* sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: *Myriangiales* (1 taxon)			
Elsinoaceae	**Elsinoe quercus-ilicis* G. Arnaud ex Jenkins & Goid. [[Apl]] = *Sphaceloma quercus-ilicis* Martelli & Laviola	*Quercus ilex*	Venturella (1991), Fan et al. (2017)
Order: *Patellariales* (2 taxa)			
Patellariaceae	**Patellaria atrata* (Hedw.) Fr. [S, [Lig, Lom, Tus, Ven]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**Rhizodiscina lignyota* (Fr.) Hafellner [S, [Lom, Tre]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
Order: *Pleosporales* (71 taxa)			
Amniculicolaceae	**Murispora fagicola* Wanas., Camporesi, E.B.G. Jones & K.D. Hyde [S, [Emi]]	*Fagus sylvatica*	Wanasinghe et al. (2015)
Amorosiaceae	**Angustimassarina coryli* Wanas., Camporesi, E.B.G. Jones & K.D. Hyde [S, [Tre]]	*Corylus avellana*	Hyde et al. (2017)
	**A. premilcurensis* Tibpromma, Camporesi & K.D. Hyde [S, [Emi]]	*Carpinus betulus*	Tibpromma et al. (2017)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	A. sylvatica* N.I. de Silva, Camporesi & K.D. Hyde **S, [Emi]	*Fagus sylvatica*	Hyde et al. (2019)
Bambusicolaceae	**Corylicola italica* Wijesinghe, Camporesi, Yong Wang bis & K.D. Hyde **S, [Emi]**	*Corylus avellana*	Wijesinghe et al. (2020)
Camarosporiaceae	*Camarosporium* sp. **P, [Tus]**	*Quercus* spp.	Panzavolta et al. (2018)
Coniothyriacea	*Coniothyrium* sp. **En, [Tus]**	*Fagus sylvatica*	Danti et al. (2002)
Cucurbitariaceae	**Neocucurbitaria cava* (Schulzer) Valenz.-Lopez, Crous, Stchigel, Guarro & Cano **[Tus]** = *Pleurophoma cava* (Schulzer) Boerema, Loer & Hamers **P** = *Phoma cava* Schulzer **En**	*Quercus* cerris, *Q. pubescens*, *Q. robur*	Ragazzi et al. (2003), de Gruyter et al. (2010), Valenzuela-Lopez et al. (2018), Hanifeh et al. (2019)
	**N. quercina* (Kabát & Bubák) Wanas., E.B.G. Jones & K.D. Hyde = *Pyrenochaeta quercina* Kabát & Bubák	*Quercus robur*	de Gruyter et al. (2010), Duarte & Barreto (2015), Giraldo et al. (2017), Valenzuela-Lopez et al. (2018)
	Parafenestella ostryae* (Wanas. et al.) Jaklitsch & Voglmayr **[Emi] = *Fenestella ostryae* Wanas., Camporesi, E.B.G. Jones & K.D. Hyde **S**	*Ostrya carpinifolia*	Wanasinghe et al. (2017), Jaklitsch et al. (2018)
Dictyosporiaceae	**Dictyosporium elegans* Corda **S, [Cam]**	*Quercus ilex*	Lunghini et al. (2013)
	Dictyocheirospora heptaspora* (Garov.) M.J. D'souza, Boonmee & K.D. Hyde **[Cam] = *Dictyosporium heptasporum* (Garov.) Damon **S**	*Quercus ilex*	Lunghini et al. (2013), Boonmee et al. (2016)
	Jalapriya toruloides* (Corda) M.J. D'souza, Hong Y. Su, Z.L. Luo & K.D. Hyde **[Cam, Tus] = *Dictyosporium toruloides* (Corda) Guég. **S**	*Quercus ilex*	Zucconi & Pasqualetti (2007), Lunghini et al. (2013), Boonmee et al. (2016)
	Pseudodictyosporium wauense* Matsush. **S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
Didymellaceae	*Ascochyta coryli* Sacc. & Speg. **P**	*Corylus avellana*	Watson (1971), Farr (1973)
	A. juglandis* Boltsh. **P	*Juglans regia*	Spaulding (1961)
	A. quercus Sacc. & Speg. **P**	*Quercus ilex*	Spaulding (1961)
	Didymella corylicola* Voglmayr, Scarpari, Di Giambattista, Vitale & Luongo **P, [Cam]	*Corylus avellana*	Scarpari et al. (2020)
	D. involucralis (Pass.) Sacc. **[Cam** = *Leptosphaeria involucralis* Pass.	*Castanea* spp.	Crane & Shearer (1991)
	Epicoccum nigrum* Link **En, P, [Laz, Tus] = *Epicoccum purpurascens* Kunze	*Castanea sativa*, *Fagus sylvatica*, *Quercus* spp.	Danti et al. (2002), Ragazzi et al. (2003), Morales-Rodriguez et al. (2019)
	Epicoccum spp. **[Tre]**	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	**Peyronellaea obtusa* (Fuckel) Aveskamp, Gruyter & Verkley = *Botryosphaeria obtusa* (Schwein.) Shoemaker	*Quercus suber*	Tang et al. (2012)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	Phoma sp. En, [Tre, Tus]	*Fagus sylvatica*, *Juglans regia*	Danti et al. (2002), Pardatscher & Schweigkofler (2009)
Didymosphaeriaceae	**Montagnula jonesii* Tennakoon, Wanas., Phook. & K.D. Hyde S, [Tus]	*Fagus sylvatica*	Tennakoon et al. (2016)
	**Pseudocamarosporium camporesii* Q. Tian & K.D. Hyde S, [Tus]	*Quercus cerris*	Hyde et al. (2020b)
	**P. quercinum* Wijayaw., Camporesi & K.D. Hyde S, [Emi]	*Quercus pubescens*	Wijayawardene et al. (2016a)
Leptosphaeriaceae	*Leptosphaeria alcides* f. *quercina* Cif. S	*Quercus robur*	Crane & Shearer (1991)
	L. faginea Pass. S, [Laz]	*Fagus sylvatica*	Crane & Shearer (1991)
	L. vagabunda Sacc. [Ven]	*Alnus glutinosa*, *Corylus avellana*, *Quercus pediinculala*	Crane & Shearer (1991)
	L. valdobbiae Ferraris S, [Lig]	*Fagus sylvatica*	Crane & Shearer (1991)
Massariaceae	*Massaria alpina* Sacc. & Speg.	*Alnus viridis*	Farr (1973)
Massarinaceae	**Helminthosporium italicum* Qing Tian, Camporesi & K.D. Hyde S, [Emi]	*Alnus glutinosa*	Tian et al. (2018)
	**H. juglandinum* Voglmayr & Jaklitsch S, [Tus]	*Juglans regia*	Voglmayr & Jaklitsch (2017)
	**H. microsorum* D. Sacc. [Ven] = *Massarinula italica* D. Sacc. S	*Quercus ilex*	Voglmayr & Jaklitsch (2017)
	•**H. quercinum*; misidentified as *Corynespora proliferata* Loer.) En	*Fagus sylvatica*	Voglmayr & Jaklitsch (2017)
Melanommataceae	*Aposphaeria labens* (Sacc.) Sacc.	*Quercus* sp.	Venturella (1991)
	A. protea Peyronel	*Quercus robur*	Poyronel (1915)
	Aposphaeria sp. En, [Tus]	*Fagus sylvatica*	Danti et al. (2002)
	**Herpotrichia macrotricha* (Berk. & Broome) Sacc. S, [Tre]	*Fagus sylvatica*	Saitta et al. (2011)
	**Melanomma pulvis-pyrius* (Pers.) Fuckel = *Dinemasporium pulvis-pyrius* (Sacc.) Shkarupa	*Alnus* sp., *Carpinus* sp.	Nag Raj (1993)
	Phragmocephala elliptica (Berk. & Broome) S. Hughes S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	Phragmocephala sp. S, [Tus] = *Endophragmia* sp. S	*Quercus ilex*	Zucconi & Pasqualetti (2007), Wijayawardene et al. (2020), MycoBank (2022)
Mycoporaceae	*Mycoporum antecellens* (Nyl.) R.C. Harris NL	*Corylus* spp., *Fagus* spp.	Nimis (2016)
Neohendersoniaceae	*Neohendersonia fagi* Wijayaw., Camporesi, McKenzie & K.D. Hyde S, [Emi]	*Fagus sylvatica*	Wijayawardene et al. (2016b)
	**N. kickxii* (Westend.) B. Sutton & Pollack En, [Tus]	*Fagus sylvatica*	Danti et al. (2002), Giraldo et al. (2017), Crous et al. (2018)
Nigrogranaceae	**Nigrograna fuscidula* (Sacc.) Jaklitsch & Voglmayr [Cam, Lom] = *Melanomma fuscidulum* (Sacc.) Sacc. S	*Fagus sylvatica*	Saitta et al. (2011), Jaklitsch & Voglmayr (2016)
Periconiaceae	**Periconia byssoides* Pers. En	*Castanea sativa*	Morales-Rodriguez et al. (2019)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**P. cookei* E.W. Mason & M.B. Ellis [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Phaeosphaeriaceae	**Scolicosporium macrosporium* (Berk.) B. Sutton [S, [Emi]]	*Fagus sylvatica*	Wijayawardene et al. (2016b)
	S. minkeviciusii Treigienė [S, [Emi]]	*Quercus pubescens*	Wijayawardene et al. (2013), Li et al. (2015a)
Pleomassariaceae	**Prosthemium alni* Qing Tian, Camporesi & K.D. Hyde [S, [Emi]]	*Alnus glutinosa*	Tian et al. (2018)
Pleosporaceae	**Alternaria alternariae* (Cooke) Woudenb. & Crous [[Tus]] = *Ulocladium alternariae* (Cooke) E.G. Simmons [S]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Woudenberg et al. (2013)
	**A. alternata* (Fr.) Keissl. [En, P, S, [Cam, Tus]]	*Corylus avellana*, *Juglans regia*, *Quercus ilex*, *Q. cerris*, *Q. pubescens*, *Q. robur*, *Quercus* spp.	Belisario et al. (1999), Ragazzi et al. (2003), Hong et al. (2006), Andrew et al. (2009), Belisario & Santori (2009), Lunghini et al. (2013), Panzavolta et al. (2018)
	**A. arborescens* E.G. Simmons [P, [Emi, Laz]]	*Juglans regia*, *Corylus avellana*	Hong et al. (2006), Andrew et al. (2009), Belisario & Santori (2009)
	**A. consortialis* (Thüm.) J.W. Groves & S. Hughes [S,P , [Tus]] = **Ulocladium consortiale* (Thüm.) E.G. Simmons [P]	*Quercus ilex*, *Quercus* spp.	Zucconi & Pasqualetti (2007), Panzavolta et al. (2018)
	**A. longipes* (Ellis & Everh.) E.W. Mason [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	A. scrophulariae (Desm.) Rossman & Crous = *Pleospora vulgaris* var. *putaminum* Sacc.	*Corylus avellana*	Shoemaker (1992), Rossman et al. (2015)
	**A. tenuissima* (Kunze) Wiltshire [P, [Laz, Ven]]	*Juglans regia*, *Corylus avellana*	Hong et al. (2006), Andrew et al. (2009), Belisario & Santori (2009)
	Alternaria spp. [[Tre, Tus]] = *Ulocladium* spp. [S]	*Juglans regia*, *Quercus ilex*	Zucconi & Pasqualetti (2007), Pardatscher & Schweigkofler (2009), Woudenberg et al. (2013)
	Alternaria sp. [[Tus]] = *Ulocladium* sp. [En]	*Quercus cerris*, *Q. pubescens*, *Q. robur*	Ragazzi et al. (2003), Woudenberg et al. (2013)
	**Curvularia spicifera* (Bainier) Boedijn [[Tus]] = *Cochliobolus spicifer* R.R. Nelson [S]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**C. tsudae* H. Deng, Y.P. Tan & R.G. Shivas [[Tus]] = *Cochliobolus australiensis* (Tsuda & Ueyama) Alcorn [S]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Deng et al. (2015)
	Drechslera spp. [S [Tre, Tus]]	*Juglans regia*, *Quercus ilex*	Zucconi & Pasqualetti (2007), Pardatscher & Schweigkofler (2009)
	**Stemphylium vesicarium* (Wallr.) E.G. Simmons [P, [Laz]] = *Pleospora herbarum* var. *ostryae* Berl.	*Castanea sativa*, *Ostrya carpinifolia*	Shoemaker (1992), Morales-Rodriguez et al. (2019)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Pleosporales genera *incertae sedis*	*Pyrenochaeta* sp. En, [Tus]	*Fagus sylvatica*	Danti et al. (2002)
	*_Repetophragma dennisii_ M.B. Ellis ex Subram. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	Scolecobasidium constrictum E.V. Abbott [Cam] = *_Ochroconis constricta_ (E.V. Abbott) de Hoog & Arx S	*Quercus ilex*	Lunghini et al. (2013)
	Scolecobasidium sp. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Torulaceae	*Dendryphion* spp. [Tre]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	*_Torula herbarum_ (Pers.) Link S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	Torula sp. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: _Strigulales_ (4 taxa)			
Strigulaceae	*Strigula affinis* (A. Massal.) R.C. Harris L	*Juglans* spp.	Nimis (2016)
	S. glabra (A. Massal.) V. Wirth E, L	*Carpinus* spp., *Fagus* spp.	Nimis (2016)
	*_S. stigmatella_ (Ach.) R.C. Harris L	*Fagus* spp.	Nimis (2016)
	S. ziziphi (A. Massal.) Cl. Roux & Serus. L	*Quercus* spp., *Castanea* spp.	Nimis (2016)
Order: •_Trypetheliales_ (9 taxa)			
Trypetheliaceae	*Arthopyrenia fallaciosa* (Stizenb. ex Arnold) Thiyagaraja, Ertz, Lücking, Coppins & K.D. Hyde = *_Julella fallaciosa_ (Arnold) R.C. Harris NL	*Betula* spp.	Nimis (2016), Thiyagaraja et al. (2021)
	A. analepta (Ach.) A. Massal NL	*Carpinus* spp., *Corylus* spp., *Quercus* spp.	Nimis (2016)
	A. cerasi (Schrad.) A. Massal. NL	*Corylus* spp.	Nimis (2016)
	A. cinereopruinosa (Schaer.) A. Massal. NL	*Corylus* spp.	Nimis (2016)
	A. grisea (Schaer.) Kъrb. E, L	*Betula* spp.	Nimis (2016)
	A. persoonii A. Massal L	*Fagus* spp.	Nimis (2016)
	*_A. salicis_ A. Massal. E, L	*Carpinus* spp., *Corylus* spp.	Nimis (2016)
	*_A. subcerasi_ (Vain.) Zahlbr. NL	*Betula* spp.	Nimis (2016)
	A. tuscanensis Coppins & Ravera NL	*Castanea* spp.	Nimis (2016)
Order: _Tubeufiales_ (3 taxa)			
Tubeufiaceae	*_Helicoma monilipes_ Ellis & L.N. Johnson S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	Helicosporium sp. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	*_Tubeufia cerea_ (Berk. & M.A. Curtis) Höhn. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: _Venturiales_ (4 taxa)			
Sympoventuriaceae	*Fusicladium scribnerianum* (Briosi & Cavara) M.B. Ellis P, [Lom]	*Betula populifolia*	Ellis (1976), Schubert et al. (2003), Dugan et al. (2004)
	*_Matsushimaea fasciculata_ Subram. S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**Ochroconis tshawytschae* (Doty & D.W. Slater) Kiril. & Al-Achmed [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Venturiaceae	*Venturia alnea* (Fr.) E. Müll.	*Alnus glutinosa*	Sivanesan (1977)
***Dothideomycetes incertae sedis* (8 taxa)**			
Aulographaceae	**Aulographum hederae* Lib. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Englerulaceae	*Sarcinella heterospora* Sacc.	*Juglans regia*	Hosagoudar (2003)
Naetrocymbaceae	*Leptorhaphis epidermidis* (Ach.) Th. Fr. [NL]	*Betula* spp.	Nimis (2016)
	L. maggiana (A. Massal.) Korb. [NL]	*Carpinus* spp., *Corylus* spp., *Quercus* spp.	Nimis (2016)
	Tomasellia diffusa (Leight.) J. Lahm [NL]	*Alnus* spp.	Nimis (2016)
	T. gelatinosa (Chevall.) Zahlbr. [NL]	*Alnus* spp., *Corylus* spp.	Nimis (2016)
Trichothyriaceae	*Lichenopeltella ammophilae* (J.P. Ellis) P.M. Kirk & Minter [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	L. salicis (J.P. Ellis) P.M. Kirk & Minter [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
# *Dothideomycetes* family *incertae sedis* (1 taxon)			
Cookellaceae	*Cookella microscopica* Sacc	*Quercus robur*	Hyde et al. (2013), Hongsanan et al. (2020b)
# *Dothideomycetes* (4 taxa)			
Dothideomycetes genera *incertae sedis*	*Ampullifera foliicola* Deighton [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Bactrodesmium cubense (R.F. Castañeda & G.R.W. Arnold) Zucconi & Lunghini	*Quercus ilex*	Zucconi & Lunghini (1997)
	**Monodictys levis* (Wiltshire) S. Hughes [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Monodictys sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
Order: *Valsariales* (3 taxa)			
Valsariaceae	**Valsaria rudis* (P. Karst. & Har.) Theiss. & Syd. ex Petr. & Syd. [S, [Emi, Laz]]	*Quercus cerris*, *Quercus* sp.	Jaklitsch et al. (2015), Pem et al. (2019), This study
	**V. insitiva* (Tode) Ces. & De Not.	*Carpinus betulus*, *Quercus robur*	Ju et al. (1996)
	**V. ostryae* D. Pem, R. Jeewon, Camporesi & K.D. Hyde [S, [Emi]]	*Ostrya carpinifolia*	Pem et al. (2019)
Class: *Eurotiomycetes* (25)			
Order: *Eurotiales* (10 taxa)			
Aspergillaceae	*Aspergillus* spp. [[Tre, Tus]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	Aspergillus sp.	*Quercus* spp.	Panzavolta et al. (2018)
	**Penicillium adametzioides* S. Abe ex G. Sm. [S]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
	**P. brevicompactum* Dierckx [S,P]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
	**P. citrinum* Thom [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**P. expansum* Link	*Quercus pubescens*	Venturella (1991)
	Penicillium sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
	Penicillium spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Elaphomycetaceae	**Elaphomyces anthracinus* Vittad. [H, [Sic]]	*Quercus cerris*, *Quercus ilex*	Saitta et al. (2008)
Thermoascaceae	*Paecilomyces* sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: *Chaetothyriales* (4 taxa)			
Herpotrichiellaceae	**Capronia nigerrima* (R.R. Bloxam) M.E. Barr [S, [Lom]]	*Quercus* spp.	Saitta et al. (2011)
	Phialophora sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
	Rhinocladiella sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	Thysanorea rousseliana (Mont.) Hern.-Restr. & Crous [[Tus]] = *Pseudospiropes rousselianus* (Mont.) M.B. Ellis [S]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Hernández-Restrepo et al. (2020)
Order: *Mycocaliciales* (5 taxa)			
Mycocaliciaceae	**Chaenothecopsis pusilla* (Ach.) A. F. W. Schmidt = *Embolidium italicum* Sacc.	*Fagus* spp.	Farr (1973), Roskov et al. (2018)
	**Mycocalicium victoriae* (C. Knight ex F. Wilson) [L]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
	Phaeocalicium compressulum (Vain.) A.F.W. Schmidt [NL]	*Alnus viridis*	Nimis (2016)
	**Sphinctrina leucopoda* Nyl. [LC]	*Quercus cerris*	Nascimbene et al. (2021)
	**Stenocybe pullatula* (Ach.) Stein [NL]	*Alnus* spp.	Nimis (2016)
Order: *Phaeomoniellales* (1 taxon)			
Celotheliaceae	*Celothelium ischnobelum* (Nyl.) M.B. Aguirre [E, L]	*Corylus* spp.	Nimis (2016)
Order: *Pyrenulales* (4 taxa)			
Pyrenulaceae	**Pyrenula chlorospila* Arnold [L]	*Corylus* spp., *Quercus* spp.	Nimis (2016)
	Pyrenula coryli A. Massal. [D, L]	*Corylus* spp.	Nimis (2016)
	P. laevigata (Pers.) Arnold [E, L]	*Carpinus* spp., *Fagus* spp.	Nimis (2016)
	**P. nitida* (Weigel) Ach. [L]	*Carpinus* spp., *Fagus* spp., *Quercus* spp.	Nimis (2016)
Order: *Verrucariales* (1 taxon)			
Verrucariaceae	*Verrucaria aberrans* Garov. [L]	*Castanea* spp.	Nimis (2016)
Class: *Lecanoromycetes* (125)			
Order: *Baeomycetales* (5 taxa)			
Trapeliaceae	**Placynthiella icmalea* (Ach.) Coppins & P. James [L]	*Castanea* spp.	Nimis (2016)
	**P. uliginosa* (Schrad.) Coppins & P. James [L]	*Castanea* spp.	Nimis (2016)
	**Trapeliopsis flexuosa* Coppins & P. James [L]	*Castanea* spp.	Nimis (2016)
	**T. pseudogranulosa* Coppins & P. James [L]	*Castanea* spp.	Nimis (2016)
	**T. viridescens* (Schrad.) Coppins & P. James [L]	*Castanea* spp.	Nimis (2016)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Order: *Caliciales* (24 taxa)			
Caliciaceae	**Acolium inquinans* (Sm.) A. Massal. **E, L**	*Castanea* spp., *Quercus* spp.	Nimis (2016)
	A. marcianum (B. de Lesd.) M. Prieto & Wedin **L**	*Castanea sativa*	Nascimbene et al. (2021)
	Buellia hyperbolica Bagl. **E, L**	*Castanea* spp., *Quercus* spp.	Nimis (2016)
	Calicium abietinum* Pers. **L	*Castanea* spp.	Nimis (2016)
	C. adspersum* Pers. **L	*Castanea sativa*, *Quercus* sp.	Nascimbene et al. (2021)
	C. glaucellum* Ach. **L	*Castanea* spp.	Nimis (2016)
	C. montanum* Tibell **E, L	*Castanea* spp.	Nimis (2016)
	C. notarisii* (Tul.) M. Prieto & Wedin **E, L	*Quercus* spp.	Nimis (2016)
	C. quercinum* Pers. **L	*Castanea* spp., *Quercus* spp.	Nimis (2016)
	C. trabinellum* (Ach.) Ach. **L	*Quercus ilex*	Nimis (2016)
	Tetramelas triphragmioides (Anzi) A. Nordin & Tibell **E, L**	*Alnus* spp.	Nimis (2016)
Physciaceae	**Phaeophyscia ciliata* (Hoffm.) Moberg **L**	*Juglans* spp.	Nimis (2016)
	P. orbicularis* (Neck.) Moberg **L	*Juglans regia*	Gheza (2019)
	P. pusilloides* (Zahlbr.) Essl. **L	*Juglans* spp.	Nimis (2016)
	Physcia adscendens* H. Olivier **L	*Alnus alnobetula*	Gheza (2019)
	P. aipolia* (Humb.) Fürnr. **L	*Alnus alnobetula*, *Juglans regia*	Gheza (2019)
	Physconia distorta* (With.) J.R. Laundon **L	*Juglans regia*	Gheza (2019)
	Rinodina albana* (A. Massal.) A. Massal. **L	*Fagus sylvatica*	Nascimbene et al. (2021)
	R. anomala* (Zahlbr.) H. Mayrhofer & Giralt **L	*Quercus* spp.	Nimis (2016)
	R. colobina (Ach.) Th. Fr. **E, L**	*Juglans* spp.	Nimis (2016)
	R. confinis Samp. **L**	*Quercus* spp.	Nimis (2016)
	R. efflorescens* Malme **L	*Fagus* spp., *Quercus* spp.	Nimis (2016)
	R. polyspora Th. Fr. **E, L**	*Carpinus* spp.	Nimis (2016)
	R. polysporoides Giralt & H. Mayrhofer **E, L**	*Juglans* spp., *Quercus* spp.	Nimis (2016)
Order: *Graphidales* (2 taxa)			
Gomphillaceae	*Gyalideopsis calabrica* Puntillo & Vězda **E, L**	*Fagus* spp.	Nimis (2016)
Thelotremataceae	**Thelotrema lepadinum* (Ach.) Ach. **L**	*Fagus* spp.	Nimis (2016)
Order: *Gyalectales* (6 taxa)			
Gyalectaceae	*Ramonia subsphaeroides* (Tav.) Vězda **L**	*Quercus* spp.	Nimis (2016)
Phlyctidaceae	**Phlyctis agelaea* (Ach.) Flot. **L**	*Quercus ilex*	Nimis (2016)
	P. argena* (Spreng.) Flot. **L	*Carpinus* spp.	Nimis (2016)
Trichotheliaceae	**Porina aenea* (Wallr.) Zahlbr. **L**	*Quercus ilex*	Nimis (2016)
(= *Porinaceae*)	= *Pseudosagedia aenea* (Körb.) Hafellner & Kalb		
	P. coralloidea P. James **E, L**	*Quercus ilex*	Nimis (2016)
	P. hibernica P. James & Swinscow **E, L**	*Quercus ilex*	Nimis (2016)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Order: *Lecanorales* (58 taxa)			
Cladoniaceae	**Cladonia macilenta* Hoffm. [L]	*Castanea* spp.	Nimis (2016)
	**C. parasitica* (Hoffm.) Hoffm. [L]	*Castanea* spp.	Nimis (2016)
	**C. polydactyla* (Flörke) Spreng. [L]	*Castanea* spp.	Nimis (2016)
	C. pseudopityrea Vain. [E, L]	*Fagus* spp.	Nimis (2016)
	**Hertelidea botryosa* (Fr.) Printzen & Kantvilas [L]	*Quercus* spp.	Nimis (2016)
	**Lepraria jackii* Tønsberg [L]	*Quercus suber*	Nimis (2016)
Lecanoraceae	*Glaucomaria leptyrodes* (G.B.F. Nilsson) S.Y. Kondr., Lőkös & Farkas = **Lecanora leptyrodes* (Nyl.) Degel. [L]	*Betula* spp., *Fagus* spp.	Nimis (2016), Kondratyuk et al. (2019)
	**Lecanora albella* (Pers.) Ach. [L]	*Fagus* spp.	Nimis (2016)
	**L. argentata* (Ach.) Malme [L]	*Fagus* spp.	Nimis (2016)
	**L. cinereofusca* H. Magn. [E, L]	*Fagus* spp.	Nimis (2016)
	**L. expallens* Ach. [L]	*Quercus cerris*	Nimis (2016)
	**L. horiza* (Ach.) Linds. [L]	*Fagus sylvatica*	Nascimbene et al. (2021)
	L. hypoptoides (Nyl.) Nyl. [L]	*Castanea* spp.	Nimis (2016)
	L. quercicola Coppins & P. James [E, L]	*Castanea* spp., *Quercus* spp.	Nimis (2016)
	**Lecidella albida* Hafellner [L]	*Fagus* spp.	Nimis (2016)
	Polyozosia populicola (DC.) S.Y. Kondr., Lőkös & Farkas = **Lecanora populicola* (DC.) Duby [E, L]	*Alnus* spp.	Nimis (2016), Kondratyuk et al. (2019)
Megalariaceae	**Megalaria laureri* (Th. Fr.) Hafellner [E, L]	*Fagus* spp., *Quercus* spp.	Nimis (2016)
Parmeliaceae	**Bryoria capillaris* (Ach.) Brodo & D. Hawksw. [L]	*Fagus* spp.	Nimis (2016)
	**Cetrelia cetrarioides* (Duby) W.L. Culb. & C.F. Culb. [E, L]	*Alnus alnobetula*	Gheza (2019)
	**C. chicitae* (W.L. Culb.) W.L. Culb. & C.F. Culb.	*Fagus sylvatica*	Nascimbene et al. (2021)
	**C. monachorum* (Zahlbr.) W.L. Culb. & C.F. Culb. [L]	*Fagus sylvatica*	Nascimbene et al. (2021)
	**C. olivetorum* (Nyl.) W.L. Culb. & C.F. Culb.	*Fagus* spp.	Nimis (2016)
	**Cetraria sepincola* (Ehrh.) Ach. [L]	*Alnus viridis*, *Betula* spp.	Nimis (2016)
	**Evernia mesomorpha* Nyl. = *Evernia prunastri* (L.) Ach. [L]	*Alnus alnobetula*	Gheza (2019)
	**Letharīella intricata* (Moris) Krog [E, L]	*Fagus sylvatica*, *Quercus cerris*	Ravera et al. (2010)
	**Melanelixia glabratula* (Lamy) Sandler & Arup [E, L]	*Alnus alnobetula*, *Fagus* spp.	Nimis (2016), Gheza (2019)
	**M. subaurifera* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [L]	*Alnus alnobetula*	Gheza (2019)
	**Melanohalea elegantula* (Zahlbr.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [L]	*Castanea* spp., *Quercus* spp.	Nimis (2016)
	**M. exasperata* (De Not.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [L]	*Quercus* spp.	Nimis (2016)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**M. exasperatula* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [L]	*Alnus alnobetula*	Gheza (2019)
	**M. laciniatula* (H. Olivier) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [L]	*Fagus* spp.	Nimis (2016)
	**M. olivacea* (L.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [L]	*Betula* spp.	Nimis (2016)
	**Parmelia ernstiae* Feuerer & A. Thell [L]	*Quercus* spp.	Nimis (2016)
	**P. submontana* Hale [L]	*Fagus* spp.	Nimis (2016)
	Parmeliella testacea P.M. Jørg. [E, L]	*Castanea* spp.	Nimis (2016)
	**Parmeliopsis ambigua* (Hoffm.) Nyl. [L]	*Castanea* spp.	Nimis (2016)
	**Nephromopsis laureri* (Kremp.) Kurok. [E, L]	*Fagus* spp.	Nimis (2016)
	**Usnea flavocardia* Räsänen [L]	*Fagus* spp., *Quercus ilex*	Nascimbene et al. (2021)
	**U. intermedia* (A. Massal.) Jatta [L]	*Alnus alnobetula*	Gheza (2019)
	**U. rubicunda* Stirt. [E, L]	*Quercus cerris*, *Q. suber*	Nimis (2016)
	**Vulpicida pinastri* (Scop.) J.E. Mattsson & M.J. Lai [L]	*Castanea* spp.	Nimis (2016)
Pilocarpaceae	**Fellhaneropsis vezdae* (Coppins & P. James) Sérus. & Coppins [E, L]	*Quercus* spp.	Nimis (2016)
	**Micarea elachista* (Kьrb.) Coppins & R. Sant. [L]	*Castanea* spp.	Nimis (2016)
	**M. globulosella* (Nyl.) Coppins [E,L]	*Quercus* spp.	Nascimbene et al. (2021)
	**M. meridionalis* van den Boom, Brand, Coppins & Sérus. [L]	*Quercus suber*	Nimis (2016)
	**M. peliocarpa* (Anzi) Coppins & R. Sant. [L]	*Fagus* spp., *Quercus* spp.	Nimis (2016)
Ramalinaceae	**Bacidia arceutina* (Ach.) Rehm & Arnold [L]	*Quercus ilex*	Nascimbene et al. (2021)
	**B. rosella* (Pers.) De Not. [E, L]	*Quercus ilex*	Nimis (2016)
	**Biatora pontica* Printzen & Tønsberg [L]	*Fagus* spp.	Nimis (2016)
	**B. sphaeroidiza* (Vain.) Printzen & Holien [L]	*Alnus* spp.	Nimis (2016)
	**Lecania cyrtella* (Ach.) Th. Fr. [L]	*Juglans* spp.	Nimis (2016)
	**L. fuscella* (Schaer.) A. Massal. [L]	*Juglans* spp.	Nimis (2016)
	**Mycobilimbia epixanthoides* (Nyl.) Hafellner & Türk [L]	*Fagus sylvatica*	Nascimbene et al. (2021)
	**Ramalina subgeniculata* Nyl. [E, L]	*Quercus cerris*	Nascimbene et al. (2021)
	**Toniniopsis subincompta* (Nyl.) Kistenich, Timdal, Bendiksby & S. Ekman = *Bacidia subincompta* (Nyl.) Arnold [L]	*Fagus* spp., *Quercus* spp.	Nimis (2016), Kistenich et al. (2018)
Ramboldiaceae	**Ramboldia cinnabarina* (Sommerf.) Kalb, Lumbsch & Elix [L]	*Quercus ilex*	Zedda (2002)
Scoliciosporaceae	**Scoliciosporum umbrinum* (Ach.) Lojka [L]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
Tephromelataceae	**Violella fucata* (Stirt.) T. Sprib. [E, L]	*Alnus incana*	Nascimbene et al. (2021)
Order: *Lecideales* (3 taxa)			
Lecideaceae	**Lecidea albofuscescens* Nyl. [L]	*Betula* spp.	Nimis (2016)
	**L. turgidula* Fr. [L]	*Castanea* spp.	Nimis (2016)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Lopadiaceae	**Lopadium disciforme* (Flot.) Kullh [E, L]	*Quercus* spp.	Nimis (2016)
Order: *Ostropales* (1 taxon)			
Stictidaceae	**Thelopsis rubella* Nyl. [E, L]	*Fagus* spp., *Quercus* spp.	Nimis (2016)
Order: *Peltigerales* (9 taxa)			
Collemataceae	**Enchylium conglomeratum* (Hoffm.) Otálora, P.M. Jørg. & Wedin [L]	*Juglans* spp.	Nimis (2016)
	E. ligerinum (Hy) Otálora, P.M. Jørg. & Wedin [E, L]	*Juglans* spp.	Nimis (2016)
	**Leptogium hildenbrandii* (Garov.) Nyl. [E, L]	*Juglans* spp.	Nimis (2016)
	Paracollema italicum (B. de Lesd.) Otálora, P.M. Jørg. & Wedin [E, L]	*Quercus ilex*	Nimis (2016)
	**Rostania occultata* (Bagl.) Otálora, P.M. Jørg. & Wedin [E, L]	*Juglans* spp.	Nimis (2016)
	**Scytinium subtile* (Schrad.) Otálora, P.M. Jørg. & Wedin [L]	*Juglans* spp.	Nimis (2016)
Koerberiaceae	**Koerberia biformis* A. Massal. [L]	*Castanea* spp., *Quercus* spp.	Nimis (2016)
Peltigeraceae	**Lobarina scrobiculata* (Scop.) Nyl. [E, L]	*Castanea* spp.	Nimis (2016)
	**Sticta limbata* (Sm.) Ach. [L]	*Fagus sylvatica*	Nascimbene et al. (2021)
Order: *Pertusariales* (6 taxa)			
Pertusariaceae	*Pertusaria constricta* Erichsen [L]	*Fagus* spp.,*Quercus* spp.	Nimis (2016)
	P. jurana Erichsen [L]	*Fagus* spp.	Nimis (2016)
	**P. pustulata* (Ach.) Duby [L]	*Carpinus* spp., *Fagus* spp.	Nimis (2016)
Variolariaceae	*Lepra multipuncta* (Turner) Hafellner [L]	*Carpinus* spp., *Fagus* spp.	Nimis (2016)
	**L. ophthalmiza* (Nyl.) Hafellner [L]	*Fagus* spp.	Nimis (2016)
	**L. trachythallina* (Erichsen) Lendemer & R.C. Harris [L]	*Fagus* spp.	Nimis (2016)
Order: *Teloschistales* (8 taxa)			
Megalosporaceae	**Megalospora tuberculosa* (Fée) Sipman [L]	*Fagus* spp.	Nimis (2016)
Teloschistaceae	**Athallia cerinella* (Nyl.) Arup, Frödén & Søchting [L]	*Juglans* spp.	Nimis (2016)
	**A. pyracea* (Ach.) Arup, Frödén & Søchting [L]	*Juglans* spp.	Nimis (2016)
	**Caloplaca cerina* (Hedw.) Th. Fr. s.lat [L]	*Juglans* spp.	Nimis (2016)
	**Huneckia pollinii* (A. Massal.) S.Y. Kondr., Kärnefelt, Elix, A. Thell, Jung Kim, A.S. Kondr. & Hur [L]	*Alnus* spp.	Nimis (2016)
	Lendemeriella lucifuga (G. Thor) S.Y. Kondr. = **Caloplaca lucifuga* G. Thor [L]	*Castanea* spp., *Quercus* spp.	Nimis (2016), Kondratyuk et al. (2020)
	**Solitaria chrysophthalma* (Degel.) Arup, Søchting & Frödén [L]	*Juglans* spp.	Nimis (2016)
	**Xanthomendoza huculica* (S.Y. Kondr.) Diederich [L]	*Juglans regia*	Gheza (2019)
Order: *Umbilicariales* (2 taxa)			
Fuscideaceae	*Fuscidea stiriaca* (A. Massal.) Hafellner [L]	*Fagus* spp.	Nimis (2016)
Ophioparmaceae	**Hypocenomyce scalaris* (Ach.) M. Choisy [L]	*Castanea* spp.	Nimis (2016)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Class: *Leotiomycetes* (87)			
Order: *Chaetomellales* (1 taxon)			
Chaetomellaceae	*Chaetomella* sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
Order: *Helotiales* (67 taxa)			
Amorphothecaceae (= *Myxotrichaceae*)	**Oidiodendron tenuissimum* (Peck) S. Hughes [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013), Ekanayaka et al. (2019)
Arachnopezizaceae	**Arachnopeziza aurata* Fuckel [S, [Lig, Lom, Tus]]	*Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**A. aurelia* (Pers.) Fuckel [S, [Lom, Tre, Tus]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
Chlorociboriaceae	**Chlorociboria aeruginascens* (Nyl.) Kanouse & C.S. Ramamurthi, Korf & L.R. Batra [S, [Lom, Sic, Tre, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**C. aeruginosa* (Oeder) Seaver ex C.S. Ramamurthi, Korf & L.R. Batra [S, [Abr]]	*Fagus sylvatica*	Saitta et al. (2011)
Dermateaceae	**Pezicula acericola* (Peck) Peck ex Sacc. & Berl. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
	**P. carpinea* (Pers.) Tul. ex Fuckel [S, [Fri, Lom]]	*Fagus sylvatica*	Saitta et al. (2011)
	**P. cinnamomea* (DC.) Sacc. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002), Chen et al. (2016)
	**P. fagacearum* Chen Chen, Verkley & Crous [En, P]	*Fagus sylvatica*	Chen et al. (2016), Romero et al. (2018)
	**P. italica* W.J. Li, Camporesi & K.D. Hyde [S, [Tus]]	*Corylus* spp.	Li et al. (2020)
	**P. neocinnamomea* Chen Chen, Verkley & Crous	*Fagus sylvatica*	Chen et al. (2016)
	Pezicula sp. [[Tus]] = *Cryptosporiopsis* sp. [En] (sexual *Pezicula* and *Neofabrea*)	*Fagus sylvatica*	Danti et al. (2002), Lynch et al. (2013)
Discinellaceae	**Naevala minutissima* (Auersw.) B. Hein [S]	*Castanea* sp.	Morales-Rodriguez et al. (2019)
Drepanopezizaceae	*Drepanopeziza* sp. [[Tus]] = *Gloeosporidiella* sp. [En]	*Fagus sylvatica*	Danti et al. (2002), Wijayawardene et al. (2020)
	•*Marssonina matteiana* (Sacc.) Karak.	*Quercus robur*	Venturella (1991)
Erysiphaceae	**Erysiphe alphitoides* (Griffon & Maubl.) U. Braun & S. Takam. = *Microsphaera alphitoides* Griffon & Maubl. = *Microsphaera alphitoides var. alphitoides* Griffon & Maubl. = *Microsphaera quercina* (Schwein.) Griffiths	*Castanea sativa*, *Fagus sylvatica*, *Quercus frainetto*, *Q. ilex*, *Q. petraea*, *Q. pubescens*, *Q. pyrenaica*, *Q. robur*, *Q. suber*, *Q. trojana*, *Quercus* sp.	Amano (1986), Venturella (1991), Braun (1995), Braun et al. (2000), Takamatsu et al. (2007), Roskov et al. (2019), MycoBank (2022)
	E. extensa (Cooke & Peck) U. Braun & S. Takam. = *Microsphaera alni* var. *extensa* (Cooke & Peck) E.S. Salmon [P]	*Quercus cerris*, *Q. ilex*, *Q. petraea*, *Q. robur*	Spaulding (1961)
	**E. hypophylla* (Nevod.) U. Braun & Cunningt. = *Microsphaera hypophylla* Nevod.	*Quercus frainetto*, *Q. petraea*	Amano (1986), Takamatsu et al. (2007)
	**E. ornata* (U. Braun) U. Braun & S. Takam. = *Microsphaera betulae* Magnus	*Betula pubescens*, *B. verrucosa*	Amano (1986), Braun (1995), Braun et al. (2000)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**E. penicillata* (Wallr.) Link = *Microsphaera penicillata* (Wallr.) Sacc.	*Alnus cordata*, *A. glutinosa*, *A. viridis*	Braun (1995), Braun et al. (2000)
	Oidium sp.	*Quercus robur*	Amano (1986)
	**Phyllactinia alnicola* U. Braun	*Alnus cordata*, *A. glutinosa*, *A. viridis*	Amano (1986)
	**P. alnicola* U. Braun = *Microsphaera alni* (DC.) G. Winter [P]	*Juglans regia*	Spaulding (1961), Amano (1986)
	**P. guttata* (Wallr.) Lév. = *Phyllactinia suffulta* (Rebent.) Sacc.	*Alnus glutinosa*, *A. incana*, *Betula alba*, *B. pendula*, *B. pubescens*, *B. verrucosa*, *Carpinus betulus*, *Carpinus* sp., *Corylus avellana*, *C. maxima*, *Fagus sylvatica*, *Ostrya carpinifolia*, *Quercus ilex*, *Q. petraea*, *Q. pubescens*, *Q. robur*	Amano (1986), Venturella (1991), Braun (1995)
	**P. roboris* (Gachet) S. Blumer	*Quercus ilex*, *Q. petraea*, *Q. pubescens*, *Q. robur*,	Braun (1995)
Gelatinodiscaceae	**Ascocoryne cylichnium* (Tul.) Korf [S, [Cam, Lig, Lom]]	*Fagus sylvatica*	Saitta et al. (2011)
	**A. sarcoides* (Jacq.) J.W. Groves & D.E. Wilson [S, [Cam, Lig, Lom, Tus]]	*Fagus sylvatica*	Saitta et al. (2011)
	**Ascotremella faginea* (Peck) Seaver [S, [Lom, Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
	**Neobulgaria pura* (Pers.) Petr. var. pura [S, [Cam, Lom, Sic, Tre, Ven]] = *Neobulgaria pura* var. *foliacea* (Bres.) Dennis & Gamundí	*Fagus sylvatica*	Saitta et al. (2011)
Helotiaceae	**Bisporella citrina* (Batsch) Korf & S. E. Carp. [[Lig]]	*Fagus sylvatica*	Ambrosio et al. (2018)
	**B. subpallida* (Rehm) Dennis [S, [Emi, Lom, Tre]]	*Quercus* spp.	Saitta et al. (2011)
	**Hymenoscyphus calyculus* (Fr.) W. Phillips [[Cam, Lig, Lom, Pie, Sic, Tre, Ven]] = *Helotium conscriptum* P. Karst. [S]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**H. fructigenus* (Bull.) Gray	*Quercus ilex*	Venturella (1991)
	**H. imberbis* (Bull.) Dennis [[Lom, Ven]]	*Fagus sylvatica*	Saitta et al. (2011)
	H. monticola (Berk.) Baral [[Lom]] = **Phaeohelotium monticola* (Berk.) Dennis [S]	*Quercus* spp.	Saitta et al. (2011), Dimitrova et al. (2005)
	**H. serotinus* (Pers.) W. Phillips [S, [Cam, Ven]]	*Fagus sylvatica*	Saitta et al. (2011)
	H. sublateritius (Berk. & Broome) Dennis [S, [Emi]]	*Fagus sylvatica*	Saitta et al. (2011)
	**Scytalidium lignicola* Pesante [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	**Strossmayeria basitricha* (Sacc.) Dennis [[Lom]]	*Castanea* sp., *Carpinus* sp., *Fagus* sp., *Quercus* spp.	Iturriaga & Korf (1990), Saitta et al. (2011), Quijada et al. (2017)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Helotiales genera *incertae sedis*	*Durella commutata* Fuckel [S, [Lom, Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
	**D. macrospora* Fuckel [S, [Lom]]	*Quercus* spp.	Saitta et al. (2011)
Hyaloscyphaceae	**Hyaloscypha aureliella* (Nyl.) Huhtinen [[Cam]] = *Cheiromycella microscopica* (P. Karst.) S. Hughes [S]	*Quercus ilex*	Lunghini et al. (2013)
	H. hyalina (Pers.) Boud. [S, [Lom, Tre, Ven]]	*Quercus* spp.	Saitta et al. (2011)
Lachnaceae	**Dasyscyphella nivea* (R. Hedw.) Raitv [S, [Lig, Lom, Sic, Tre, Tus, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**Lachnum bicolor* (Bull.) P. Karst. [S, [Cam, Lom, Sic, Tre]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**L. brevipilosum* Baral [S, [Tus]]	*Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**L. virgineum* (Batsch) P. Karst. [S, [Cam, Emi, Lig, Lom, Sic, Tre, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**Neodasyscypha cerina* (Pers.) Spooner [S, [Emi, Ven]]	*Fagus sylvatica*	Saitta et al. (2011)
Leotiaceae	**Leotia lubrica* (Scop.) Pers. [[Lig]]	*Castanea sativa*	Ambrosio et al. (2018)
Mollisiaceae	**Phialocephala dimorphospora* W.B. Kendr. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
	Phialocephala sp. [[Tus]]	*Fagus sylvatica*	Grunig et al. (2009)
	**Tapesia villosa* Aebi	*Alnus viridis*	Aebi (1972)
	**Mollisia cinerea* (Batsch) P. Karst. [S, [Cam, Laz, Lig, Lom, Sic, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Lunghini et al. (2013)
	**M. discolor* (Mont. & Fr.) W. Phillips [[Lom]] = *Mollisia discolor* var. *longispora* Le Gal [S]	*Quercus* spp.	Saitta et al. (2011)
	**M. ligni* (Desm.) P. Karst. [S, [Cam, Lig, Lom, Tre]]	*Quercus* spp.	Saitta et al. (2011)
	**M. melaleuca* (Fr.) Sacc. [S, [Lom, Tre, Sic]]	*Fagus sylvatica*	Saitta et al. (2011)
	M. ramealis P. Karst. [S, [Lom]]	*Quercus* spp.	Saitta et al. (2011)
Patellariopsidaceae	**Patellariopsis atrovinosa* (A. Bloxam ex Curr.) Dennis [S, [Emi]]	*Corylus avellana*	Karunarathna et al. (2020)
Ploettnerulaceae	*Cylindrosporium* spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Sclerotiniaceae	**Botrytis cinerea* Pers. [S, En, P, [Cam, Tus]]	*Castanea sativa*, *Fagus sylvatica*, *Quercus ilex*	Danti et al. (2002), Lunghini et al. (2013), Morales-Rodriguez et al. (2019)
	Botrytis spp.	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	**Monilinia laxa* (Aderh. & Ruhland) Honey = *Monilia laxa* (Ehrenb.) Sacc. & Voglino	*Corylus avellana*	Richardson (1990)
	Monilinia spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Solenopeziaceae	*Lasiobelonium nidulus* [as '*nidulum*'] (J.C. Schmidt & Kunze) Spooner [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013), Wijayawardene et al. (2020)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Thelebolaceae	*Patinella hyalophaea* Sacc.	*Fagus sylvatica*	Baral et al. (2020)
•*Vibrisseaceae*	**Cheirospora botryospora* (Mont.) Berk. & Broome [S, [Emi]]	*Fagus sylvatica*	Karunarathna et al. (2020)
	•*Cheirospora* sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002), Karunarathna et al. (2020)
Order: *Leotiales* (1 taxon)			
Tympanidaceae	*Vexillomyces atrovirens* (Pers.) Baral, Quijada & G. Marson [[Cam, Lom]] = **Claussenomyces atrovirens* (Pers.) Korf & Abawi [S]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011), Baral & Quijada (2020)
Order: *Marthamycetales* (1 taxon)			
Marthamycetaceae	**Propolis farinosa* (Pers.) Fr. [S, [Cal, Lom, Sic, Tre, Ven]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
Order: *Phacidiales* (1 taxon)			
Phacidiaceae	**Bulgaria inquinans* (Pers.) Fr. [S, [Lom, Sic, Tus]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
Order: *Rhytismatales* (4 taxa)			
Rhytismataceae	*Coccomyces coronatus* (Schumach.) De Not. = *Coccomyces coronatus* var. *megathecius* Speg.	*Fagus sylvatica*	Farr (1973)
	**Colpoma quercinum* (Pers.) Wallr. [S, En, [Laz, Lom, Tus]]	*Quercus* spp.	Ragazzi et al. (2003), Saitta et al. (2011)
	Lophodermium maculare (Fr.) De Not.	*Quercus* sp.	Venturella (1991)
	**L. petiolicola* Fuckel	*Castanea* sp.	Farr (1973)
***Leotiomycetes* families *incertae sedis* (12 taxa)**			
Calloriaceae	*Dactylaria irregularis* de Hoog [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013), Wijayawardene et al. (2020)
	D. naviculiformis Matsush. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Wijayawardene et al. (2020)
	**D. purpurella* (Sacc.) [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013), Wijayawardene et al. (2020)
	Dactylaria spp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Wijayawardene et al. (2020)
	Dactylaria sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Wijayawardene et al. (2020)
Cenangiaceae	*Cenangium dolosum* Sacc. & Speg.	*Corylus avellana*	Farr (1973)
Hamatocanthoscyphaceae	**Chalara fungorum* (Sacc.) [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	**C. hughesii* Nag Raj & W.B. Kendr. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	C. stipitata Nag Raj & W.B. Kendr. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	C. unicolor S. Hughes & Nag Raj [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	Chalara spp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Pezizellaceae	**Calycina claroflava* (Grev.) Kuntze [[Lom, Tre, Sic]] = *Bisporella sulfurina* (Quél.) S.E. Carp [S]	*Fagus sylvatica*	Saitta et al. (2011), Wijayawardene et al. (2020)
Class: *Orbiliomycetes* (1)			
Order: *Orbiliales* (1 taxon)			
Orbiliaceae	**Dactylellina ellipsospora* (Preuss) M. Scholler, Hagedorn & A. Rubner [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Class: *Pezizomycetes* (23)			
Order: *Pezizales* (22 taxa)			
Helvellaceae	**Balsamia vulgaris* Vittad. [H, [Sic]]	*Quercus ilex*, *Q. suber*	Saitta et al. (2008)
Pezizaceae	**Adelphella babingtonii* (Berk. & Broome) Pfister, Matočec & I. Kušan [[Lom, Tre, Ven]] = **Pachyella babingtonii* (Berk.) Boud. [S]	*Fagus sylvatica*	Saitta et al. (2011)
	Legaliana badia (Pers.) Van Vooren [[Lig]] = **Peziza badia* Pers.	*Castanea sativa*	Ambrosio et al. 2018, Van (2020)
	**Peziza varia* (Hedw.) Fr. [S, [Abr, Cal, Lig, Lom, Fri, Tre, Sic, Tus, Ven]]	*Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**Phylloscypha phyllogena* (Cooke) Van Vooren [[Lig]] = **Peziza phyllogena* Cooke	*Quercus cerris*	Ambrosio et al. 2018, Van (2020)
Pyronemataceae	**Genea fragrans* (Wallr.) Sacc. [H, [Sic]]	*Corylus avellana*, *Fagus sylvatica*, *Quercus cerris*, *Q. ilex*, *Q. pubescens*, *Q. suber*, *Q. virgiliana*	Saitta et al. (2008)
	**G. lespiaultii* Corda [H, [Sic]]	*Fagus sylvatica*, *Quercus ilex*	Saitta et al. (2008)
	**G. sphaerica* Tul. & C. Tul. [H, [Sic]]	*Quercus cerris*,	Saitta et al. (2008)
	**G. verrucosa* Vittad. [H, [Sic]]	*Corylus avellana*, *Fagus sylvatica*, *Quercus ilex*, *Q. pubescens*, *Q. suber*, *Q. virgiliana*	Saitta et al. (2008)
	**Scutellinia kerguelensis* (Berk.) O. Kuntze [S, [Cam, Lom, Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
	**S. scutellata* (L.) Lambotte [S, [Abr, Lom, Fri, Tre, Sic, Tus, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**Trichophaea abundans* (P. Karst.) Boud. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Sarcoscyphaceae	**Sarcoscypha coccinea* (Jacq.) Sacc. [S, [Mar, Laz, Lom, Tre, Sic, Tus]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
Tarzettaceae	**Tarzetta catinus* (Holmsk.) Korf & J. K. Rogers [[Lig]]	*Quercus cerris*	Ambrosio et al. 2018
Tuberaceae	**Tuber aestivum* Vittad. [H, [Sic]]	*Ostrya carpinifolia*, *Quercus ilex*, *Q. virgiliana*	Saitta et al. (2008)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	***T. borchii* Vittad. [H, [Sic]]	*Castanea sativa*, *Corylus avellana*, *Fagus sylvatica*, *Quercus cerris*, *Q. ilex*, *Q. petraea*, *Q. pubescens*, *Q. suber*	Saitta et al. (2008)
	**T. brumale* Vittad. [H, [Sic]]	*Corylus avellana*, *Ostrya carpinifolia*, *Quercus ilex*, *Q. leptobalanos*, *Q. virgiliana*	Saitta et al. (2008)
	**T. excavatum* Vittad. [H, [Sic]]	*Fagus sylvatica*, *Quercus petraea*, *Q. pubescens*	Saitta et al. (2008)
	**T. maculatum* Vittad. [H, [Sic]]	*Quercus ilex*, *Q. pubescens*	Saitta et al. (2008)
	**T. panniferum* Tul. & C. Tul. [H, [Sic]]	*Ostrya carpinifolia*, *Quercus ilex*, *Q. virgiliana*	Saitta et al. (2008)
	**T. puberulum* Berk. & Broome [H, [Sic]]	*Castanea sativa*, *Fagus sylvatica*, *Quercus cerris*, *Q. ilex*, *Q. pubescens*, *Q. suber*, *Q. virgiliana*	Saitta et al. (2008)
	**T. rufum* Pico var. *rufum* [H, [Sic]]	*Corylus avellana*, *Fagus sylvatica*, *Quercus cerris*, *Q. ilex*, *Q. leptobalanos*	Saitta et al. (2008)
Class: *Sordariomycetes* (264)			
Order: *Amphisphaeriales* (33 taxa)			
Amphisphaeriaceae	**Amphisphaeria umbrina* (Fr.) De Not. [[Ven]]	*Carpinus betulus*	Aptroot (1995)
Beltraniaceae	**Beltrania querna* Harkn. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013), Pirozynski (1963)
	**B. rhombica* Penz. [S, [Cam, Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Lunghini et al. (2013)
	**Parapleurotheciopsis inaequiseptata* (Matsush.) P.M. Kirk [S, [Cam, Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Lunghini et al. (2013)
	**Subramaniomyces fusisaprophyticus* (Matsush.) P.M. Kirk [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Cylindriaceae	**Cylindrium elongatum* Bonord.	*Quercus ilex*	Venturella (1991)
Hyponectriaceae	*Anisostomula quercus-ilicis* (Traverso) Höhn.	*Quercus ilex*	von Arx & Mueller (1954), Roskov et al. (2019)
Melogrammataceae	**Melogramma campylosporum* Fr. [S, [Lom, Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
	**Melogramma spiniferum* (Wallr.) De Not. [S, [Cam, Lom, Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
Sporocadaceae	**Discosia artocreas* (Tode) Fr. = *Discosia artocreas var. juglandis* C. Massal.	*Fagus sylvatica*	Nag Raj (1993)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**D*. *fagi* W.J. Li, Jian K. Liu & K.D. Hyde [S, [Emi]]	*Fagus sylvatica*	Li et al. (2015b), Liu et al. (2019)
	D. *faginea* Lib.	*Alnus glutinosa*	Nag Raj (1993)
	**D*. *italica* W.J. Li, Jian K. Liu & K.D. Hyde [S, [Emi]]	*Fagus sylvatica*	Li et al. (2015b), Liu et al. (2019)
	**D*. *neofraxinea* W.J. Li, Camporesi & K.D. Hyde [S, [Emi, Tus]]	*Fagus sylvatica*	Senanayake et al. (2015), Liu et al. (2019)
	Discostroma corticola (Fuckel) Brockmann = **Seimatosporium lichenicola* (Corda) Shoemaker & E. Müll.	*Quercus ilex*	Venturella (1991)
	**Immersidiscosia eucalypti* (Pat.) Kaz. Tanaka, Okane & Hosoya [S, [Emi]]	*Quercus pubescens*	Hyde et al. (2017)
	Monochaetia ilicina (Sacc.) Nag Raj = *Cryptostictis ilicina* (Sacc.) Sacc. = *Pestalotia ilicina* Sacc.	*Quercus ilex*, *Q*. *pubescens*	Nag Raj (1985), Nag Raj (1993), Venturella (1991), Nag Raj (1993)
	**M*. *kansensis* (Ellis & Barthol.) Sacc. & D. Sacc.	*Castanea vesca*	Guba (1961)
	* *M*. *monochaeta* (Desm.) Allesch.[En, S, [Pie, Tus]] = *Pestalotia monochaeta* var. *monochaeta* Desm.	*Castanea sativa*, *C*. *vesca*, *Quercus cerris*, *Quercus robur*, *Q*. *pubescens*	Nag Raj (1993), Gennaro et al. (2003), Jeewon et al. (2002), Jeewon et al. (2003a, b), Liu et al. (2019), Morales-Rodriguez et al. (2019)
	M. *mucronata* (C. Massal.) Maire	*Quercus pubescens*	Nag Raj (1993)
	M. *pachyspora var*. *brevicornis* Bubák	*Quercus ilex*	Nag Raj (1993)
	M. *saccardoana* (Voglino) Sacc. & Traverso	*Quercus pubescens*	Guba (1961)
	Monochaetia sp. [En, [Tus]]	*Quercus cerris*, *Q*. *pubescens*, *Q*. *robur*	Ragazzi et al. (2003)
	**Nonappendiculata quercina* F. Liu, L. Cai & Crous [S, [Emi, Tus]]	*Quercus pubescens*, *Q*. *suber*	Liu et al. (2019)
	**Pestalotiopsis adusta* (Ellis & Everh.) Steyaert = *Pestalotia adusta* Ellis & Everh.	*Carpinus betulus*	Guba (1961)
	P. *breviseta* (Sacc.) Steyaert = *Pestalotia breviseta* Sacc.	*Fagus sylvatica*	Guba (1961)
	**P*. *funerea* (Desm.) Steyaert = *Pestalotia funerea* var. *punctiformis* Sacc.	*Fagus sylvatica*	Nag Raj (1993)
	**P*. *osyridis* (Thüm.) H.T. Sun & R.B. Cao = *Pestalotia osyridis* Thüm.	*Castanea crenata*	Guba (1961)
	P. *versicolor* (Speg.) Steyaert [P, [Tus]]	*Quercu* spp.	Panzavolta et al. (2018)
	Pestalotiopsis sp. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	**Sporocadus rosigena* F. Liu, L. Cai & Crous [S, [Emi]]	*Quercus ilex*	Bundhun et al. (2021)
	**Truncatella angustata* (Pers.) S. Hughes [S, [Emi]]	*Alnus glutinosa*	Hyde et al. (2018)
	•**Zetiasplozna thuemenii* (Speg.) Nag Raj = **Pestalotia thuemenii* Speg.	*Casuarina equisetifolia*	Guba (1961), Nag Raj (1993), Roskov et al. (2018),

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	= •*Pestalotia monochroa* Tassi		Wijayawardene et al. (2020)
Order: *Boliniales* (2 taxa)			
Boliniaceae	**Camarops microspora* (P. Karst.) Shear S, [Lom, Tre]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**C. tubulina* (Alb. & Schwein.) Shear [Lom] = **Endoxyla operculata* (Alb. & Schwein.) Sacc. S	*Quercus* spp.	Saitta et al. (2011), Roskov et al. (2018)
Order: *Calosphaeriales* (3 taxa)			
Calosphaeriaceae	*Calosphaeria wahlenbergii* Nitschke S	*Castanea sativa*	Réblová (2011)
	**Jattaea discreta* (Berl.) Réblová S	*Quercus* sp.	Huang et al. (2021)
	**J. tumidula* (Sacc.) Réblová [Ven] = *Calosphaeria tumidula* Sacc. S	*Fagus sylvatica*	Réblová (2011), Réblová et al. (2015a)
Order: *Coniochaetales* (3 taxa)			
Coniochaetaceae	**Coniochaeta pulveracea* (Ehrh.) Munk S, [Lom]	*Quercus* spp.	Saitta et al. (2011)
	**C. taeniospora* (Sacc.) Friebes, Jaklitsch & Voglmayr S, [Emi]	*Quercus* sp.	Hyde et al. (2020c)
	Coniochaeta sp. En, [Tus]	*Fagus sylvatica*	Danti et al. (2002)
Order: *Coronophorales* (7 taxa)			
Bertiaceae	**Bertia moriformis* (Tode) De Not. S, [Lig, Lom, Sic, Tre] = *Bertia moriformis* var. *multiseptata* Sivan. S	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011), Roskov et al. (2018)
	**B. macrospora* Sacc. = *Massarina macrospora* (Sacc.) O.E. Erikss. & J.Z. Yue	*Fagus sylvatica*	Eriksson & Yue (1986), Roskov et al. (2018)
Ceratostomataceae	*Arxiomyces vitis* (Fuckel) P.F. Cannon & D. Hawksw. [Ven] = *Phaeostoma vitis* (Fuckel) Arx	*Juglans* sp., *Juglans regia* (as *J. regiae*)	Cannon & Hawksworth (1982), Roskov et al. (2018)
	Ceratostoma venetum Speg.	*Corylus avellana*	Farr (1973)
	Harzia sympodialis (C. Perini) D.W. Li & N.P. Schultes = *Chlamydomyces sympodialis* C. Perini	*Quercus pubescens*	Perini (1986), Schultes et al. (2017)
Chaetosphaerellaceae	**Chaetosphaerella phaeostroma* (Durieu & Mont.) E. Müll. & C. Booth S, [Cam]	*Fagus sylvatica*	Saitta et al. (2011)
Nitschkiaceae	*Fracchiaea heterogenea* Sacc. [Ven]	*Corylus* sp.	Saccardo (1873), Huang et al. (2021)
Order: *Chaetosphaeriales* (12 taxa)			
Chaetosphaeriaceae	**Chaetosphaeria vermicularioides* (Sacc. & Roum.) W. Gams & Hol.-Jech. S, [Cam, Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Lunghini et al. (2013)
	Chloridium cylindrosporum W. Gams & Hol.-Jech. S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	Chloridium sp. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**Dictyochaeta assamica* (Agnihothr.) Aramb., Cabello & Mengasc. S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	**Menispora ciliata* Corda [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	Menispora sp. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	Polynema ornatum (De Not.) Lév.	*Castanea* sp.	Nag Raj (1993)
	**Pyrigemmula aurantiaca* D. Magyar & Shoemaker [S]	*Castanea sativa*	Magyar (2011), Morales-Rodriguez et al. (2019)
Helminthosphaeriaceae	**Endophragmiella boewei* J.L. Crane ex S. Hughes [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Endophragmiella cesatii (Mont.) S. Hughes	*Quercus robur*	Hughes (1979)
	Endophragmiella sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Wijayawardene et al. (2020), MycoBank (2022)
	**Ruzenia spermoides* (Hoffm.) O. Hilber [S, [Cam, Lom, Tre]] = *Lasiosphaeria spermoides* (Hoffm.) Ces & De Not. [S]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011), Hilber & Hilber (2002), Lunghini et al. (2013)
Order: *Diaporthales* (79 taxa)			
Asterosporiaceae	**Asterosporium asterospermum* (Pers.) S. Hughes [En, [Emi, Tus]]	*Fagus sylvatica*	Danti et al. (2002), Tanaka et al. (2010), Wijayawardene et al. (2016b), Senanayake et al. (2017a, b), (2018), Fan et al. (2018a, b, c), Yang et al. (2018), Hyde et al. (2020c)
Coryneaceae	**Coryneum arausiacum* (Fabre) Senan., Maharachch. & K.D. Hyde [[Emi]] = **Coryneum arausiaca* Senan., Maharachch. & K.D. Hyde [S]	*Quercus* sp.	Senanayake et al. (2017b, (2018)
	**C. lanciforme* (Fr.) Voglmayr & Jaklitsch	*Betula alba*, *Betula* sp.	Sutton (1975, 1980)
	C. mucronatum C. Massal.	*Quercus pubescens*	Sutton (1975)
	**C. modonium* (Sacc.) [S, [Emi]]	*Castanea sativa*	This study
	**C. umbonatum* Nees = **Pseudovalsa longipes* (Tul. & C. Tul.) Sacc. [En]	*Quercus* spp., *Quercus* sp.	Ragazzi et al. (2003), Rossman et al. (2015), Fan et al. (2018b,c), Jiang et al. (2018)
	Coryneum sp. [En]	*Quercus pubescens*	Ragazzi et al. (2003)
Cryphonectriaceae	**Cryphonectria carpinicola* D. Rigling, T. Cech, Cornejo & L. Beenken [P]	*Carpinus betulus*	Cornejo et al. (2021)
	**C. decipiens* Gryzenh. & M.J. Wingf. [P]	*Castanea sativa*, *Castanea* sp.	Gryzenhout et al. (2009), Chen et al. (2018), Cornejo et al. (2021)
	**C. naterciae* Bragança, E. Diogo & A.J.L. Phillips [P]	*Quercus suber*	Pinna et al. (2019)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**C. parasitica* (Murrill) M.E. Barr P, [Apl, Bas, Cal, Cam, Emi, Fri, Laz, Lom, Lig, Pie, Sar, Sic, Tre, Tus, Aos] = *Endothia parasitica* (Murrill) P.J. Anderson & H.W. Anderson P	*Castanea crenata*, *C. dentata*, *C. sativa*, *Castanea* sp., *Quercus frainetto*, *Q. ilex*, *Q. pubescens*, *Q. petraea*, *Q. robur*	Biraghi (1946), Spaulding (1961), Grente (1965), Cortesi et al. (1996), Milgroom et al. (1996), Gobbi et al. (2002), Vannini et al. (2018), Chandelier et al. (2019), Roskov et al. (2019)
Cryphonectriaceae (•*Cryphonectria-Endothia* complex)	**C. radicalis* (Schwein. ex Fr.) M.E. Barr P, [Pie] = *Endothia fluens* (Sowerby) Shear & N.E. Stevens P	*Carpinus* sp., *Castanea sativa*, *C. vesca*, *Quercus suber*	Spaulding (1961), Walker et al. (1985), Venter et al. (2002), Myburg et al. (2004), Gryzenhout et al. (2006), Chen et al. (2018)
	**Endothia gyrosa* (Schwein.) Berk. P	*Castanea vesca*, *C. sativa*, *Quercus* spp.	Spaulding (1961), Venter et al. (2002), Senanayake et al. (2018)
	Endothiella sp. P	*Carpinus betulus*, *Castanea* sp.	Walker et al. (1985), Saracchi et al. (2015)
Cytosporaceae	**Cytospora cedri* Syd., P. Syd. & E.J. Butler S, [Emi]	*Ostrya carpinifolia*	Shang et al. (2020)
	C. corylicola Sacc. ex Fuckel P, [Sar]	*Corylus avellana*	Venturella (1991), Linaldeddu et al. (2016a)
	**Cytospora cotini* Norph., Bulgakov & K.D. Hyde S, [Emi]	*Ostrya carpinifolia*	Shang et al. (2020)
	Cytospora juglandina Sacc. P	*Juglan nigra*, *J. regia*	Belisario (1996)
	**C. phialidica* W.J. Li, Camporesi & K.D. Hyde S, [Emi]	*Alnus glutinosa*	Li et al. (2020)
	**C. predappioensis* Q.J. Shang, Norph., Camporesi & K.D. Hyde S, [Emi]	*Ostrya carpinifolia*	Shang et al. (2020)
	**C. prunicola* Norph., Camporesi, T.C. Wen & K.D. Hyde S, [Emi]	*Fagus sylvatica*, *Ostrya carpinifolia*, *Quercus pubescens*	Li et al. (2020) Shang et al. (2020)
	**C. pubescentis* Q.J. Shang, E. Camporesi & K.D. Hyde S, [Emi]	*Quercus pubescens*	Shang et al. (2020)
	**C. quercicola* Senan., Camporesi & K.D. Hyde S	*Quercus* sp.	Shang et al. (2020)
Diaporthaceae	**Diaporthe alnea* Fuckel P, [Lig]	*Alnus glutinosa*, *Alnus* sp.	Moricca (2002), Dissanayake et al. (2017a)
	**D. eres* Nitschke S, [Emi, Lom]	*Castanea vesca*, *Corylus* sp., *Juglans regia*, *Ostrya carpinifolia*	Wehmeyer (1933), Dissanayake et al. (2017a, b), Gomes et al. (2013), McTavish et al. (2018), Arciuolo et al. (2021)
	**D. foeniculina* (Sacc.) Udayanga & Castl. P, [Umb]	*Castanea sativa*	Annesi et al. (2016), Dissanayake et al. (2017a, b)
	D. juglandina (Fuckel) Nitschke = *Phoma juglandina* (Fuckel) Sacc. P	*Juglans nigra*, *J. regia*	Belisario (1996)
	**D. oncostoma* (Duby) Fuckel S, [Lom]	*Quercus* spp.	Saitta et al. (2011)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	***D. rudis* (Fr.) Nitschke = **Diaporthe medusaea* Nitschke [P]	*Juglans regia*	Kanematsu et al. (2000)
	Phomopsis endogena (Speg.) Cif. [P]	*Castanea sativa*, *Castanea* sp.	Richardson (1990), Dissanayake et al. (2017a)
	**P. juglandina* (Sacc.) Höhn. = *Phyllosticta juglandina* Sacc. [P]	*Juglans regia*, *Juglans nigra*	Belisario (1996), Watson (1971), Roskov et al. (2019)
	**P. quercina* (Sacc.) Höhn. ex Died. [En, [Tus]]	*Quercus robur*, *Quercus* sp.	Venturella (1991), Ragazzi et al. (2003), Dissanayake et al. (2017a)
	Phomopsis sp. [P, En, [Tre, Tus]]	*Fagus sylvatica*, *Juglans nigra*, *Ostrya carpinifolia*, *Quercus* spp.	Danti et al. (2002), Ragazzi et al. (2003), Luongo et al. (2011), Scala et al. (2019)
	Phomopsis spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	P. viterbensis Camici	*Castanea* sp.	Richardson (1990)
Diaporthales genera *incertae sedis*	**Diaporthella cryptica* Linald., Deidda & Scanu [P, [Sar]]	*Corylus avellana*, *Corylus* sp.	Linaldeddu et al. (2016a)
	Diaporthella sp.	*Corylus avellana*	Fan et al. (2018a, b, c)
Erythrogloeaceae	**Dendrostoma castaneum* (Tul. & C. Tul.) Voglmayr & Jaklitsch [[Sic, Ven]]	*Castanea sativa*	Jaklitsch & Voglmayr (2019), Samarakoon et al. (2021)
	**D. leiphaemia* (Fr.) Senan. & K.D. Hyde = **Amphiporthe leiphaemia* (Fr.) Butin [En]	*Quercus robur*	Ragazzi et al. (2003), Senanayake et al. (2018**)**
Gnomoniaceae	**Apiognomonia errabunda* (Roberge ex Desm.) Höhn. [En, S, [Emi, Tus]]	*Fagus sylvatica*	Danti et al. (2002), Li et al. (2020)
	A. ostryae (De Not.) M. Monod [[Tre]] = *Gnomonia veneta* Speg. = *Gnomonia ostryae* De Not.	*Ostrya carpinifolia*	Farr (1973), Sogonov et al. (2008**)**
	**A. pseudohystrix* W.J. Li, Camporesi & K.D. Hyde [S, [Emi]]	*Ostrya carpinifolia*	Li et al. (2020)
	•*A. quercina* (Kleb.) [En, [Tus]]	*Quercus* spp.	Ragazzi et al. (2003)
	Asteroma alnigena (Sacc.) Bedlan = *Septoria alnigena* Sacc. [P]	*Alnus glutinosa*	Constantinescu (1984), Bedlan (2015)
	A. coryli (Fuckel) B. Sutton = *Septoria avellanae* Berk. & Broome [P]	*Corylus avellana*	Watson (1971), Constantinescu (1984), Roskov et al. (2019)
	Asteroma sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
	**Cryptosporella alni-cordatae* W.J. Li, Qing Tian, Camporesi & K.D. Hyde [S, [Emi]]	*Alnus cordata*	Tian et al. (2018)
	•**Discula quercina* (Westend.) Arx [P]	*Fagus sylvatica*, *Quercus pubescens*	Spaulding (1961), Hanifeh et al. (2019)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**D. umbrinella* (Berk. & Broome) M. Morelet	*Quercus pubescens*	Venturella (1991), Cohen (2004)
	**Ditopella aseptatospora* Qing Tian, Camporesi & K.D. Hyde S, [Emi]	*Alnus glutinosa*	Tian et al. (2018)
	**D. biseptata* Perera, Senan., Camporesi & K.D. Hyde S, [Emi]	*Alnus glutinosa*	Senanayake et al. (2017b), Guterres et al. (2018)
	**Gnomonia gnomon* (Tode) J. Schröt.	*Corylus avellana*	Castlebury et al. (2002), Mejia et al. (2008), Sogonov et al. (2008), Broders & Boland (2011), Jaklitsch & Voglmayr (2014), Fan et al. (2016, 2018), Voglmayr et al. (2017), Guterres et al. (2018), Yang et al. (2018), Minoshima et al. (2019)
	G. quercus-ilicis Berl.	*Quercus ilex*	Monod (1983)
	Gnomoniella tubaeformis (Tode) Sacc. P	*Alnus cordata*	Spaulding (1961)
	**Gnomoniopsis smithogilvyi* L.A. Shuttlew., E.C.Y. Liew & D.I. Guest P, [Laz, Pie, Sar, Tre, Tus] = *Gnomoniopsis castanea* Tamietti En, P	*Castanea sativa*, *Castanea* sp., *Corylus avellana*	Visentin et al. (2012), Vannini et al. (2017, 2018), Shuttleworth et al. (2015), Linaldeddu et al. (2016a), Pasche et al. (2016), Jiang & Tian (2019), Lione et al. (2019), Morales-Rodriguez et al. (2019), Jiang et al. (2020)
	Gnomoniopsis sp. P, [Laz]	*Castanea crenata*, *Castanea* sp.	Magro et al. (2010), Pasche et al. (2016)
	**Neognomoniopsis quercina* Crous P, [Laz]	*Quercus ilex*	Crous et al. (2019a)
	**Ophiognomonia leptostyla* (Fr.) Sogonov [Laz] = *Gnomonia juglandis* (DC.) Traverso = *Marssonia juglandis* (Lib.) Sacc. P	*Juglans regia*, *J. nigra*, *Juglans* sp.	Petri (1940, 1941), Venturella (1991), Walker et al. (2012)
	**Ophiognomonia setacea* (Pers.) Sogonov [Tre, Ven] = *Gnomonia setacea* (Pers.) Ces. & De Not.	*Quercus lanuginosa*, *Q. robur*, *Quercus* sp.	Sogonov et al. (2005), Walker et al. (2012)
	**Phragmoporthe conformis* (Berk. & Broome) Petr. S, [Emi]	*Alnus glutinosa*	Li et al. (2016), Minoshima et al. (2019)
	**Valsalnicola oxystoma* (Rehm) D.M. Walker & Rossman P, [Tre] = *Cryptodiaporthe oxystoma* (Rehm) Z. Urb.	*Alnus viridis*	Crous et al. (2012), Pisetta et al. (2012), Minoshima et al. (2019)
Juglanconidaceae	**Juglanconis juglandina* (Kunze) Voglmayr & Jaklitsch = *Melanconium juglandinum* Kunze P	*Juglans regia*, *J. nigra*	Belisario & Onofri (1995), Voglmayr et al. (2017)
Lamproconiaceae	*Hercospora* sp. En	*Quercus pubescens*	Ragazzi et al. (2003)
Melanconidaceae	**Melanconis marginalis* (Peck) Wehm. [Emi] = *Melanconis italica* Senan., Camporesi & K.D. Hyde S	*Alnus cordata*	Jaklitsch & Voglmayr (2020)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**M. stilbostoma* (Fr.) Tul. [Sic]	*Betula aetnensis*	Jaklitsch & Voglmayr (2020)
	Melanconium apiocarpum Link [P, Lig]	*Alnus glutinosa*	Moricca (2002)
	M. carpinicola Wijayaw., Camporesi, McKenzie & K.D. Hyde [S, Emi]	*Carpinus betulus*	Wijayawardene et al. (2016b)
	Melanconium spp. [Tre]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Melanconiellaceae	**Dicarpella dryina* Belisario & M.E. Barr [Laz,Tus, Ven] = *Tubakia dryina* (Sacc.) B. Sutton [En, P] = *Actinopelte dryina* (Sacc.) Höhn. [En, P]	*Quercus cerris*, *Q. rubra*, *Q. pseudorubra* (*Q. petraea*), *Quercus robur*	Spaulding (1961), Belisario (1991), Gennaro et al. (2003), Harrington et al. (2012), Braun et al. (2018), Harrington & McNew (2018)
	**Melanconiella chrysodiscosporina* Voglmayr & Jaklitsch [S, Emi]	*Fagus sylvatica*	Senanayake et al. (2017b)
	**M. chrysomelanconium* Voglmayr & Jaklitsch [S, Emi]	*Carpinus betulus*	Senanayake et al. (2017b), Guterres et al. (2018)
	**M. flavovirens* (G.H. Otth) Voglmayr & Jaklitsch [S, Emi, Lom, Tus] = *Melanconis flavovirens* (G.H. Otth) Wehm. [En]	*Corylus avellana*, *Fagus sylvatica*	Danti et al. (2002), Voglmayr et al. (2012), Fan et al. (2018b), This study
	**M. meridionalis* Voglmayr & Jaklitsch [Tre, Tus]	*Ostrya carpinifolia*	This study
	**Tubakia macnabbii* T.C. Harrington & McNew [Laz]	*Quercus rubra*	Harrington & McNew (2018)
Sydowiellaceae	**Alborbis galericulata* (Tul. & C. Tul.) Senan. & K.D. Hyde [S, Lom] = **Cryptodiaporthe galericulata* (Tul. & C. Tul.) Wehm.	*Fagus sylvatica*	Saitta et al. (2011), Senanayake et al. (2017a**)**
	Ranulospora alnea* Senan., Camporesi & K.D. Hyde [S, Tre], (*R. alnii*; in the original publication)**	*Alnus incana*	Senanayake et al. (2017a, 2018), Morocko-Bicevska et al. (2019),
	**Sillia italica* N.I. de Silva, Camporesi & K.D. Hyde [S, Emi]	*Corylus avellana*	Tibpromma et al. (2017), Morocko-Bicevska et al. (2019)
	**S. karstenii* Senan., Camporesi & K.D. Hyde [S, Emi]	*Corylus avellana*	Senanayake et al. (2017a), Morocko-Bicevska et al. (2019)
	**Tenuiappendicula alnicola* Senan., Camporesi & K.D. Hyde [S, Emi]	*Alnus cordata*	Senanayake et al. (2017a, 2018), Morocko-Bicevska et al. (2019)
#*Diaporthomycetidae* families *incertae sedis* (4 taxa)			
Barbatosphaeriaceae	**Barbatosphaeria dryina* (Berk. & Broome) Réblová [Tus, Ven] = *Calosphaeria dryina* (Berk. & Broome) Nitschke [S]	*Quercus* spp.	Saitta et al. (2011), Réblová et al. (2015b)
Diaporthomycetidae genus *incertae sedis*	**Sporidesmiella hyalosperma* (Corda) P.M. Kirk [S, Cam]	*Quercus ilex*	Lunghini et al. (2013), Hyde et al. (2020c)
Thyridiaceae	*Pleurocytospora* sp. [En, Tus]	*Fagus sylvatica*	Danti et al. (2002)
Woswasiaceae	**Woswasia atropurpurea* Jaklitsch, Réblová & Voglmayr [S, Emi]	*Corylus avellana*	This study

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Order: *Glomerellales* (7 taxa)			
Glomerellaceae	**Colletotrichum acutatum* J.H. Simmonds [P, [Emi, Laz, Lom, Tre, Tus]]	*Castanea sativa*	Gaffuri et al. (2015, 2017), Vannini et al. (2018), Morales-Rodriguez et al. (2019)
	Colletotrichum spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Plectosphaerellaceae	*Verticillium dahliae* Kleb. [P, [Tus]]	*Quercus* spp.	Panzavolta et al. (2018)
	Verticillium spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
Reticulascaceae	**Cylindrotrichum oligospermum* (Corda) Bonord. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	C. hennebertii W. Gams & Hol.-Jech. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Kylindria sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: *Hypocreales* (33 taxa)			
Bionectriaceae	*Acremonium* sp. [En,S, [Tus]]	*Quercus cerris*, *Q. ilex*, *Q. pubescens*, *Q. robur*	Ragazzi et al. (2003), Lunghini et al. (2013)
	**Acremonium strictum* W. Gams [En, [Pie]]	*Quercus robur*	Gennaro et al. (2003)
	**Clonostachys rosea* (Link) Schroers, Samuels, Seifert & W. Gams [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
	Dendrodochium sp. [En, [Pie]]	*Quercus cerris*, *Q. robur*	Gennaro et al. (2003)
	**Geosmithia morbida* M. Kolařík, Freeland, C. Utley & Tisserat [P, [Ven, Tus]]	*Juglans regia*, *J. nigra*	Montecchio & Faccoli (2014), Moricca et al. (2019)
	**G. pallida* (G. Sm.) M. Kolařík, Kubátová & Pažoutová [P, [Laz]]	*Quercus* spp.	Morales-Rodriguez et al. (2019)
Calcarisporiaceae	**Calcarisporium arbuscula* Preuss [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Clavicipitaceae	**Metacordyceps chlamydosporia* (H.C. Evans) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora [S]	*Quercus ilex*	Lunghini et al. (2013)
Cordycipitaceae	**Cordyceps farinosa* (Holmsk.) Kepler, B. Shrestha & Spatafora [[Tus]] = *Paecilomyces farinosus* (Holmsk.) A.H.S. Br. & G. Sm. [En]	*Fagus sylvatica*	Danti et al. (2002), Kepler et al. (2017)
Hypocreaceae	**Hypocrea gelatinosa* (Tode) Fr. [S, [Cam, Lom, Ven]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**Trichoderma aureoviride* Rifai [[Emi, Lom, Tre, Ven]] = *Hypocrea aureoviridis* Plowr. & Cooke [S]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**T. citrinum* (Pers.) Jaklitsch, W. Gams & Voglmayr [[Cam, Lom, Tre]] = *Hypocrea citrina* (Pers.) Fr. [S]	*Fagus sylvatica*	Saitta et al. (2011), Jaklitsch & Voglmayr (2013)
	**T. harzianum* Rifai [En]	*Quercus* spp.	Ragazzi et al. (2003)
	**T. strictipile* Bissett [[Tus]] = *Hypocrea strictipilosa* P. Chaverri & Samuels	*Fagus sylvatica*	Jaklitsch (2009), Jaklitsch & Voglmayr (2013)
	**T. viride* Pers. [[Cam, Lom, Tus]] = *Hypocrea rufa* (Pers.) Fr. [En, S]	*Fagus sylvatica*, *Quercus cerris*, *Q. pubescens*, *Q. robur*	Ragazzi et al. (2003), Saitta et al. (2011)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**Trichothecium roseum* (Pers.) Link [En]	*Quercus* spp.	Ragazzi et al. (2003)
Nectriaceae	**Chaetopsina fulva* Rambelli	*Carpinus* sp.	Okada et al. (1997)
	**Cylindrocladiella parva* (P.J. Anderson) Boesew. [P, [Ven]]	*Quercus robur*	van Coller et al. (2005), Scattolin & Montecchio (2007)
	Cylindrocarpon spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009), Roskov et al. (2019)
	**Fusarium avenaceum* (Fr.) Sacc. [P]	*Fagus sylvatica*	Montecchio & Accordi (2007)
	**F. incarnatum* (Desm.) Sacc. [[Lom]] = *Fusarium semitectum* Berk. & Ravenel [P]	*Juglans regia*	Belisario et al. (2010), Singh et al. (2011), Roskov et al. (2019)
	**F. lateritium* Nees [En, P, [Cam, Laz, Pie]]	*Corylus avellana*, *Juglans regia*, *Quercus robur*, *Quercus cerris* *Piedmont*	Gennaro et al. (2003), Belisario et al. (2005), Belisario & Santori (2009), Santori et al. (2010), Vitale et al. (2011)
	**F. larvarum* Fuckel [P, [Laz]]	*Castanea sativa*	Morales-Rodriguez et al. (2019)
	**F. reticulatum* Mont. [En, P, [Ven]]	*Quercus robur*	Montecchio & Accordi (2007)
	**F. solani* (Mart.) Sacc. [P, [Tus]]	*Juglans nigra*, *J. regia*, *Quercus* spp.	Montecchio et al. (2015) Panzavolta et al. (2018)
	Fusarium spp. [[Tre]]	*Juglans regia*	Pardatscher & Schweigkofler (2009)
	**Ilyonectria destructans* (Zinssm.) Rossman, L. Lombard & Crous = **Cylindrocarpon destructans* (Zinssm.) Scholten [P]	*Juglans regia*	Montecchio & Causin (1995), Belisario (1996), Lombard et al. (2015)
	**Nectria cinnabarina* (Tode) Fr. [S, [Lig, Lom, Tre, Sic, Tus, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	N. sanguinea (Bolton) Fr. [S, [Cam]]	*Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**Neonectria ditissima* (Tul. & C. Tul.) Samuels & Rossman [[Tus]] = *Nectria ditissima* Tul. & C. Tul. [En]	*Corylus avellana*, *Fagus sylvatica*	Venturella (1991), Danti et al. (2002), Samuels & Rossman (2006)
	**Volutella ciliata* (Alb. & Schwein.) Fr.	*Quercus ilex*	Lunghini et al. (2013)
Stachybotryaceae	**Melanopsamma pomiformis* (Pers.) Sacc. [S]	*Fagus sylvatica*	Samuels (1997), Lombard et al. (2016)
	**Stachybotrys chartarum* (Ehrenb.) S. Hughes [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: *Microascales* (1 taxon)			
Ceratocystidaceae	**Ceratocystis fimbriata* Ellis & Halst. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Order: *Myrmecridiales* (1 taxon)			
Myrmecridiaceae	**Myrmecridium schulzeri* (Sacc.) Arzanlou, W. Gams & Crous [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Order: *Pleurotheciales* (1 taxon)			

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Pleurotheciaceae	**Pleurothecium recurvatum* (Morgan) Höhn. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: *Phyllachorales* (1 taxon)			
Phyllachoraceae	*Trabutia quercina* (F. Rudolphi ex Fr.) Sacc. & Roum.	*Corylus avellana*, *Quercus* sp.	Venturella (1991)
Order: *Sordariales* (5 taxa)			
Chaetomiaceae	*Humicola* sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**Trichocladium asperum* Harz [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Lasiosphaeriaceae	**Bombardia bombarda* (Batsch) J. Schröt. [S, [Ven]]	*Alnus* sp.	Huang et al. (2021)
	**Lasiosphaeria ovina* (Pers.) Ces. & De Not. [S, [Lom, Tre]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
Sordariales genera *incertae sedis*	**Lasiosphaeris hirsuta* (Fr.) A.N. Mill. & Huhndorf [S, [Cam, Lom, Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
Order: *Sporidesmiales* (1 taxon)			
Sporidesmiaceae	*Sporidesmium* spp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
Order: *Togniniales* (1 taxon)			
Togniniaceae	*Phaeoacremonium leptorhynchum* (Durieu & Mont.) Gramaje, L. Mostert & Crous = *Togninia leptorrhyncha* (Durieu & Mont.) Réblová	*Castanea sativa*	Réblová (2011), Gramaje et al. (2015), Kazemzadeh et al. (2017)
Order: *Xenospadicoidales* (1 taxon)			
Xenospadicoidaceae	**Lentomitella cirrhosa* (Pers.) Réblová [S, [Lom]]	*Quercus* spp.	Saitta et al. (2011)
Order: *Xylariales* (67 taxa)			
Barrmaeliaceae	**Barrmaelia oxyacanthae* (Mont.) Rappaz [[Tre]]	*Castanea vesca*	Rappaz (1995)
Cainiaceae	**Vesiculozygosporium echinosporum* (Bunting & E.W. Mason) Crous = *Zygosporium echinosporum* Bunting & E.W. Mason [S]	*Quercus ilex*	Lunghin et al. (2013), Crous et al. (2020)
Diatrypaceae	**Anthostoma decipiens* (DC.) Nitschke [P, S, [Lom, Sar]]	*Carpinus betulus*, *Corylus avellana*, *Quercus* spp.	Saitta et al. (2011), Saracchi et al. (2015) Linaldeddu et al. (2016a)
	A. dryophilum (Curr.) Sacc. [S, [Cam, Tus, Ven]]	*Quercus* spp.	Saitta et al. (2011)
	**A. turgidum* (Pers.) Nitschke [S, [Bas, Lom]]	*Fagus sylvatica*	Saitta et al. (2011)
	**Diatrype bullata* (Hoffm.) Fr. [S, [Lig,Lom,Tre]]	*Fagus sylvatica*	Saitta et al. (2011), Ambrosio et al. (2018)
	**Diatrype disciformis* (Hoffm.) Fr. [S, [Cam, Emi, Lig, Lom, Sic, Tus, Ven]]	*Fagus sylvatica*, *Ostrya carpinifolia*, *Quercus* spp.	Saitta et al. (2011), Senanayake et al. (2015)
	**D. stigma* (Hoffm.) Fr. [S, [Bas, Cal, Cam, Emi, Fri, Lom, Sic, Tre, Tus, Ven]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**Diatrypella macrospora* Mehrabi, Hemmati, Vasilyeva & Trouillas [S, [Emi]]	*Quercus cerris*	Carpouron et al. (2021)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	D. quercina (Pers.) Cooke [En, S]	*Fagus sylvatica*, *Quercus ilex*, *Quercus robur*, *Quercus* spp.	Ragazzi et al. (2003), Saitta et al. (2011)
	**Eutypa flavovirens* (Pers.) Tul. & C. Tul. [S, [Emi, Lom]]	*Quercus* spp., *Quercus* sp.	Saitta et al. (2011), Boonmee et al. (2021)
	E. lata (Pers.) Tul. & C. Tul. [S, [Emi]]	*Corylus avellana*	Boonmee et al. (2021)
	**E. leioplaca* (Fr.) Cooke [S, [Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
	E. ludibunda Sacc.	*Juglans regia*	Venturella (1991)
	Eutypella alnifraga (Wahlenb.) Sacc	*Alnus glutinosa*	Venturella (1991)
	**E. quaternata* (Pers.) Rappaz [[Emi, Lom, Fri, Tus]] = *Libertella faginea* Desm. [En, S]	*Fagus sylvatica*	Danti et al. (2002), Saitta et al. (2011)
	**Peroneutypa scoparia* (Schwein.) Carmarán & A.I. Romero [[Bas, Lom, Tre, Ven]] = **Eutypella scoparia* (*Schwein.*) *Ellis & Everh.* [S]	*Quercus* spp.	Saitta et al. (2011), Carmarán et al. (2006)
	**Quaternaria quaternata* (Pers.) J. Schröt. [S]	*Fagus sylvatica*	Li et al. (2020)
	Q. dissepta (Fr.) Tul. & C. Tul. [S, [Lom, Tre]]	*Fagus sylvatica*	Saitta et al. (2011)
Graphostromataceae	**Biscogniauxia destructiva* Vujanovic [P, F, [Sic]]	*Fagus sylvatica*	Vujanovic et al. (2020)
	**B. mediterranea* (De Not.) Kuntze [P, S [Apl, Cam, Laz, Lom, Sic, Tus]] = *Hypoxylon mediterraneum* (De Not.) Ces. & De Not.	*Fagus sylvatica*, *Juglans* sp., *Quercus ilex*, *Q. pubescens*, *Quercus* spp.	Ju et al. (1998), Miller (1961), Venturella (1991), Saitta et al. (2011), Raimondo et al. (2016), Zibarova & Kout (2017), Panzavolta et al. (2018), Hanifeh et al. (2019)
	**B. nummularia* (Bull.) Kuntze [S]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011) Luchi et al. (2015)
	**B. rosacearum* M.L. Raimondo & Carlucci [P, [Apl]]	*Quercus pubescens*	Raimondo et al. (2016)
Hypoxylaceae	**Daldinia concentrica* (Bolton) Ces. & De Not. [S, [Cam, Laz, Lom, Sic, Tre, Tus]]	*Quercus ilex*, *Q. pubescens*, *Quercus* spp.	Saitta et al. (2011), Stadler et al. (2014)
	**D. martinii* M. Stadler, Venturella & Wollw. [S, [Sic]]	*Quercus suber*, *Quercus* spp.	Saitta et al. (2011), Stadler et al. (2014)
	**D. raimundi* M. Stadler, Venturella & Wollw. [S, [Abr, Sic]]	*Quercus ilex*, *Quercus* spp.	Saitta et al. (2011), Stadler et al. (2014)
	**D. vernicosa* Ces. & De Not. [[Pie]]	*Fagus* sp.	Stadler et al. (2014)
	**Hypoxylon fragiforme* (Pers.) J. Kickx f. (*Nodulisporium* anam.) [En, S, [Abr, Cam, Lig, Lom, Sic, Tre, Tus]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Danti et al. (2002), Saitta et al. (2011)
	**H. fuscum* (Pers.) Fr. [S, [Cam, Lig, Lom]]	*Alnus glutinosa*, *Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Stadler et al. (2008), Saitta et al. (2011)
	**H. howeanum* Peck [S, [Lom, Mar, Ven]]	*Quercus* spp.	Saitta et al. (2011)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	**H. rubiginosum* (Pers.) Fr. [S, [Laz, Lom, Tus, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**H. rutilum* Tul. & C. Tul. [S, [Cam, Ven]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	Hypoxylon sp. = *Nodulisporium* sp. [En]	*Quercus* spp.	Ragazzi et al. (2003), Roskov et al. (2019)
•*Hypoxylaceae* or *Xylariaceae*	*H. tassianum* (Ces. & De Not.) P.M.D. Martin = *Rosellinia tassiana* Ces. & De Not.	*Quercus ilex*	Petrini (1992)
Hypoxylaceae	**Jackrogersella cohaerens* (Pers.) L. Wendt, Kuhnert & M. Stadler [[Cam, Emi, Fri, Lom, Sic]] = *Hypoxylon cohaerens* (Pers.) Fr. = *Annulohypoxylon cohaerens* (Pers.) Y.M. Ju, J.D. Rogers & H.M. Hsieh [S]	*Fagus sylvatica*, *Fagus* sp.	Miller (1961), Saitta et al. (2011), Wendt et al. (2018)
	**J. multiformis* (Fr.) L. Wendt, Kuhnert & M. Stadler [[Cam, Emi, Lig, Lom, Tus, Ven]] = *Annulohypoxylon multiforme* (Fr.) Y.M. Ju, J.D. Rogers & H.M. Hsieh [S]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011), Wendt et al. (2018)
Lopadostomaceae	**Lopadostoma gastrinum* (Fr.) Traverso [S, [Emi]]	*Quercus* sp.	Hyde et al. (2020c)
	**L. fagi* Jaklitsch, J. Fourn. & Voglmayr [S, [Emi]]	*Fagus sylvatica*	Daranagama et al. (2016)
Microdochiaceae	**Selenodriella fertilis* (Piroz. & Hodges) R.F. Castañeda & W.B. Kendr. [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
Xylariaceae	**Euepixylon udum* (Pers.) Læssøe & Spooner [S, [Lom]]	*Quercus* spp.	Saitta et al. (2011)
	**Kretzschmaria deusta* (Hoffm.) P.M.D. Martin [S, [Cam, Fri, Lig, Lom, Tre]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**Nemania serpens* (Pers.) Gray [S, [Cam, Fri, Laz, Lom, Tus, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)
	**Rosellinia aquila* (Fr.) Ces. & De Not. [S, [Emi, Lom, Tus]]	*Fagus sylvatica*, *Quercus* spp.	Saitta et al. (2011)
	**R. desmazieri* (Berk. & Broome) Sacc.	*Fagus* sp., *Quercus* sp.	Petrini (2013), Venturella (1991)
	**R. necatrix* Berl. ex Prill. [P]	*Corylus avellana*, *Juglans regia*	Spaulding (1961), Petrini (2013), Wittstein et al. (2020)
	**R. subsimilis* Sacc.	*Corylus avellana*	Petrini (1992, 2013)
	**Xylaria hypoxylon* (L.) Grev. [S, [Abr, Bas, Cal, Cam, Emi, Fri, Laz, Lig, Lom, Tre, Sic, Tus, Ven]]	*Fagus sylvatica*, *Quercus ilex*, *Quercus* spp.	Saitta et al. (2011), Saitta et al. (2011), Ambrosio et al. (2018), Lunghini et al. (2013)
	**X. longipes* Nitschke [S, [Lig, Lom, Sic]]	*Fagus sylvatica*	Saitta et al. (2011)
	**X. polymorpha* (Pers.) Grev. [S, [Abr, Cam, Lig, Lom, Sic, Tre, Tus]]	*Quercus ilex*, *Quercus* spp.	Saitta et al. (2011)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
•*Xylariales* genera *incertae sedis*	*Anungitea longicatenata* Matsush. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	A. fragilis B. Sutton S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	A. uniseptata Matsush. S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
Xylariales genera *incertae sedis*	*Circinotrichum maculiforme* Nees S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	C. olivaceum (Speg.) Piroz. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**Gyrothrix circinata* (Berk. & M.A. Curtis) S. Hughes S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	G. citricola Piroz. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	G. magica Lunghini & Onofri S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**G. podosperma* (Corda) Rabenh. S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	**G. verticiclada* (Goid.) S. Hughes & Piroz. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Lunghini et al. (2013)
	**G. verticillata* Piroz. S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	Leptomassaria unedonis (De Not.) Rappaz [Lig]	*Castanea sativa*	Rappaz (1995)
	**Polyscytalum fecundissimum* Riess S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	**Pseudosubramaniomyces fusisaprophyticus* (Matsush.) Crous [Tus] = *Subramaniomyces fusisaprophyticus* (Matsush.) P.M. Kirk S	*Quercus ilex*	Zucconi & Pasqualetti (2007), Crous et al. (2017)
Zygosporiaceae	**Zygosporium gibbum* (Sacc., M. Rousseau & E. Bommer) S. Hughes S	*Quercus ilex*	Lunghini et al. (2013)
	**Z. masonii* S. Hughes S	*Quercus ilex*	Lunghini et al. (2013)
	Zygosporium sp. S, [Tus]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
#*Sordariomycetes incertae sedis* (2 taxa)			
Sordariomycetes genera *incertae sedis*	**Selenosporella curvispora* G. Arnaud ex MacGarvie S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	Saccardoella montellica Speg. S	*Quercus* sp.	Hyde et al. (2013)
#*Pezizomycotina incertae sedis* (2 taxa)			
Pezizomycotina genera *incertae sedis*	**Biatoridium monasteriense* J. Lahm ex Körb. L	*Quercus* spp.	Nimis (2016)
	Wadeana dendrographa (Nyl.) Coppins & P. James E, L	*Quercus* spp.	Nimis (2016)
Subphylum: *Saccharomycotina* (2)			
Class: *Saccharomycetes* (2)			
Order: *Saccharomycetales* (2 taxa)			
Saccharomycetales genera *incertae sedis*	*Candida* sp. S, [Tus]	*Quercus* spp.	Panzavolta et al. (2018)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
Saccharomycetaceae	**Eremothecium coryli* (Peglion) Kurtzman = *Nematospora coryli* Peglion [P]	*Corylus avellana*	Venturella (1991), Scarpari et al. (2018)
Subphylum: *Taphrinomycotina* (5) Class: ***Taphrinomycetes* (5)**			
Order: *Taphrinales* (5 taxa)			
Taphrinaceae	**Taphrina alni* (Berk. & Broome) = *Taphrina amentorum* (Sadeb.) Rostr. [P]	*Alnus* sp.	Spaulding (1961)
	**T. caerulescens* (Desm. & Mont.) Tul. [P, [Sar]]	*Quercus cerris*, *Q. ilex*, *Q. pubescens*	Venturella (1991), Spaulding (1961), Spooner (2007)
	**T. carpini* (Rostr.) Johanson [P]	*Carpinus betulus*, *Castanea sativa*, *Quercus pyrenaica*	Spaulding (1961) Morales-Rodriguez et al. (2019)
	**T. kruchii* (Vuill.) Sacc. [P]	*Quercus ilex*	Mix (1949), Spaulding (1961)
	T. ostryae C. Massal. [P]	*Ostrya carpinifolia*	Mix (1949), Spaulding (1961)
#*Ascomycota incertae sedis* (23 taxa)			
Ascomycota genera *incertae sedis*	**Acrospeira mirabilis* Berk. & Broome	*Castanea sativa*	Farr & Rossman (2022)
	Anungitopsis triseptata (Matsush.) R.F. Castañeda & W.B. Kendr. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Lunghini et al. (2013)
	**Bispora antennata* (Pers.) E.W. Mason [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Ceratophorum helicosporum (Sacc.) Sacc. [P]	*Quercus robur*	Ellis (1971)
	**Ceratosporella deviata* Subram. [S, [Cam, Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007), Lunghini et al. (2013)
	**Ciliochora calabrica* B. Sutton & Mugnai [En, [Cal]]	*Fagus sylvatica*	Sutton et al. (1996), Moriondo & Menguzzato (2000)
	Cyrtidula quercus (A. Massal.) Minks [L]	*Alnus* sp., *Quercus* sp.	Nimis (2016)
	**Everhartia hymenuloides* Sacc. & Ellis [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	Hymenopsis sp.[P, [Lig]]	*Alnus glutinosa*	Moricca (2002)
	Linodochium sp. [En, [Tus]]	*Fagus sylvatica*	Danti et al. (2002)
	Minimidochium setosum B. Sutton [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Monostichella robergei (Desm.) Höhn.	*Carpinus betulus*	Sutton (1980)
	**Paratrichoconis biseptata* Matsush. [S, [Cam]	*Quercus ilex*	Lunghini et al. (2013)
	**Phaeostalagmus cyclosporus* (Grove) W. Gams [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Piggotia coryli (Roberge ex Desm.) B. Sutton	*Corylus avellana*	Venturella (1991)
	Quadracaea mediterranea Lunghini, Pinzari & Zucconi [S, [Cam]]	*Quercus ilex*	Lunghini et al. (1996)
	Rhexoampullifera fagi (M.B. Ellis) P.M. Kirk & C.M. Kirk [S, [Cam]]	*Quercus ilex*	Lunghini et al. (2013)
	Spiropes sp. [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)

Table 4 Continued

Family	Species	Host plant(s)	Reference(s)
	Stigmella effigurata (Schwein.) S. Hughes = *Coryneum effiguratum* Schwein.	*Quercus pubescens*	Sutton (1975)
	**Subulispora britannica* B. Sutton [S, [Tus]]	*Quercus ilex*	Zucconi & Pasqualetti (2007)
	**S. procurvata* Tubaki [[Cam]]	*Quercus ilex*	Sutton (1975), Lunghini et al. (2013)
	**Sympodiella goidanichii* (Rambelli) Crous & Hern.-Restr. [[Tus]] = *Sporidesmium goidanichii* (Rambelli) S. Hughes [S]	*Fagus sylvatica*, *Quercus ilex*	Zucconi & Pasqualetti (2007), Crous et al. (2019b), Shen et al. (2020)
	Titaea callispora Sacc.	*Carpinus betulus*	Sutton (1984)

Symboles: [D]-Doubtful, [F]-Fungicolous, [L]-Lichenized, [LC]-Lichenicolous, [NL]-Non-lichenized, Non-lichenicolous fungus, [E]-Epiphytic, [En]-Endophytic, [S]-Saprobic, [P]-Pathogenic. [H]-Hypogeous**,** *Sequence data available, #-*incertae sedis* taxa, •-taxonomically updated/problematic.

Taxonomic classification of reported *Ascomycota*

The extracted data on *Ascomycota* were categorized based on the latest taxonomic classifications. In the checklist, 696 records out of 776 were identified at the species level and 80 records at the genus level. Taxa from *Pezizomycotina*, *Saccharomycotina*, and *Taphrinomycotina* were reported in *Ascomycota*. In *Pezizomycotina*, the majority of taxa were reported in different classes (Fig. 7) except for *Geoglossomycetes*, *Laboulbeniomycetes*, *Lichinomycetes*, *Xylonomycetes*, and *Xylobotryomycetes*. Taxa from *Saccharomycetes* and *Taphrinomycetes* were reported from *Saccharomycotina* and *Taphrinomycotina*, respectively. The majority of taxa belonged to *Pezizomycotina* (746), followed by *Saccharomycotina* (2), *Taphrinomycotina* (5), and *Ascomycota* genera *incertae sedis* (23) (Table 4). From the 12 reported classes, *Sordariomycetes* species were the most dominant (34%), followed by *Dothideomycetes* (24%), *Lecanoromycetes* (16%), and *Leotiomycetes* (11%), while the rest were less reported (Fig. 7).

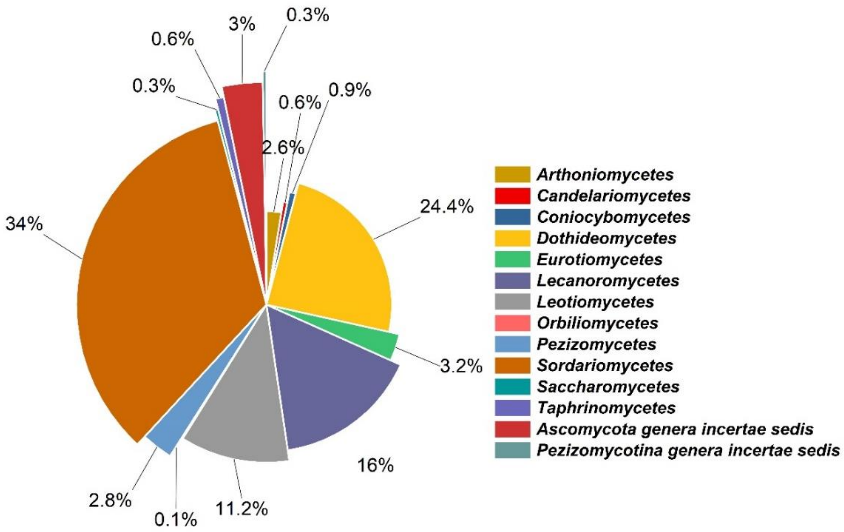

Fig. 7 – Classes and groups of *incertae sedis* of *Fagales*-inhabiting *Ascomycota*.

In our survey, *Sordariomycetes* were dominant, with 264 species belonging to 135 genera, 61 families, and 20 orders. *Dothideomycetes* included 189 species belonging to 97 genera, 52 families, and 19 orders, followed by *Lecanoromycetes* records with 124 species in 67 genera, 28 families, and 11 orders, and *Leotiomycetes* records with 87 species in 44 genera, 29 families, and seven orders. *Candelariomycetes*, *Coniocybomycetes*, *Orbiliomycetes*, *Saccharomycetes*, and *Taphrinomycetes* were recorded with very few taxa under a monotypic order in each class, belonging to a few families and genera (Fig. 8).

Molecular data availability of recorded taxa

Records of *Ascomycota* on *Fagales* were checked in GenBank (2022) for sequence data to understand molecular data richness. The sequence data in the GenBank for some listed *Ascomycota* species are not derived from *Fagales*-based isolates. However, we considered only the sequence data available for any isolate related to our reported fungal species. Among 776 *Ascomycota* records, 532 taxa (68.5%) with molecular data were revealed. A total of 189 (72%) *Sordariomycetes* taxa were prominent, followed by *Dothideomycetes* (103 taxa, 54%), *Lecanoromycetes* (103 taxa, 83%), and *Leotiomycetes* (60 taxa, 70%). The smaller numbers of taxa (<25 records in the class) were recorded in *Arthoniomycetes*, *Candelariomycetes*, *Coniocybomycete*, *Eurotiomycetes*, *Leotiomycetes*, *Orbiliomycetes*, *Pezizomycetes*, *Pezizomycotina incertae sedis*, *Saccharomycetes*, *Taphrinomycetes*, and *Ascomycota* genera *incertae sedis* (Fig. 9).

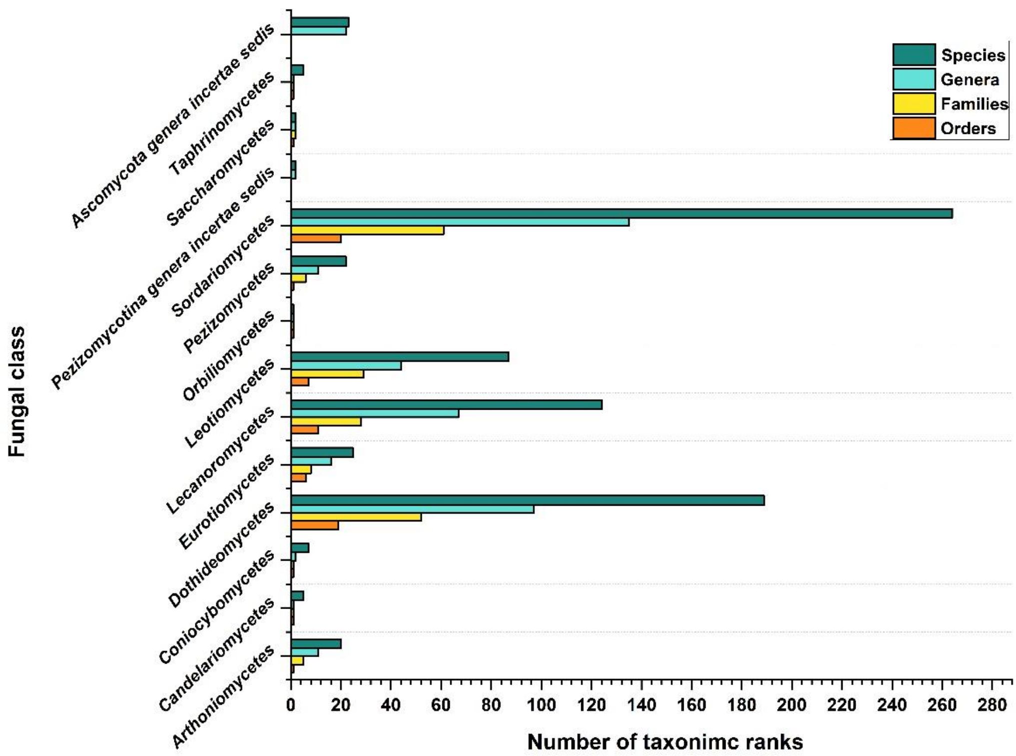

Fig. 8 – Number of species, genera, families and orders in different classes of *Fagales*-inhabiting *Ascomycota*.

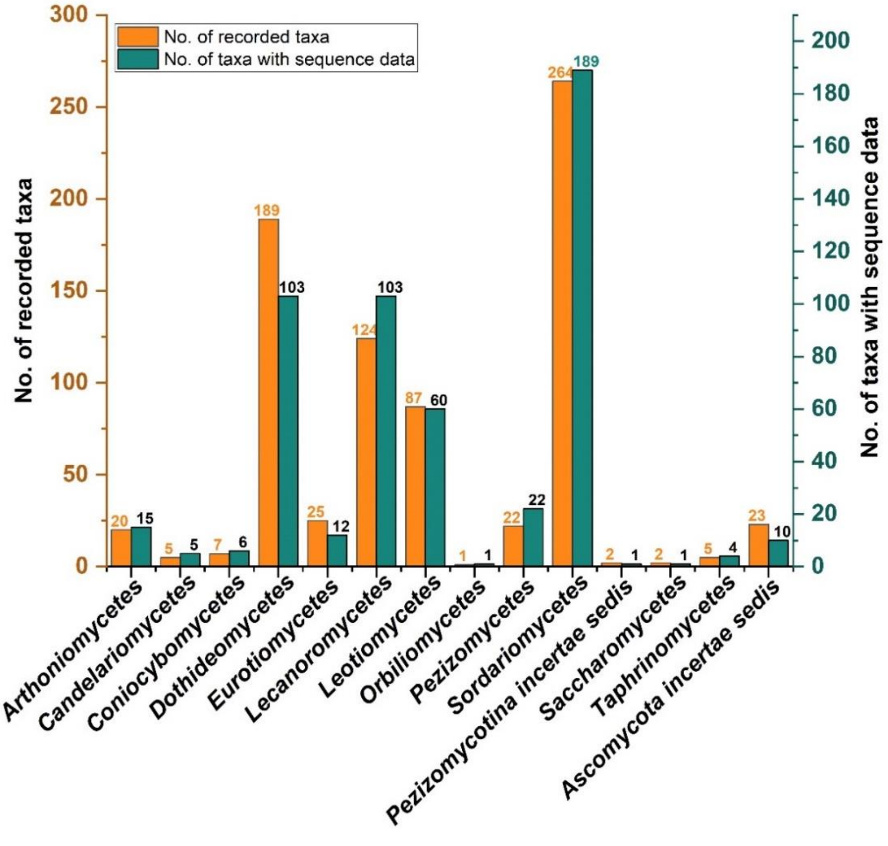

Fig. 9 – Number of sequence data available in the GenBank for reported *Ascomycota* species listed in this study.

Lifemodes of *Fagales*-inhabiting *Ascomycota*

Endophytic (9%), pathogenic (12%), saprobic (40%), lichenicolous (0.1%), lichenized (23%), non-lichenicolous (2%), and fungicolous (0.1%) records of *Ascomycota* were identified on *Fagales* hosts based on the total list (Table 4). For the rest, life mode data were not reported. The *Pezizomycotina* records show all life modes mentioned above, with two records each for the fungicolous and lichenicolous taxa. Records of *Saccharomycotina* contain pathogenic and saprobic taxa, while *Taphrinomycotina* contains only pathogenic taxa. *Ascomycota incertae sedis* taxa were reported with endophytic, pathogenic, saprobic, and lichenized life modes. Lichenized records of *Ascomycota* are reported in *Arthoniomycetes*, *Candelariomycetes*, *Coniocybomycetes*, *Lecanoromycetes* and *Pezizomycotina incertae sedis*. As the most dominant class, *Sordariomycetes* taxa include saprobic (142), pathogenic (46), endophytic (32), and fungicolous (1) life modes. Dothideomycetous records consist of all mentioned life modes, with saprobic being dominant (85 taxa), followed by pathogenic (37 taxa), and endophytic (21 taxa) records, except for fungicolous and lichenicolous taxa. Reported life mode data for *Ascomycota* on *Fagales* hosts, including their number of taxa, are listed in Table 5.

Table 5 Life mode data (no. of taxa) of *Fagales*-inhabiting *Ascomycota* in Italy.

Subphylum	Class	Order	Endophytic	Pathogenic	Saprobic	Lichenicolous	Lichenized	Non-lichenized; non-lichenicolous	Fungicolous
Pezizomycotina	*Arthoniomycetes*	*Arthoniales*					20		
	Candelariomycetes	*Candelariales*					5		
	Coniocybomycetes	*Coniocybales*					6		
	Dothideomycetes	*Asterinale*			1				
		Botryosphaeriales	5	18	5				
		Capnodiales	1	1	8				
		Dothideales	2						
		Eremithallales					1		
		Gloniales			1				
		Hysteriales			2				
		Kirschsteiniotheliales	1		1				
		Microthyriales			3				
		Mycosphaerellales		5	9				
		Patellariales			2				
		Pleosporales	11	12	41			1	
		Strigulales					4		
		Trypetheliales					3	6	
		Tubeufiales			3				
		Venturiales		1	2				
		Dothideomycetes incertae sedis			3			4	
		Dothideomycetes genera *incertae sedis*	1		2				
		Valsariales			2				
	Eurotiomycetes	*Eurotiales*	1	1	4				
		Chaetothyriales	1		3				
		Mycocaliciales				1	1	2	
		Phaeomoniellales					1		
		Pyrenulales					3		
		Verrucariales					1		

Table 5 Continued.

Subphylum	Class	Order	Endophytic	Pathogenic	Saprobic	Lichenicolous	Lichenized	Non-lichenized; non-lichenicolous	Fungicolous
	Lecanoromycetes	*Baeomycetales*					5		
		Caliciales					25		
		Graphidales					2		
		Gyalectales					6		
		Lecanorales					58		
		Lecideales					3		
		Ostropales					1		
		Peltigerales					9		
		Pertusariales					6		
		Teloschistales					8		
		Umbilicariales					2		
	Leotiomycetes	*Chaetomellales*	1						
		Helotiales	9	3	37				
		Leotiales			1				
		Marthamycetales			1				
		Phacidiales			1				
		Rhytismatales	1		1				
		Leotiomycetes families *incertae sedis*			10				
	Orbiliomycetes	*Orbiliales*			1				
	Pezizomycetes	*Pezizales*			6				
	Sordariomycetes	*Amphisphaeriales*	2	1	15				
		Boliniales			2				
		Calosphaeriales			3				
		Coniochaetales	1		2				
		Coronophorales			2				
		Chaetosphaeriales			9				
		Diaporthales	13	29	26				
		Diaporthomycetidae families *incertae sedis*	1		3				
		Glomerellales		2	3				
		Hypocreales	11	9	11				
		Microascales			1				
		Myrmecridiales			1				
		Pleurotheciales			1				
		Sordariales			5				
		Sordariomycetes incertae sedis			2				
		Sporidesmiales			1				
		Xenospadicoidales			1				
		Xylariales	4	5	54				1
Saccharomycotina	*Saccharomycetes*	*Saccharomycetales*		1	1				
Taphrinomycotina	*Taphrinomycetes*	*Taphrinales*		5					
	#*Ascomycota* genera *incertae sedis*		2	2	12		1		
	#*Pezizomycotina* genera *incertae sedis*						2		

Symboles: # - unresolved taxonomic groups.

Fungal-host relationship between *Ascomycota* and *Fagales* hosts

The correlation between the occurrence of fungal taxa and the host genera of *Fagales* (Fig. 10) has been provided by a clustered heat map (double dendrogram). The data matrix consists of the number of taxa reported in different fungal classes and the host genera. A record of one fungal species on a specific host genus was counted as a single record. When the same fungal taxon was reported several times on one host genus, they were counted as a single record to avoid repetition. Several fungal records identified at the genus level from the same host genus were counted as one record. Both rows and columns were determined by performing hierarchical cluster analyses. The color of a cell is proportional to its position along the color range and the number of taxa within the host genus.

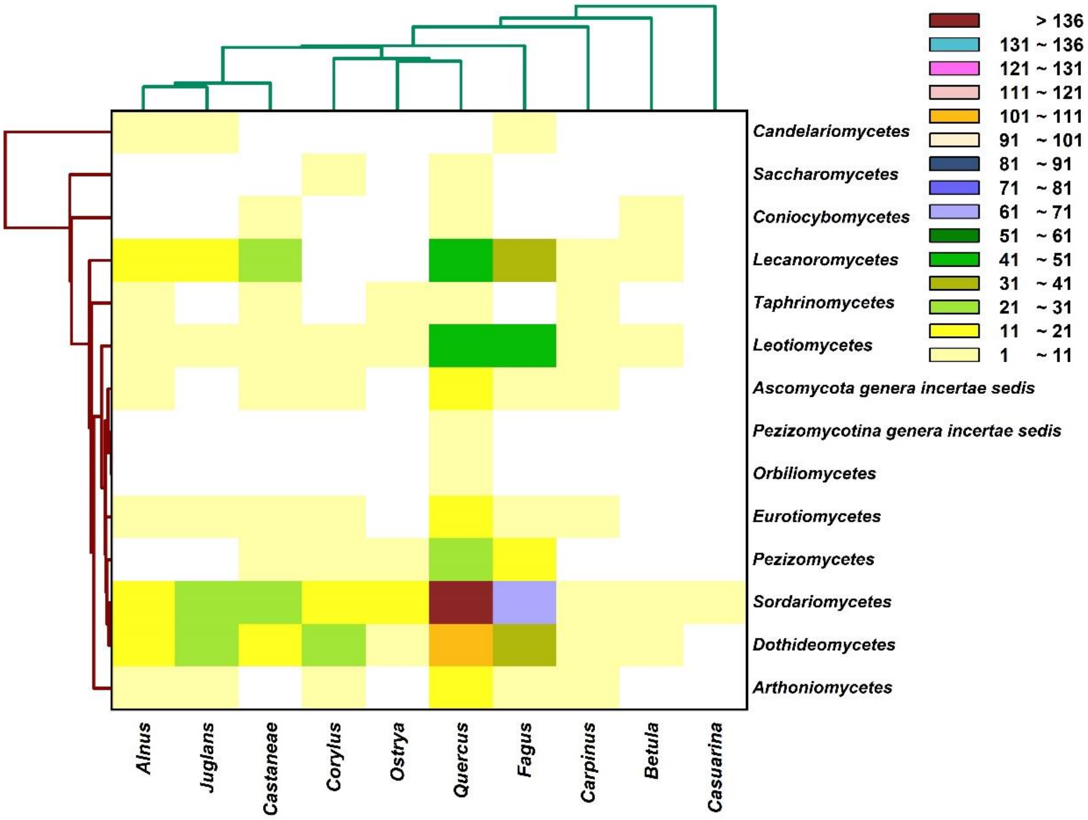

Fig. 10 – The correlation between the numbers of *Ascomycota* on different host genera of Italian *Fagales*. Fungal classes are shown as rows and the host genera as columns. In the ranking number, fungal taxa were expanded from 1–10 increment levels, with the corresponding color, up to 136–141. Similarly, the white represents zero taxa reported in the classes. The respective host genera can be found on the data matrix's X-axis.

Based on our data (Fig. 10), *Sordariomycetes* mostly record on *Quercus* hosts (brown), followed by *Fagus* (pale-blue), *Juglans*, *Castaneae* (pale-green), *Alnus*, *Corylus*, *Ostrya* (yellow) and *Carpinus*, *Betula*, and *Casuarina* (pale-yellow). Dothideomycetous taxa were mostly associated with *Quercus* hosts, followed by *Fagus* (golden), *Juglans*, *Corylus* (pale-green), *Alnus*, *Castaneae* (yellow), and a few with *Carpinus* and *Betula* (pale-yellow), with no records on *Casuarina* hosts. Majority of *Lecanoromycetes* were recorded on *Quercus* hosts (green), followed by *Fagus* (golden), *Castaneae* (pale green), *Alnus*, *Juglans* (yellow), *Carpinus*, and *Betula* (pale-yellow) hosts, while they were absent on other *Fagales* genera. Based on the matrix, the majority of fungal taxa were recorded on *Quercus* hosts. This may be because of the high abundance and distribution of *Quercus* species in Italy. There are 22 *Quercus* species reported from Italian *Fagales*, and the genus covers nearly half of the total number of *Fagales* taxa. Because of this wide distribution of *Quercus* species, a higher number of fungal studies have been performed from the past.

Mapping

Spatial distribution of *Fagales* species in Italy

The spatial distribution of Italian *Fagales* species was illustrated to expand the knowledge of current host occurrence. From online web-based data, 42,598 *Fagales* records were obtained, belonging to *Betulaceae* (14,807), *Casuarinaceae* (7), *Fagaceae* (21,954), and *Juglandaceae* (5,830). The georeferenced records of *Alnus* (2,664), *Betula* (1,780), *Carpinus* (3,270), *Corylus* (4,934), and *Ostrya* (2,159) in *Betulaceae*, *Casuarina* (7) in *Casuarinaceae*, *Castanea* (2,641), *Fagus* (9,448) and *Quercus* (9,865) in *Fagaceae* and *Juglans* (5,629) and *Pterocarya* (201) in *Juglandaceae* were mapped (Fig. 11). Blue, orange, green, and red represent *Betulaceae*, *Casuarinaceae*, *Fagaceae*, and *Juglandaceae*, respectively. Members of *Betulaceae* and *Fagaceae* are common in the Alps and Apennines mountain ranges as well as in Sicily and Sardinia islands (blue and green). *Juglandaceae* taxa showed a scattered, wide distribution in all parts of the country. On the generic level, *Quercus* is the most prominent host genus, followed by *Fagus* and *Juglans*, while *Casuarina* is rarely available.

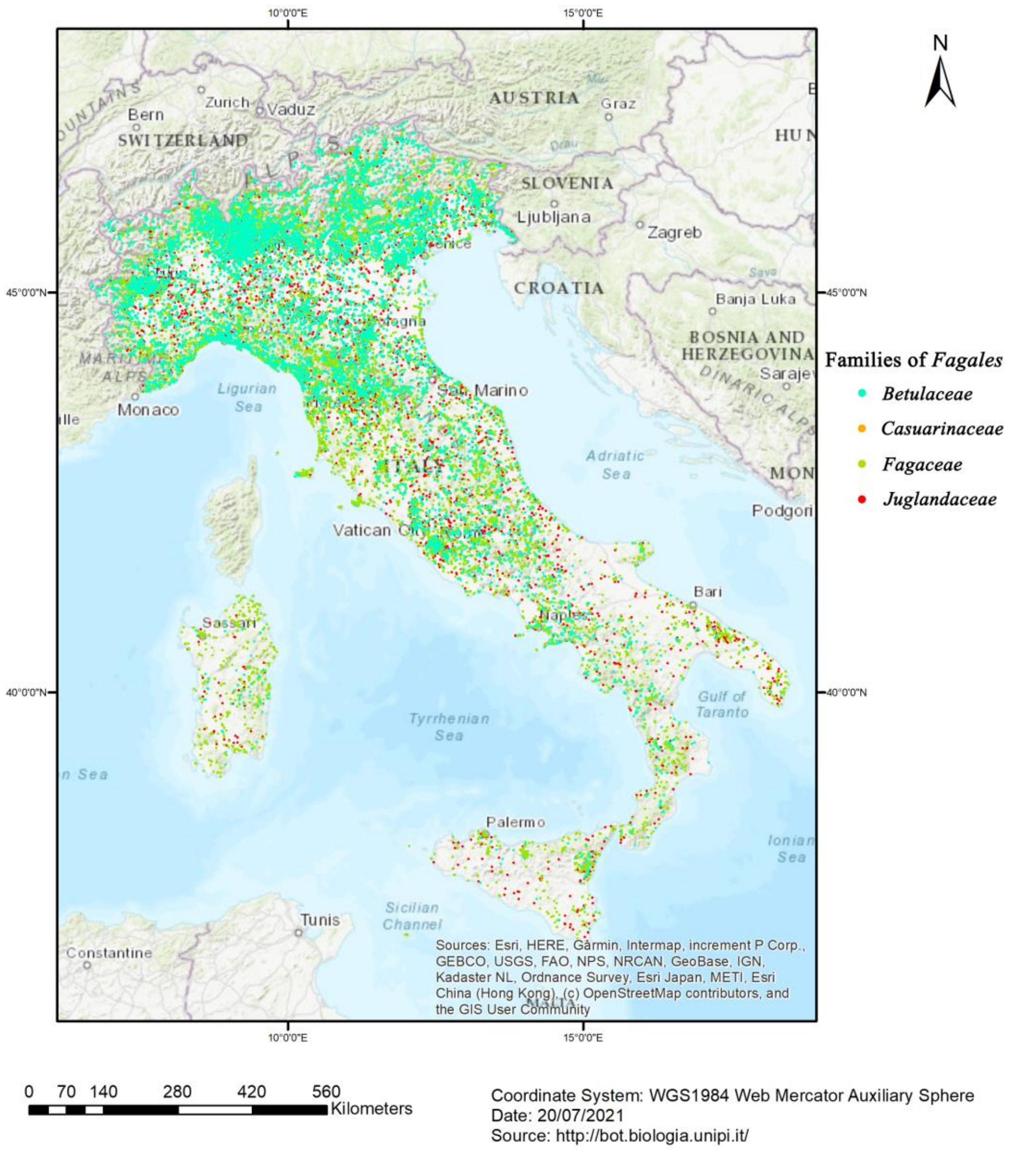

Fig. 11 – Spatial distribution of *Fagales* trees in Italy.

Spatial distribution of *Fagales* associated *Ascomycota* in Italy

Fungal taxa recorded with location data were selected and listed with their regional distribution. Lichenized and lichen-associated taxa were excluded as Nimis & Martellos (2022) are currently working on ITALIC 6.0 (http://italic.units.it/) taxonomy and geography of Italian lichens. A total of 435 taxa in *Ascomycota* were revealed with 723 location records (Fig. 12). The regional distributions of scattered fungal data were collected and rearranged according to class level. Among 704 records (locations) for 417 *Pezizomycotina* taxa, *Dothideomycetes* (162 records, 130 taxa), *Eurotiomycetes* (11 records, 10 taxa), *Leotiomycetes* (132 records, 64 taxa), *Orbiliomycetes* (one record, one taxon), *Pezizomycetes* (45 records, 22 taxa), and *Sordariomycetes* (353 records, 190 taxa) were counted. In *Saccharomycotina* and *Taphrinomycotina* only one fungal species with one location record was available for each *Saccharomycetes* and *Taphrinomycetes*, respectively, while 17 location data were available for 16 *Ascomycota incertae sedis* taxa.

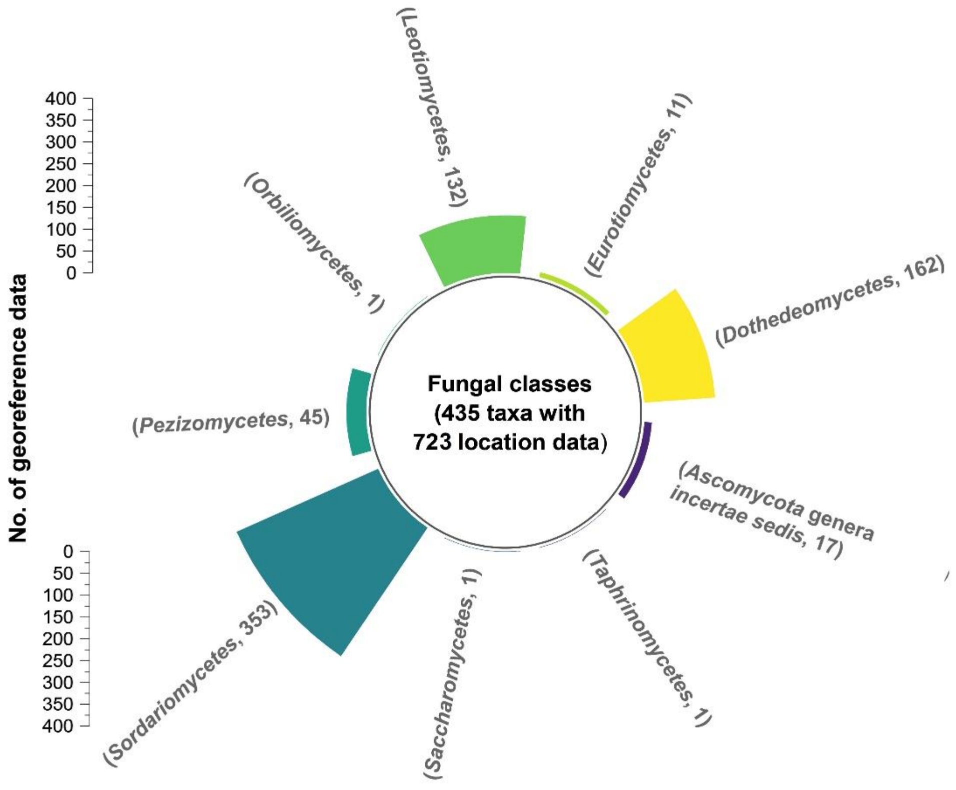

Fig. 12 – Number of location data records for *Fagales*-inhabiting taxa in respective classes.

A study-based mapping can expand the knowledge of past and present research efforts on *Fagales*-inhabiting *Ascomycota* and future research gaps. Sampling locations were poorly reported in some historical studies, and some original publications were not available. In some cases, only the country name was mentioned as the collecting site of fungal species. Some fungal taxa were reported from different provinces on different *Fagales* species. For instance, *Botryosphaeria dothidea* was recorded from Sardinia, Lombardy, and Emilia–Romagna regions on *Ostrya carpinifolia, Quercus ilex, Q. robur and Q. rubra* four times. However, these records were counted as three location data to avoid repeating the same location.

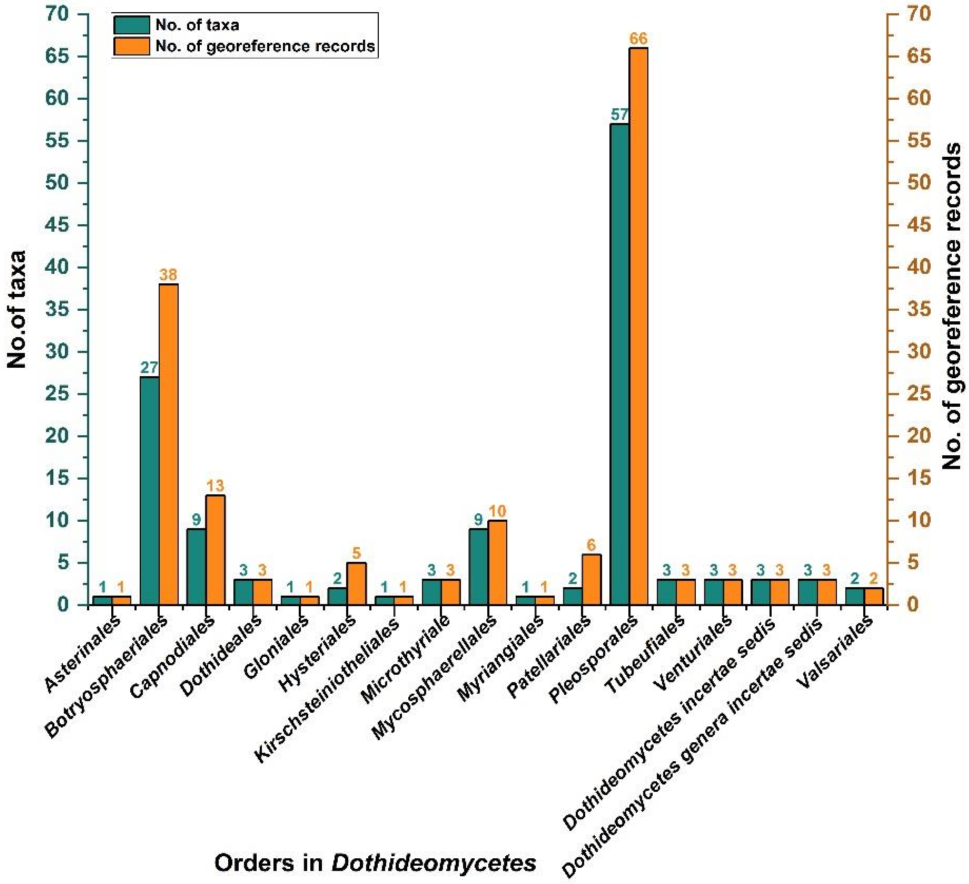

Fig. 13 – Number of taxa with location data and respective orders in *Dothideomycetes*.

According to the listed data, *Dothideomycetes*, *Leotiomycetes*, and *Sordariomycetes* were identified as the most distributed fungal classes (Figs 13, 14, and 15). *Sordariomycetes* taxa show the greater distribution in Italy, with 353 location data, followed by *Dothideomycetes* (162 location data), *Leotiomycetes* (132 location data), and other classes (76 location data). Within *Dothideomycetes*, *Botryosphaeriales* (27 taxa) and *Pleosporales* (57 taxa) show a high number of distribution records with 38 and 66 location data, respectively. Within *Sordariomycetes*, *Xylariales* (54 taxa) reports a higher number of (148) distribution records, followed by *Diaporthales* (52 taxa) with 81 distribution records, *Hypocreales* (25 taxa) with 42 distribution records, and *Amphisphaeriales* (18 taxa) with 26 distribution records, while others have fewer. Also, in *Leotiomycetes*, *Helotiales* (48 taxa) reports a high number (105) of distribution records and taxa, while other orders are less represented. In addition, a few location data were revealed for *Eurotiomycetes*, *Orbiliomycetes*, and *Pezizomycetes*. In *Eurotiomycetes*, eight fungal records from *Eurotiales* and four fungal records from *Chaetothyriales* were revealed with distribution data. Also, *Orbiliomycetes* with one fungal record (*Orbiliales*) and *Pezizomycetes* with 22 fungal records (*Pezizales*) were revealed with distribution data. One fungal record from each *Saccharomycetales* and *Taphrinales* was revealed with distribution data. The fungal records that were identified up to the genus level by authors in different studies were counted as one location record (e.g., *Phoma* spp., *Phoma* sp.), as they were distributed in the same region to avoid overlapping.

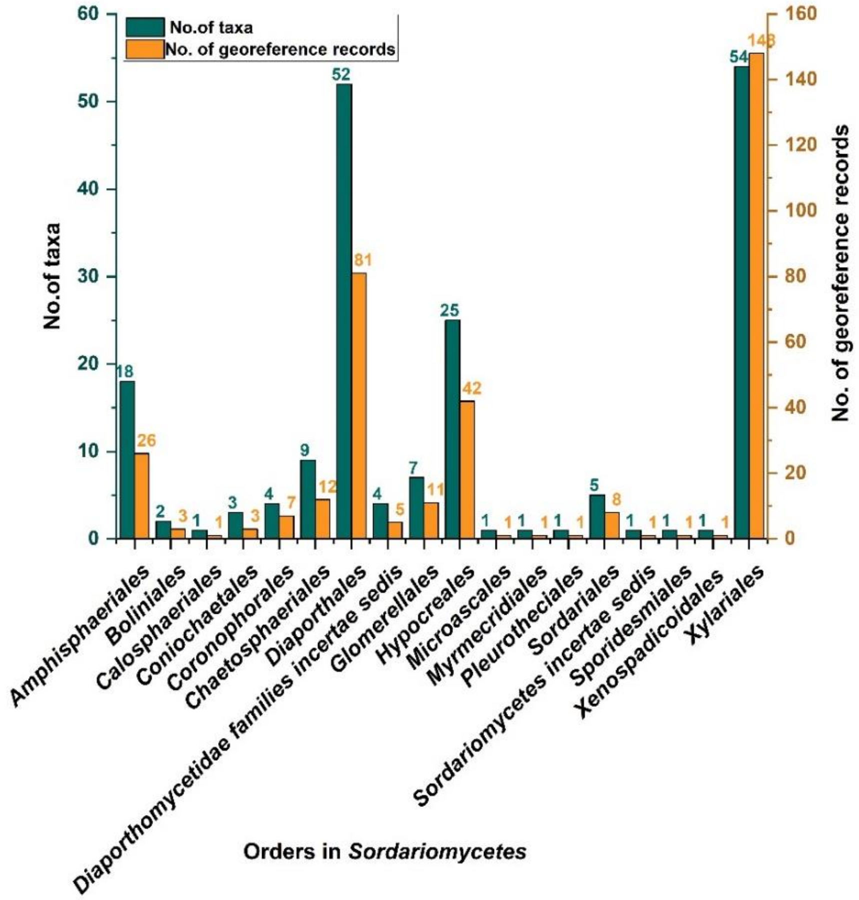

Fig. 14 – Number of taxa with location data and respective orders in *Sordariomycetes*.

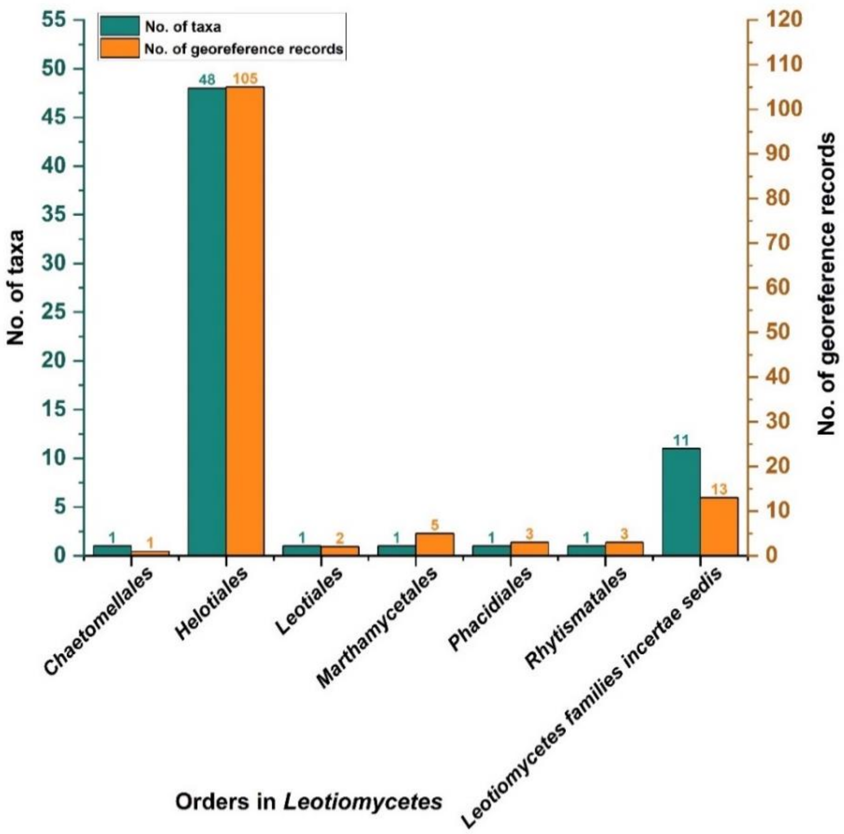

Fig. 15 – Number of taxa with location data and respective orders in *Leotiomycetes*.

Updated regional distribution data for class level *Ascomycota* on *Fagales* was mapped (Fig. 16). Sordariomycetous taxa are distributed dominantly in all Italian regions except for Molise, followed by *Leotiomycetes* (13 regions), *Pezizomycetes* (12 regions), and *Dothideomycetes* (10 regions), while other classes show minor distribution. *Pezizomycetes* and *Sordariomycetes* taxa were mostly reported in Sicily, whereas *Dothideomycetes* are common in Sardinia. The reported distribution of dothideomycetous and sordariomycetous taxa in Tuscany is high. Based on the regional richness of the reported *Ascomycota* on *Fagales* in this study, the Tuscany region has the highest number of georeferenced data with 153 records, followed by Campania (107), Lombardy (90), Trentino-Alto Adige (81), Emilia-Romagna (76), Veneto (48), Sicily (45), Liguria (32), Lazio (26), Sardinia (18), Friuli-Venezia Giulia (11), Piedmont (9), Abruzzo (7), Calabria (6), Apulia (5), Basilicata (5), Marche (2), Umbria (1) and Valle d'Aosta (Aosta Valley) (1). There were no fungal records and location data in Molise, while the other regions have at least one record.

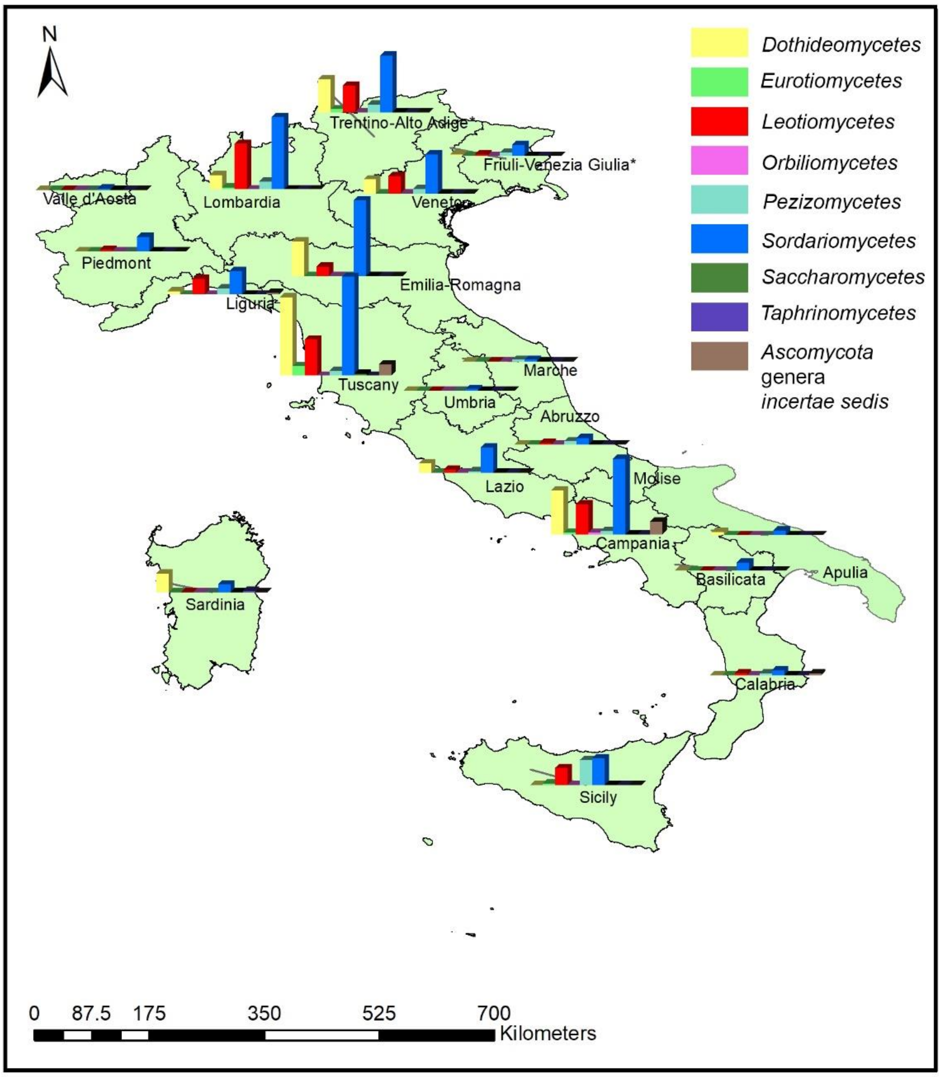

Fig. 16 – Regional distribution of *Ascomycota* more frequently recorded on *Fagales* (based on location data availability from publications used in this study).

Taxonomy

Morphology and Phylogenetic analyses

Five *Fagales*-associated species (collected from Arezzo [AR] and Forlì-Cesena [FC] provinces) are herewith described in *Dothideomycetes* and *Sordariomycetes*.

Dothideomycetes

Valsariaceae Jaklitsch, K.D. Hyde & Voglmayr (2015)

Index Fungorum number: IF 811901; Facesoffungi number: FoF 06561

Valsariaceae, *Valsariales* was introduced by Jaklitsch et al. (2015) based on the multigene phylogeny of SSU, LSU, ITS, *rpb*2, and *tef*1-α. Members of *Valsariaceae* have a worldwide distribution as saprobes, plant pathogens, or necrotrophs (Pem et al. 2019). The asexual morph of *Valsaria*, is coelomycetous in nature (Wijayawardene et al. 2017). The family comprises three genera, i.e., *Bambusaria*, *Myrmaecium*, and *Valsaria* (Hongsanan et al. 2020b, Pem et al. 2021, Wijayawardene et al. 2022).

Valsaria Ces. & De Not. (1863)

Index Fungorum number: IF 5704; Facesoffungi number: FoF 06562

Valsaria was introduced by Cesati and De Notaris (1863) with the type species, *V. insitiva*. Taxonomic placement of *Valsaria* was accepted in *Diaporthales* (Kirk et al. 2008) based on its ascomatal wall, true hamathecium, apically free paraphyses, and unitunicate asci (Barr 1978, 1990, Glawe 1985, Jaklitsch et al. 2015). Later, Ju et al. (1996) revealed that the asci of *Valsaria* are bitunicate, but not obviously fissitunicate and the genus was transferred to *Dothideomycetes*. Later, the genus was accepted in *Dothideomycetes* under *Valsariales* (Hongsanan et al. 2020a, Wijayawardene et al. 2020). There are 164 species listed under *Valsaria* in the Index Fungorum (2022), with several synonyms in the Species Fungorum (2022). The most recent study conducted by Pem et al. (2019) revealed a novel taxon, *Valsaria ostryae* on *Ostrya carpinifolia* from Italy.

Valsaria rudis (P. Karst. & Har.) Theiss. & Syd. ex Petr. & Syd. (1923) Fig. 17

Index Fungorum number: IF 277020; Facesoffungi number: FoF 00611

≡ *Dothidea rudis* P. Karst. & Har. (1889)

Saprobic on dead branches of *Quercus* sp. Sexual morph**:** *Stromata* 1.0–1.5 mm high, 1.5–2.5 mm diam, pseudostromatic, erumpent from the host surface, scattered or rarely gregarious, pustular at dehiscence, broadly conical or subglobose with flattened base, enclosed on top and/or at the sides by a thick pseudoparenchymatous black crust, 40–55 µm thick between adjacent stromata. *Ectostroma* forming inversely stellate structures of 3–5 greyish, or greenish to black tubercular segments, the tissue beneath thick pseudoparenchymatous crust, tissue at the stromatal base prosenchymatous, grey, mixed with bark cells. *Ostioles* inconspicuous, opening at the surface. *Ostiolar necks* 0.3–0.5 mm high, cylindrical or conical. *Ascomata* 0.4–0.6 mm high, 0.3–0.6 mm diam, arranged in valsoid configuration, 10–20 ascomatal structures per individual cluster, subglobose to conical, without ostiolar neck. *Peridium* 25–40 µm thick, composed of pale brown to dark cells of *textura angularis*. *Hamathecium* comprises numerous, apically free paraphyses 1.0–2.5 µm wide, dense, filamentous, tapering towards the apex, unbranched, aseptate. *Asci* 70–120 × 7–15 µm ($\bar{x}$ = 85–10 µm, n = 20), 8-spored, bitunicate, indistinctly fissitunicate, cylindrical, short pedicel, apically rounded, containing an ocular chamber and a pulvinate ring. *Ascospores* 15–20 × 5–10 µm ($\bar{x}$ = 16.6–8.5 µm, n = 20), uni-seriate, ellipsoid, hyaline when immature, becoming pale brown to dark brown at maturity, 1-septate, sometimes constricted at the septum, rounded at both ends, with two distinct guttules, surface finely warted to reticulate. Asexual morph**:** Coelomycetous, see Jaklitsch et al. (2015).

Material examined – Italy, Province of Forlì-Cesena **[**FC**]**, Rocca delle Caminate **-** Predappio, dead and fallen branches of *Quercus* sp. (*Fagaceae*), 2 March 2017, Erio Camporesi, IT 3268 (MFLU 17-0730, HKAS 102333); *ibid*., 22 March 2017, IT3268a (MFLU 17-0842, HKAS 102345); living culture MFLUCC 18-0532.

GenBank numbers – ITS: OM614589, OM614590; LSU: OM616560, OM616561; *rpb*2: ON843692, ON843693, *tef*1-α: ON843694.

Notes – In the phylogenetic analysis of *Valsariaceae*, our strains MFLUCC 18-0532 and MFLU 17-0730 grouped with *Valsaria rudis* (V3, CBS 139066, VQC, CBS 139065, V7, and V31) with 100% MLBS and 1.00 BYPP support (Fig. 18). Jaklitsch et al. (2015) designated a lectotype for *Valsaria rudis* (H, herb. Karsten 3713) from France based on morpho-molecular evidence, and a strain of *V. rudis* reported from Lazio, Italy (WU 33486; culture V3) on *Quercus cerris*. The known distribution of *V. rudis* was suggested to be host-specific on *Quercus* species (Jaklitsch et al. 2015). The absence of ectostroma and the presence of cupulate ostiolar discs on the surface of the stroma are key morphological characters of *V. rudis*. Furthermore, MFLU17-0730 and MFLUCC 18-0532 share identical morphology to *V. rudis* (WU 33485) in Jaklitsch et al. (2015). This is the first report of *V. rudis* from the Emilia–Romagna region in Italy.

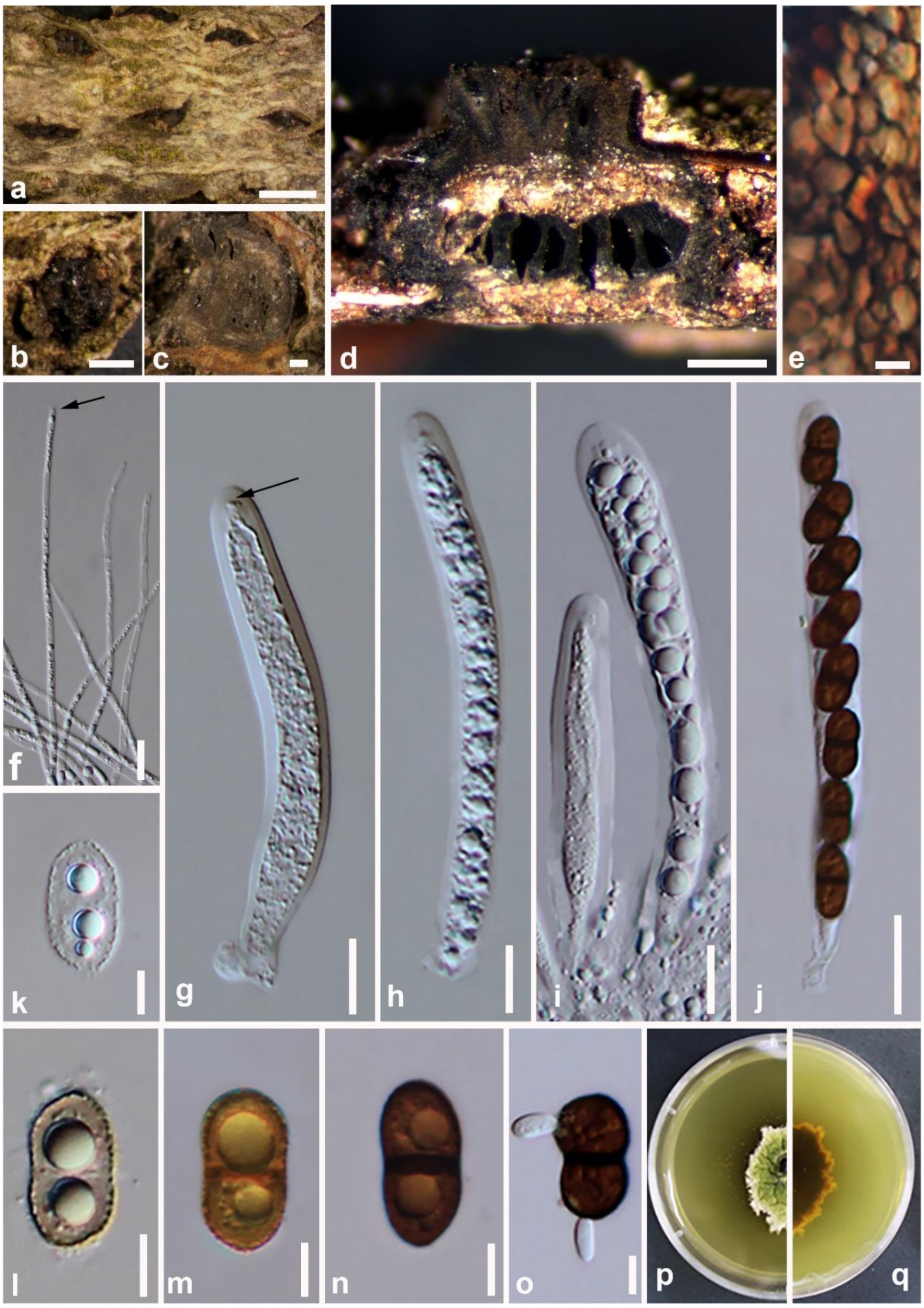

Fig. 17 – ***Valsaria rudis*** (MFLU 17-0730, MFLU 17-0842, **new regional record**). a–c. Appearance of ectostromata on a dead and fallen branch of *Quercus* sp. d. Longitudinal view of the stroma. e. Peridium. f. Apically free paraphyses. g–j. Asci. (g; pulvinate ring is arrowed) k–n. Two-cellular ascospores. o. Germinating ascospore. p, q. Culture characteristics on PDA from surface (p) and reverse (q). Scale bars: a = 1 mm, b, d = 500 µm, c = 200 µm, j = 20 µm, e–i = 10 µm, k–o = 5 µm.

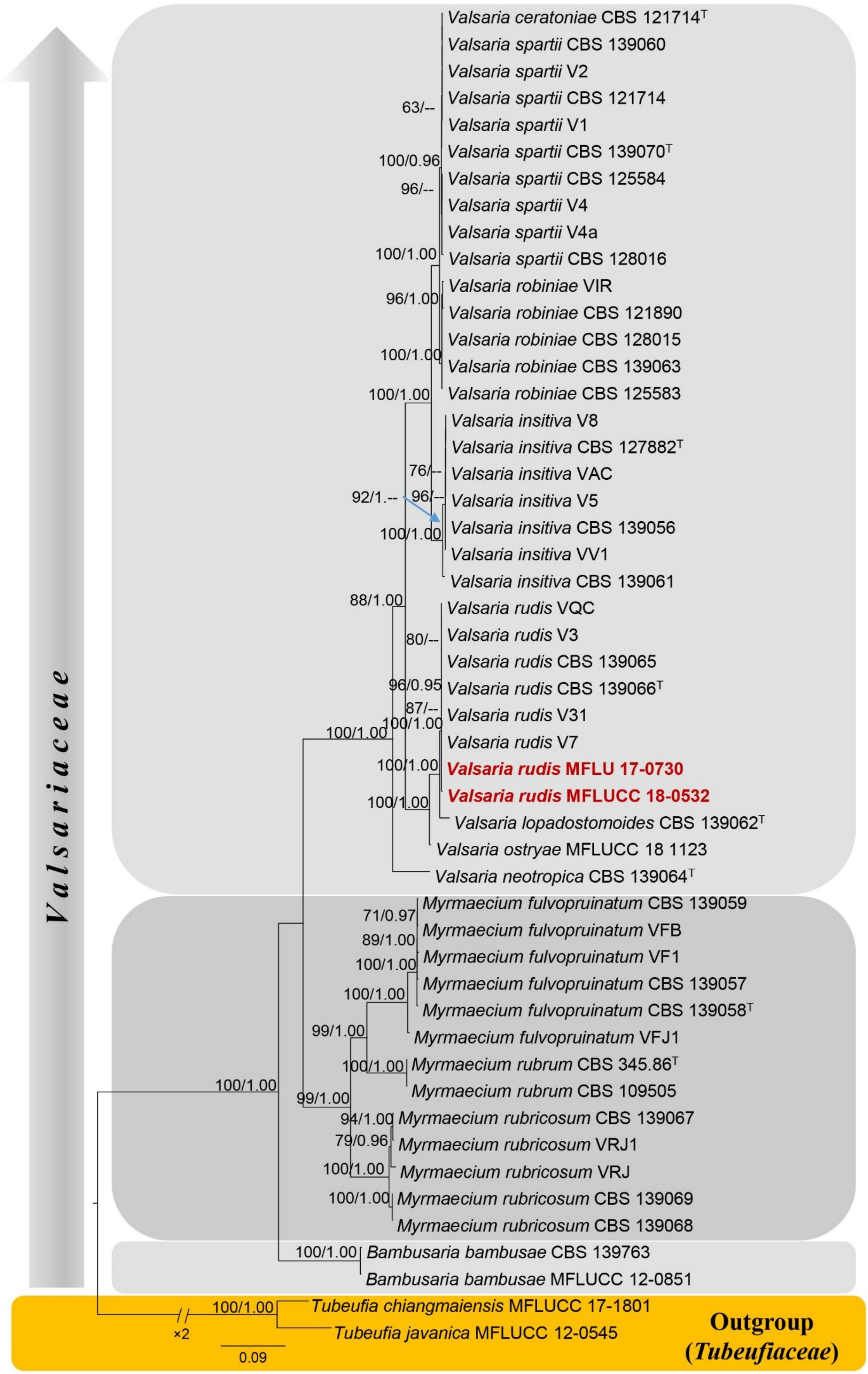

Fig. 18 – Phylogram generated from maximum likelihood analysis based on combined LSU, ITS,

*rpb*2 and *tef*1-α sequenced data. Fifty strains were included in the combined sequence analyses, which comprised 3762 characters with gaps (LSU = 899, ITS = 552, *rpb*2 = 1183, *tef*1-α = 1129). Single gene analyses were also performed, and topology and clade stability were compared from the combined gene analyses. *Tubeufia chiangmaiensis* (MFLUCC 17-1801) and *T. javanica* (MFLUCC 12-0545) were used as the outgroup taxa. The final ML optimization likelihood is -17405.539148. The matrix included 1217 distinct alignment patterns, with 8.6% undetermined characters or gaps. Estimated base frequencies were obtained as follows: A = 0.246657, C = 0.264874, G = 0.270937, T = 0.217532; substitution rates AC = 1.474653, AG = 3.446303, AT = 1.149838, CG = 0.998131, CT = 8.833067, GT = 1.0; gamma distribution. Bootstrap support values for ML (first set) equal to or greater than 70%, BYPP equal to or greater than 0.95 are given above or below the nodes. The strains from the current study are in red bold and the type strains are indicated with ^{T}.

Sordariomycetes

Coryneaceae Corda (1839)

Index Fungorum number: IF 80650; Facesoffungi number: FoF 06868

Coryneaceae was introduced by Corda (1839) to accommodate *Coryneum*, typified by *Coryneum umbonatum*. Formerly, *Coryneaceae* was known as *Pseudovalsaceae*, which was characterized by black, immersed perithecia, deliquescent asci, and brown, distoseptate conidia (Sutton 1975, Jiang et al. 2018). In the current nomenclature, the older name *Coryneaceae* has taken priority over *Pseudovalsaceae* (Senanayake et al. 2017b). The members of *Coryneaceae* can be saprobic on dead wood or pathogenic on economically important trees and forest trees (Senanayake et al. 2017b, Hyde et al. 2020c, Rathnayaka et al. 2020). Based on phylogenetic analyses, *Coryneaceae* belongs to *Diaporthales*, and it is a monophyletic family (Voglmayr & Jaklitsch 2014, Fan et al. 2018b, c, Jiang et al. 2018), consisting of three genera, namely *Coryneum*, *Hyaloterminalis*, and *Talekpea* accepted by Rathnayaka et al. (2020).

Coryneum Nees, (1816)

Index Fungorum number: IF 7798; Facesoffungi number: FoF 1464

Coryneum was typified with *C. umbonatum* based on its asexual morph (Nees von Esenbeck 1816). The majority of *Coryneum* species are phytopathogens causing cankers and dieback of shoots and twigs, especially on *Betulaceae* and *Fagaceae* hosts (Sutton 1975, Wijayawardene et al. 2016b, Senanayake et al. 2017b, Jiang et al. 2018, 2019, Rathnayaka et al. 2020).

Coryneum modonium (Sacc.) Griffon & Maubl. (1910) Figs 19, 20

≡ *Stilbospora modonia* Sacc. (1884)

Index Fungorum number: IF 120927, Facesoffngi number: FoF 11774

Saprobic on dead branches of *Castanea sativa*. Sexual morph: *Pseudostromata* 0.5–1.5 mm diam., solitary, scattered, circular, erumpent through the substrate, with perithecial bumps, containing 5–10 perithecia embedded in an entostroma. *Ectostromatic disc* 0.5–1.0 mm diam., distinct, circular, brownish. *Central column* and *entostroma* gray. *Ostioles* inconspicuous, invisible at the surface of ectostromatic disc. *Perithecia* 300–500 µm × 400–600 µm ($\bar{x}$ = 395 × 521, n = 20), globose to subglobose, uniloculate, black. *Ostiolar necks* 350–450 µm long, 100–120 µm wide, central, cylindrical, blackish-brown. *Peridium* 45–60 µm wide, thick-walled, composed of 8–11 layers, outermost layers pigmented, comprising dark brown to pale brown cells of *textura angularis* to *flattened prismatica*. *Hamathecium* comprises numerous, 5–7 µm wide, unbranched, cellular paraphyses. *Asci* 180–230 × 15–25 µm ($\bar{x}$ = 150 × 20 µm, n = 10), 8-spored, unitunicate, cylindrical, shortly rounded pedicellate, rounded at apex, with an ocular chamber. *Ascospores* 25–35 × 8–12 µm ($\bar{x}$ = 29 × 10 µm, n = 40), uni-seriate, fusiform to ellipsoidal, with rounded ends, 1-septate, constricted at septa, hyaline, guttulate, smooth-walled. Asexual morph: Coelomycetous. *Conidiomata* 850–1000 × 400–500 µm ($\bar{x}$ = 900 × 460 µm, n = 5), stromatic, acervuli, solitary, erumpent on the substrate, immersed to semi immersed, surface tissues above slightly domed.

Conidiomatal wall composed of thick-walled, dark brown cells. *Conidiophores* 30–60 × 5–10 µm ($\bar{x}$ = 43 × 7.6 µm, n = 15), cylindrical, straight, septate, branched at the base, arising from basal stroma, smooth, hyaline to pale brown. *Conidiogenous cells* holoblastic, indeterminate, cylindrical, annellidic, integrated, hyaline to pale brown. *Conidia* 30–70 × 10–20 µm ($\bar{x}$ = 58 × 16.3 µm, n = 20), clavate to subcylindrical, club-shaped, rounded apex, hyaline at apical cells, truncate at the base, straight to slightly curved, hyaline or pale brown, becoming dark brown when mature, guttulate, 3–6-euseptate.

Material examined – Italy, Province of Forlì-Cesena [FC], Ridracoli - Bagno di Romagna, a dead and hanging branch of *Castanea sativa* (*Fagaceae*), 03 April 2018, Erio Caporesi, IT 2866 (MFLU 18-1098; asexual morph); *ibid*., a dead and fallen branch, 15 October 2018, IT 4074 (MFLU 18-2312; sexual morph); *ibid*., 15 October 2018, IT 4074A, (MFLU 18-2498; sexual morph).

GenBank numbers – ITS: OM614591, OM614592; LSU: OM616562, OM616563.

Notes – Tulasne and Tulasne (1863) found both sexual and asexual morphs of *Coryneum modonium* (= *Melanconis modonia*) on chestnut wood. Fuckel (1869) reported another asexual morph as *Melanconis modonia* on dead *Castanea vulgaris*. Later, Saccardo (1883) reported the asexual morph of *Coryneum modonium* as *Stilbospora modonia* from Austria (Rhenogoviya) on dead branches of *Castanea*. After several nomenclatural updates, *Coryneum modonium* Griffon & Maubl. is the currently accepted name (Species Fungorum 2022).

The updated redrawn line illustrations for sexual and asexual morphs of *Melanconis modonia* from Griffon and Maublanc (1910) are shown in Fig. 21. These morphologies are similar to our collection of *Coryneum modonium*, except for the absence of hyaline conidial tips. Sexual and asexual morphs of *C. modonium* share key characteristics with other *Coryneum* and *Hyaloterminalis* taxa (Senanayake et al. 2017b, Jiang et al. 2018, Rathnayaka et al. 2020). However, *Talekpea* morphology does not match the extant asexual taxa in *Coryneaceae*, including our strains, while it has a hyphomycetous asexual morph (Rathnayaka et al. 2020). Phylogenetically, *Talekpea* forms a distinct lineage within *Coryneaceae* similar to Rathnayaka et al. (2020). We provide two collections of *Coryneum modonium* from the Emilia–Romagna region based on morphology and multigene phylogeny (Figs 19, 20 and 22).

In the phylogenetic analysis of *Coryneaceae*, our new strains MFLU 18-1098 and MFLU 18-2312 grouped within *Coryneaceae* in Clade A, together with *C. modonium* (D203) and *C. perniciosum* (CBS 130.25) with 100**%** MLBS, 1.00 BYPP support, and sister to *C. castaneicola* (CFCC 52715 and CFCC 52716) (Fig. 22). *Coryneum perniciosum* was reported as a parasite of chestnut bark necrosis in the Tuscany, Emilia, Piedmont, and Liguria regions of Italy (Briosi 1914). The base pair comparisons between *C. modonium* and *C. perniciosum* have revealed no differences between our two strains, MFLU 18-2498 and MFLU 18-2312 in ITS and LSU sequence data. Therefore, these four strains may be the same species. However, the holotype specimens, dry cultures, ex-type living cultures, and complete morphology for both *C. modonium* and *C. perniciosum* strains are lacking. Therefore, we keep *C. perniciosum* the same and conclude our strains should be a new collection of *C. modonium*, considering the morphology provided by Griffon and Maublanc (1910) and giving priority to the older name. We provide the first comprehensive description, color illustrations, multigene phylogenetic analyses, and taxonomic discussion for *Coryneum modonium*. According to Sutton (1975), *Coryneum* species can be found on chestnut and oak trees, and our strains are also recorded on *Castanea sativa* (sweet chestnut), and the first record in Italy (Emilia–Romagna region).

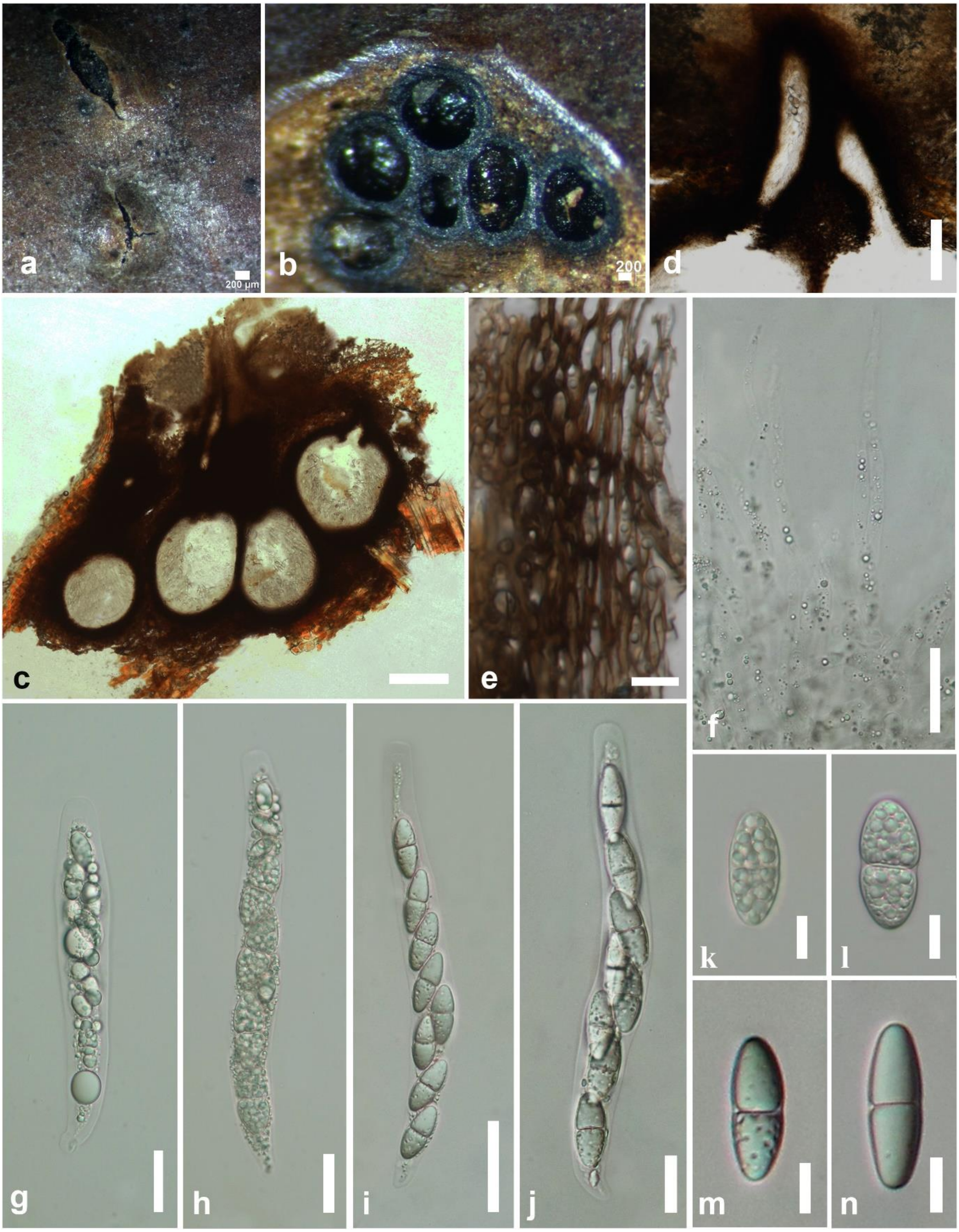

Fig. 19 – Sexual morph of ***Coryneum modonium*** (MFLU 18-2312, **new regional record**). a. Appearance of ectostromatic discs on a twig of *Castanea sativa*. b, c. Longitudinal sections of perithecia. d. Ostioles. e. Peridium. f. Paraphyses. g–j. Asci (g–h mounted in water and i, j mounted in 10% KOH). k–n. Ascospores (k, l mounted in water and m, n in 10% KOH). Scale bars: a–d = 200 µm, f, g–j = 20 µm, e, k–n = 10 µm.

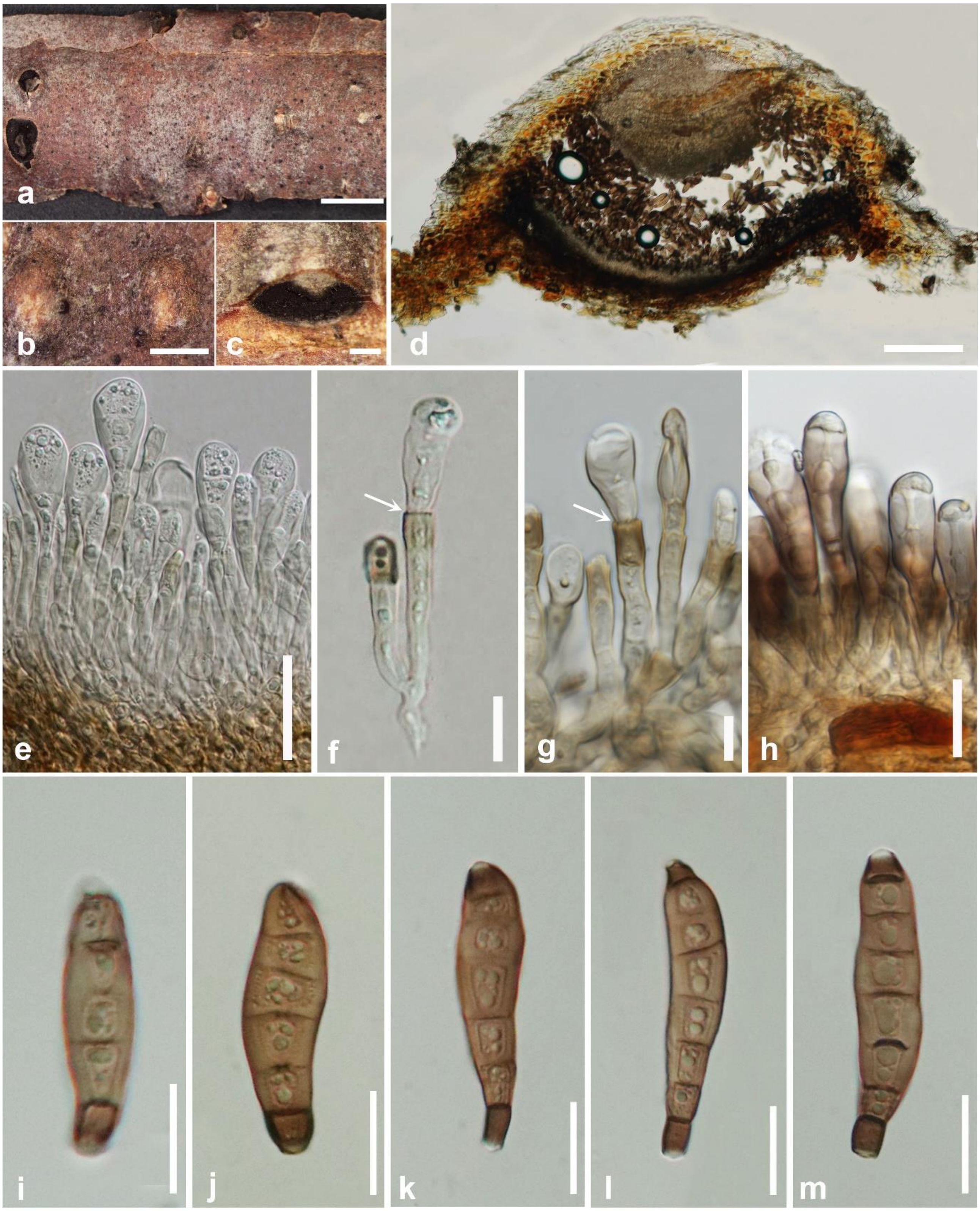

Fig. 20 – Asexual morph of ***Coryneum modonium*** (MFLU 18-1098, **new regional record**). a–c. Conidiomata on a dead and hanging branch of *Castanea sativa*. d. Longitudinal section of conidiomata. e–h. Arrangement of conidiophores and conidiogenous cells (annellidic areas arrowed). i–m. Conidiospores. Scale bars: a = 2 mm, b–c = 500 µm, d = 200 µm, e–m = 20 µm.

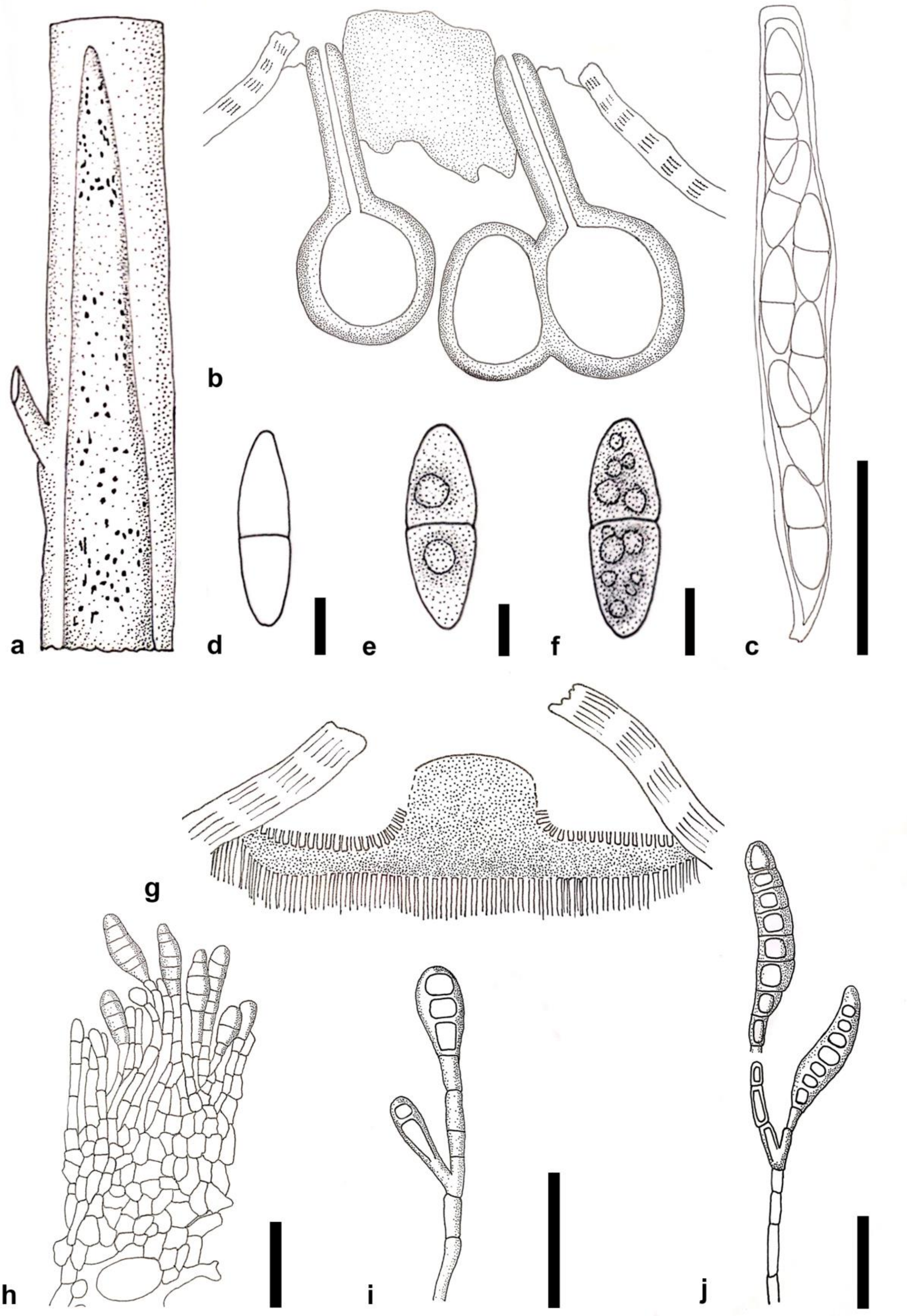

Fig. 21 – *Coryneum modonium* as *Melanconis modonia* Tul. Redrawn from Griffon and Maublanc (1910). a. Appearance of fruiting bodies (spots) on chestnut branches. b. Longitudinal sections of stromata with ostiole. c. Ascus. d–f. Ascospores. g. Longitudinal sections of a conidioma. h. Fertile part with insertion of conidia. i–j. Arrangement of conidiophores, conidiogenous cells and conidiospores. Scale bars*:* c, h–j = 50 µm, d–f = 10 µm.

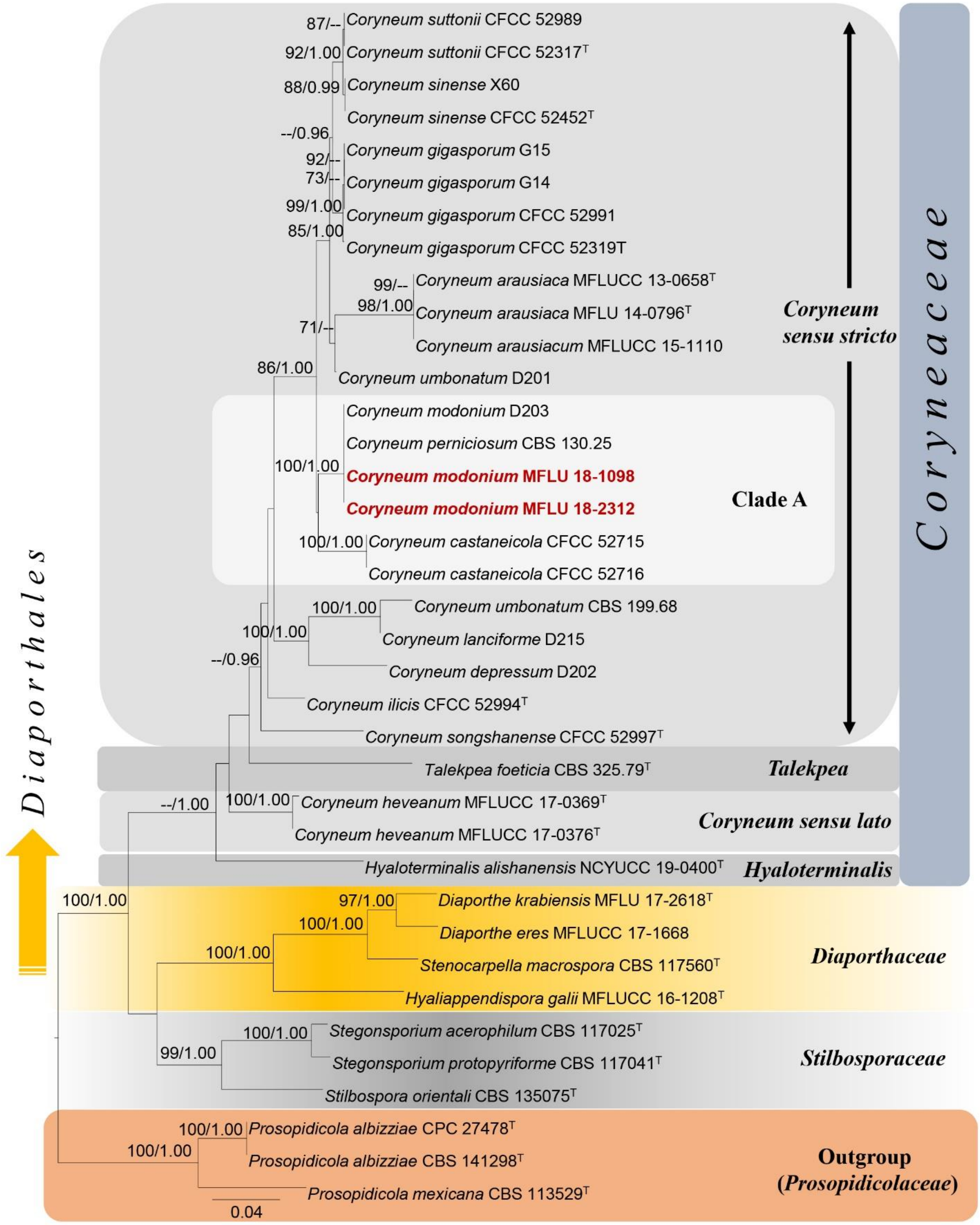

Fig. 22 – Phylogram generated from maximum likelihood analysis based on combined LSU, ITS and *tef*1-α sequenced data. Thirty-seven strains were included in the combined sequence analyses, which comprised 2762 characters with gaps (ITS = 638, LSU = 848, *tef*1-α = 1276). Single gene analyses were also performed, and topology and clade stability were compared from the combined gene analyses. *Prosopidicola albizziae* (CPC 27478, CBS 141298) and *P*. *mexicana* (CBS 113529) in *Prosopidicolaceae* were used as the outgroup taxa. Final ML optimization likelihood is -12145.448764. The matrix included 899 distinct alignment patterns, with 35.73 % undetermined characters or gaps. Estimated base frequencies were obtained as follows: A = 0.232426, C =

0.272338, G = 0.285542, T = 0.209694; substitution rates AC = 1.444912, AG = 1.869859, AT = 1.538490, CG = 1.206744, CT = 5.479664, GT = 1.0; gamma distribution. Bootstrap support values for ML (first set) equal to or greater than 70% and BYPP equal to or greater than 0.95 are given above the nodes. The strains from the current study are in red bold and the type strains are indicated with ^{T}.

Melanconiellaceae Senan., Maharachch. & K.D. Hyde (2017)

Index Fungorum number: IF 821561; Facesoffungi number: FoF 03495

Melanconiellaceae was previously introduced invalidly and later formally validated by Senanayake et al. (2017b) to accommodate four genera, namely *Dicarpella*, *Greeneria*, *Melanconiella* (type), and *Microascospora*. This family is accepted in *Diaporthales*, and *Melanconiella spodiaea* was assigned as the type species of *Melanconiella* (Braun et al. 2018, Senanayake et al. 2018, Phookamsak et al. 2019). Voglmayr et al. (2012) carried out a study on *Melanconiella* species, and Phookamsak et al. (2019) included *Septomelanconiella* in the family. Some species are phytopathogens, especially in grapes (Navarrete et al. 2009, Hyde et al. 2020c). The members of the family are characterized by having 2–8-spored asci, fusoid or ellipsoid ascospores with or without appendages and gelatinous sheath, and a coelomycetous asexual morph with hyaline to brown, ellipsoid, obovoid, or oblong conidia (Senanayake et al. 2018).

Melanconiella Sacc., (1882)

Index Fungorum number: IF 3059; Facesoffungi number: FoF 09990

Melanconiella was established for melanconis-like species with dark-coloured ascospores. Wehmeyer (1941), Müller & von Arx (1962) and Barr (1978) considered *Melanconiella* as a synonym of *Melanconis*. However, Munk (1957), Petrak (1952) and Dennis (1968) accepted them as separate genera. Morphologically, *Melanconiella* shows characters similar to *Melanconis*. Likewise, asexual morphs of *Melanconis* and *Melanconiella* are usually referred to as *Melanconium* (Voglmayr et al. 2012). In the past, many asexual morphs of *Melanconiella* have been described as species of *Melanconium*. Over 200 binomials were reported in *Melanconium*, mainly before the early 19th century (Sutton 1980, Voglmayr et al. 2012). *Melanconiella* species are mainly restricted to overwintered plants and cause mild cankers on the hosts (Voglmayr et al. 2012, Hyde et al. 2020c). Thirty-four species are listed in *Melanconiella* (Species Fungorum 2022).

Melanconiella flavovirens (G.H. Otth) Voglmayr & Jaklitsch (2012) Fig. 23

Index Fungorum number: IF 800120; Facesoffungi number: FoF 11775

≡ *Diaporthe flavovirens* G.H. Otth, (1869)

= *Melanconis flavovirens* (G.H. Otth) Wehm., (1937) (see Index Fungorum 2022, and Voglmayr et al. 2012)

Saprobic on dead, hanging branches of *Corylus avellana*. Sexual morph: *Pseudostromata* 1.0–2.5 mm diam., scattered on the substrate, circular or elliptical, erumpent, projecting up to 200–400 µm, arranged with perithecial bumps, appearing as raised black dots. *Ectostromatic disc* 0.5–1.2 mm diam, elliptic or circular outline, pulvinate, grayish-yellow. *Entostroma* more or less well developed, yellowish to pale brown. *Perithecia* 300–600 mm wide, immersed in host bark, confluent. *Ostioles* 8–10 per disc, unevenly emerging on the disc, circular, slightly papillate, black. *Peridium* 15–20 µm wide at the sides, 15–25 µm wide at the base, composed of 5–7 layers, outermost layers dark brown to pale brown cells of *textura prismatica*, fused with host tissues, inner layer comprising pale brown to hyaline cells of *textura angularis*. *Asci* 60–100 × 10–15 ($\bar{x}$ = 85 × 13.5 µm, n = 20) µm, 8-spored, unitunicate, sessile and rounded pedicel, distinct apical ring 2–3 µm wide. *Ascospores* 15–25 × 5–7 µm ($\bar{x}$ = 20 × 6.5 µm, n = 40), uni-biseriate, overlapping, ellipsoid or broadly fusoid, rounded or subacute at the apices, 1-septate, not constricted at the septum, hyaline, with distinct and persistent knob-like appendages with 1–2 µm long, commonly monomorphic upper and lower cells, cells distinctly triangular-ovate in outline, with two large or numerous small guttules. Asexual morph: *Discosporina*-like. see detailed description in Voglmayr et al. (2012).

Material examined – Italy, province of Forlì-Cesena [FC], Massera – Predappio, dead and hanging branches of *Corylus avellana* (*Betulaceae*), 10 February 2019, Erio Camporesi, IT 4222, (MFLU 19-0641); *ibid*., 15 February 2019, IT 4222a (MFLU 19-0642).

GenBank numbers – ITS: OM614593; LSU: OM616564; *rpb*2: ON843695.

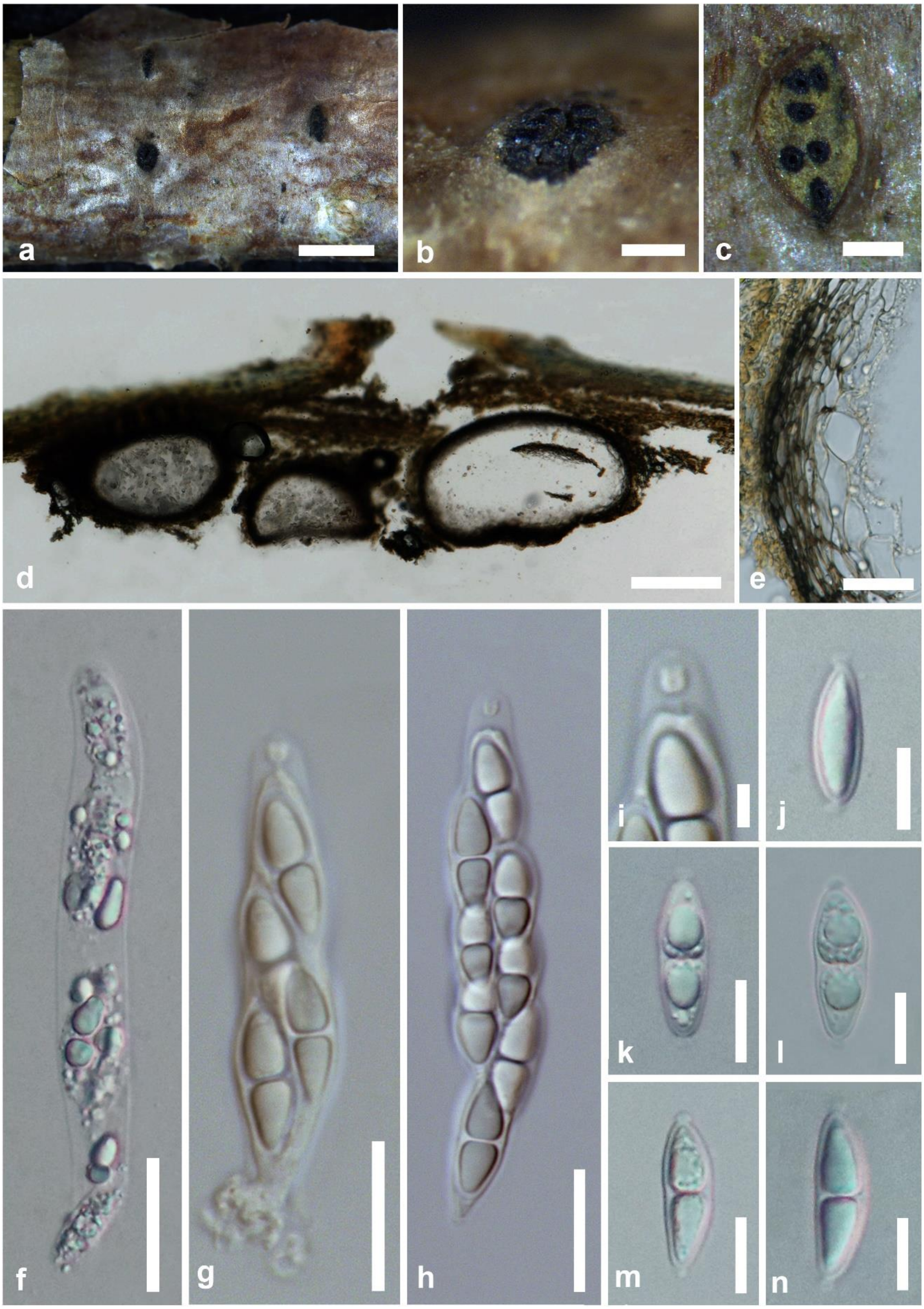

Fig. 23 – ***Melanconiella flavovirens*** (MFLU 19-0641, **new regional record**). a–b. Pseudostromata on a dead branch of *Corylus avellana*. c–d. Transverse and longitudinal sections of pseudostromata. e. Peridium. f–h. Asci. i. Well distinct apical ring. j–n. Ascospores. Scale bars*:* a = 1 mm, b, c = 400 µm, d = 200 µm, e–h= 20 µm, j–n= 10 µm, i = 5 µm.

Notes – *Myxosporium sulphureum* (asexual morph) was described by Saccardo (1884) based on the description provided by Fuckel (1871). The specimen from the Fuckel herbarium for *Myxosporium sulphureum* was designated as the lectotype of *Melanconiella flavovirens* by Voglmayr et al. (2012) based on morphological similarities. Our strain (MFLU 19-0641) is morphologically similar to the collection of *Melanconiella flavovirens* (CBS 125598, MFV3, MFV1), by having larger ectostromatic discs, triangular to ovate cells and knob-like appendages of ascospores (Voglmayr et al. 2012, this study). Asexual morph is less prominent and unavailable from fresh cultures, while a single collection of conidiomata was collected from Italy (Voglmayr et al. 2012). Phylogenetic analysis placed our strain MFLU 19-0641 with *Melanconiella flavovirens* isolates (CBS 125598, MFV3, MFV1) with 100**%** MLBS, 1.00 BYPP support (Fig. 25). Therefore, we identified our new collection as *Melanconiella flavovirens* from *Corylus avellana* (*Betulaceae*) in Italy.

The majority of phylogenetically distinct sexual taxa of *Melanconiella* could also be identified based on morphology. Some sexual morph characters are not identical to the morphology of phylogenetically closely related taxa. Therefore, host associations and sexual-asexual linkages may help to identify the taxa. The majority of *Melanconiella* species are highly host-specific and recorded on *Fagalae* trees, such as *Betula* sp., *Betula pendula*, *Carpinus betulus*, *C*. *caroliniana*, *C*. *orientalis*, *Corylus avellana*, *Ostrya carpinifolia*, and *O*. *virginiana* in Europe (Voglmayr et al. 2012). *Melanconiella flavovirens* was first reported on the *Corylus avellana* from the Lombardy region in northern Italy (Voglmayr et al. 2012), and our new collection is the first record from the Emilia–Romagna region in northern Italy.

Melanconiella meridionalis Voglmayr & Jaklitsch (2012) Fig. 24

Index Fungorum number: IF 800123; Facesoffungi number: FoF 10701

Saprobic on a dead, hanging branch of *Ostrya carpinifolia.* Sexual morph: *Pseudostromata* 0.5–1.0 mm diam., scattered on the substrate, indistinct, projecting up to 200–300 µm, circular, appearing as minute bumps, perithecial bumps distinct or inconspicuous. *Ectostromatic disc* typically inconspicuous, whitish to pale yellowish, concealed by ostioles. *Entostroma* whitish, well-developed. *Perithecia* 0.2–0.6 mm wide, immersed in host bark, oblong, aggregated unevenly in the ectostromatic disc. *Ostioles* 3–5 per disc, unevenly emerging in the disc, circular, slightly papillate, black. *Peridium* 30–35 µm wide, composed of 4–6 layers, outermost layers comprising dark brown to pale brown cells of *textura angularis*, inner layers comprising pale brown to hyaline cells of *textura angularis*. *Hamathecium* comprises numerous, 3–5 µm wide, septate, paraphyses, deliquescent at maturity. *Asci* 100–120 ×10–20 µm ($\bar{x}$ = 110 × 17 µm, n = 20), 8-spored, unitunicate, broadly cylindrical to slightly fusoid, short pedicel, distinct apical ring with 3–4 µm wide. *Ascospores* 20–25 × 5–7 µm ($\bar{x}$ = 23 × 6 µm, n = 40), overlapping, 2–3-seriate, ellipsoid to fusoid, 1-septate, sometimes constricted at the septum, rounded or subacute at apex, hyaline, knob-like appendages 2–3 µm long, monomorphic or dimorphic cells (larger upper cell), cells are distinctly triangular to ovate in outline, with numerous guttules, smooth-walled. Asexual morph: discosporina-like, see Voglmayr et al. (2012).

Material examined – Italy, Province of Arezzo [AR], Valsavignone - Pieve Santo Stefano, a dead and hanging branch of *Ostrya carpinifolia* (*Betulaceae*), 29 April 2019, Erio Camporesi, IT 4308, (MFLU 19-1206).

GenBank numbers – ITS: OM614594; LSU: OM616565.

Notes – *Melanconiella meridionalis* was introduced by Voglmayr et al. (2012) on *Ostrya carpinifolia* in Austria. Additional collections have been recorded on *Ostrya carpinifolia* from Grosseto province (Tuscany) in central Italy, and Trentino-Alto Adige region in northern Italy. The morphology of our strain (MFLU 19-0641) shares similar morphology to the strain (WU 31839) by Voglmayr et al. (2012), with less prominent guttules in ascospores. Phylogenetically, our strain MFLU 19-0641 groups with *M. meridionalis* strains (WU 31840, WU 31839, WU 31844) with 100**%** MLBS and 1.00 BYPP support. These strains form a sister clade to *M. ostryae* (CBS 208.38) (Fig. 25). Therefore, we identified our new strain as *M. meridionalis*, which is the first record from Arezzo province (Tuscany). Many further taxa have been recorded from *Ostrya carpinifolia* (Voglmayr et al. 2012).

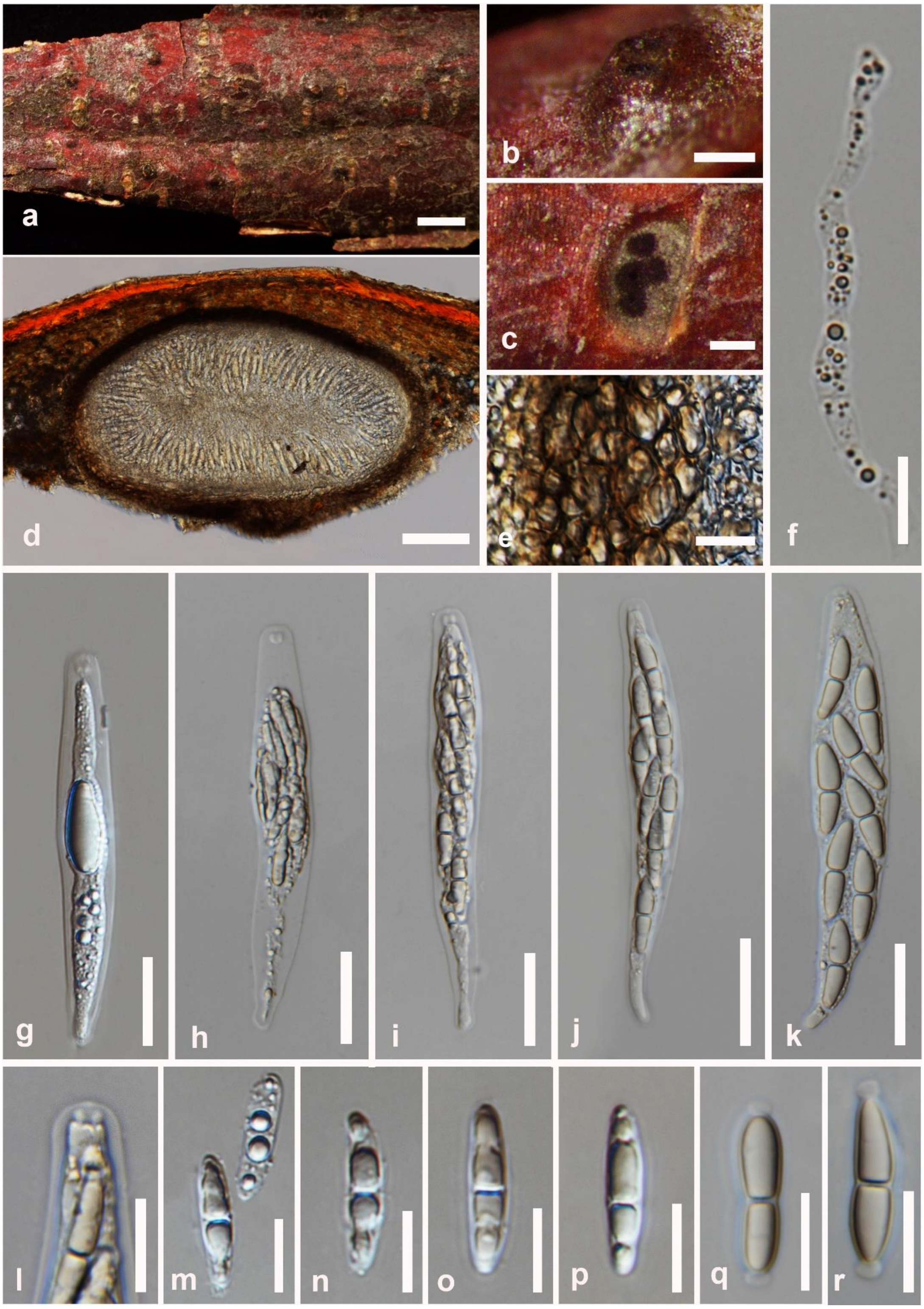

Fig. 24 – ***Melanconiella meridionalis*** (MFLU 19-1206, **new provincial record**). a–b.

Pseudostromata on a dead branch of *Ostrya carpinifolia*. c–d. Transverse and longitudinal sections of pseudostromata. e. Peridium. f. Paraphysis. g–k. Asci. l. Close up of apical ascus. m–r. Ascospores. Scale bars: a = 500 µm, b–d = 100 µm, f–k = 20, e, l–r = 10 µm.

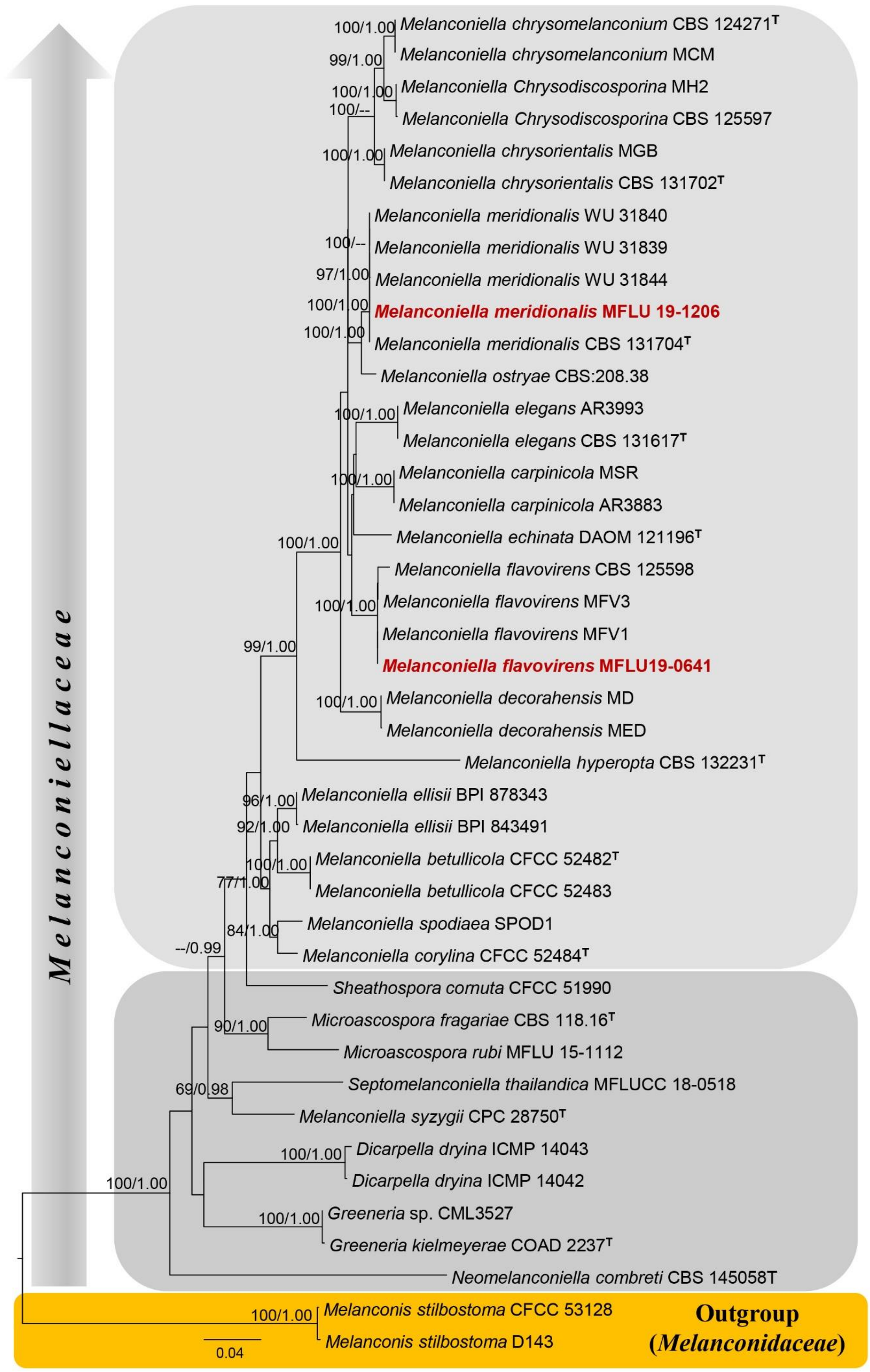

Fig. 25 – Phylogram generated from maximum likelihood analysis based on combined ITS, LSU, and *rpb*2 sequenced data. Forty-two strains were included in the combined sequence analyses,

which comprised 3,308 characters with gaps (ITS = 619, LSU = 820, *rpb*2 = 1028). Single gene analyses were also performed, and topology and clade stability were compared from the combined gene analyses. *Melanconis stilbostoma* (D143, CFCC 53128) in Melanconidaceae was used as the outgroup taxon. Final ML Optimization Likelihood is - 0.216701. The matrix included 781 distinct alignment patterns, with 25.21 % undetermined characters or gaps. Estimated base frequencies were obtained as follows: A = 0.242676, C = 0.249904, G = 0.290719, T = 0.216701; substitution rates AC = 0.611978, AG = 3.141798, AT = 1.301933, CG = 0.580412, CT = 4.913737, GT = 1.0; gamma distribution. Bootstrap support values for ML (first set) equal to or greater than 65% and BYPP equal to or greater than 0.95 are given above the nodes. The strains from the current study are in red bold and the type strains are indicated with ^{T}.

Diaporthomycetidae* families *incertae sedis

Woswasiaceae H. Zhang, K.D. Hyde & Maharachch. (2017)

Index Fungorum number: IF 553769; Facesoffungi number: FoF 03348

Woswasiaceae was introduced by Zhang et al. (2017) to accommodate *Woswasia*, *Xylochrysis*, and *Cyanoannulus* in *Diaporthomycetidae* families *incertae sedis*. The family is characterized by globose to subglobose ascomata with a cylindrical neck, nesting together in stromatic or astromatic structures with 8-spored, unitunicate asci with J^{-} apical ring, and unicellular or septate, hyaline, globose to subglobose or ellipsoidal ascospores. Currently, *Woswasiaceae* contains the above three genera and only one species is available for each genus (Wijayawardene et al. 2020, Hyde et al. 2020c).

Woswasia Jaklitsch, Réblová & Voglmayr (2013)

Index Fungorum number: IF 800841; Facesoffungi number: FoF 03348

Woswasia was typified by *Woswasia atropurpurea* (Jaklitsch et al. 2013), and it is a monotypic species in the genus (Wijayawardene et al. 2020). *Woswasia* is morphologically similar to *Amplistroma* and *Wallrothiella* (*Amplistromataceae*) in their stroma, asci, and paraphyses (Jaklitsch et al. 2013).

Woswasia atropurpurea Jaklitsch, Réblová & Voglmayr (2013) Fig. 26

Index Fungorum number: IF 800842; Facesoffungi number: FoF 11776

Saprobic on dead, hanging branches of *Corylus avellana*. Sexual morph: *Stromata* 0.8–1.0 mm long, 0.5–0.8 mm wide, 370–450 µm high, scattered, erumpent through the surface, surrounded by host tissues, unevenly positioned on the substrate, black, multi-loculate. *Ascomata* perithecial, 150–200 µm diam. × 250–300 µm high ($\bar{x}$ = 170 × 280 µm, n = 10), arranged in rows, immersed, obpyriform to ampulliform, dark brown to black. *Ostiole* raised from the center of ascomata, lined with periphyses. *Peridium* 10–20 µm wide, composed of several layers, outer layer consisting of thick-walled, dark brown cells of *textura angularis*, inner layer of thin-walled, hyaline cells of *textura angularis*. *Hamathecium* comprises numerous, 2.5–4 µm wide, septate, paraphyses. *Asci* 30–55 × 3–5 µm ($\bar{x}$ = 48 × 4 µm, n = 10), 8-spored, unitunicate, cylindrical, with a slightly long pedicel, J-, apical ring. *Ascospores* 2.5–3.5 × 2.7–3.5 µm ($\bar{x}$ = 3.0 × 3.2 µm, n = 20), uni-seriate, globose to subglobose, aseptate, hyaline, verruculose to smooth-walled. Asexual morph: see Jaklitsch et al. (2013).

Material examined – Italy, Province of Forlì-Cesena [FC], Teodorano – Meldola, on dead and hanging branches of *Corylus avellana* (*Fagaceae*), 14 January 2019, Erio Camporesi, IT 4198, (MFLU 19-0465); *ibid*., 28 January 2019, IT 4198A (MFLU 19-0486).

GenBank numbers – ITS: OM616630, OM616631; LSU: OM616566, OM616567.

Notes – Morphologically, *Woswasia atropurpurea* is characterized by having perithecia with a long neck and globose to subglobose, aseptate, and verruculose ascospores (Jaklitsch et al. 2013, this study). The morphological characters of *Woswasia* are remarkably similar to those of *Amplistroma* and *Wallrothiella* in *Amplistromataceae* (Jaklitsch et al. 2013). Our strains of *Woswasia* are morphologically similar to the generic characters of *Amplistroma* by having longstipitate asci and globose to subglobose ascospores, and similar to *Thalassogena* by having hyaline ascospores. However, phylogenetic analyses do not prove it (Jaklitsch et al. 2013). Ascospores were not able to germinate on PDA and MEA under different temperature conditions. According to the phylogenetic analyses, our collections (MFLU 19-0465, MFLU 19-0486) grouped with the type species *W. atropurpurea* (WU 32007) with 100**%** MLBS and 1.00 BYPP support (Fig. 27). All *W. atropurpurea* strains are clustered with two basal lineages within *Woswasiaceae*, namely *Cyanoannulus* and *Xylochrysis* (Fig. 27). Furthermore, the holotype of *W. atropurpurea* was found on the stromata of *Diaporthe oncostoma* growing on a *Robinia pseudoacacia* branch in Lombardy, Italy. Our strains are the first reports of *W. atropurpurea* on *Corylus avellana* from Emilia-Romagna, Italy.

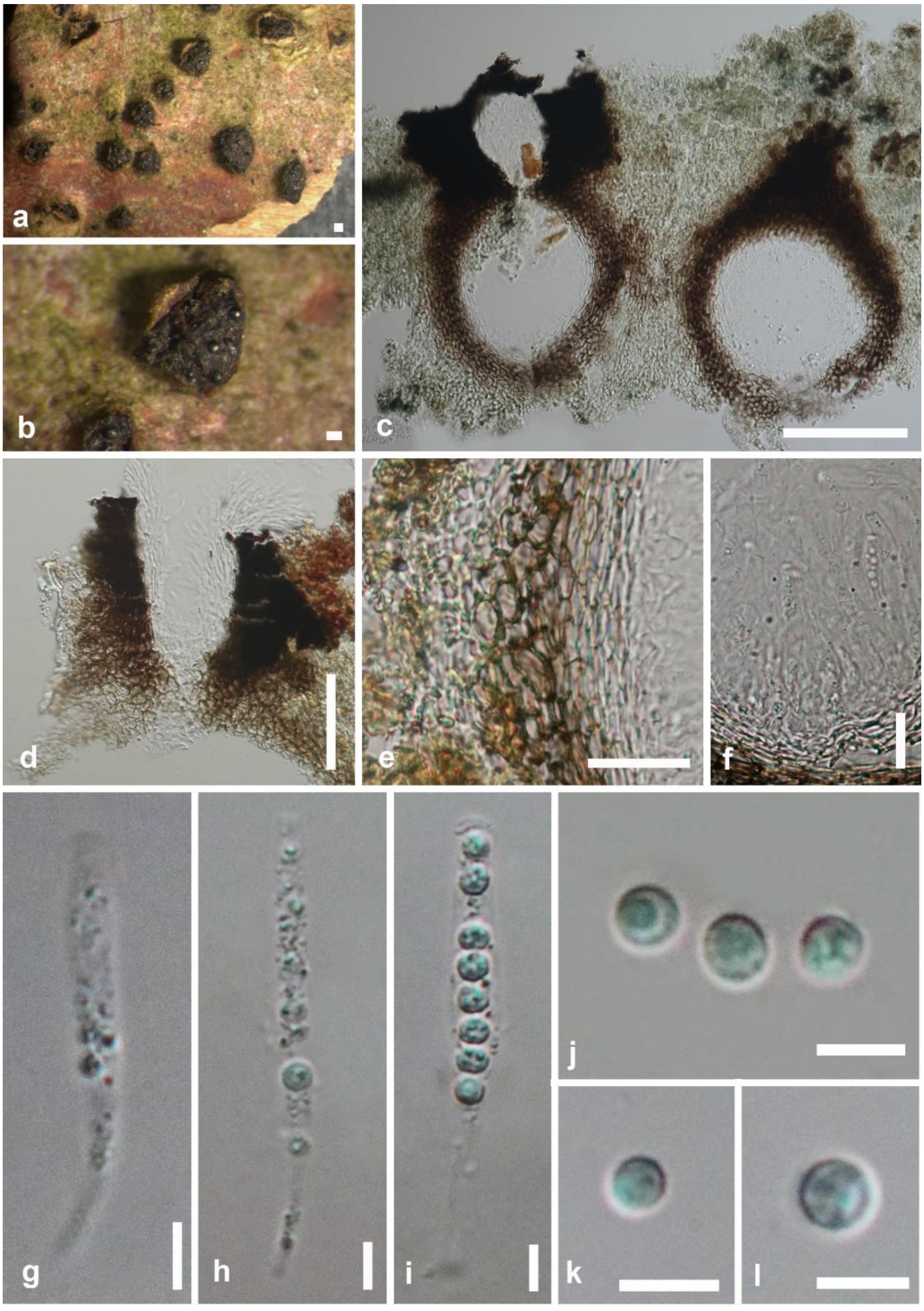

Fig. 26 – ***Woswasia atropurpurea*** (MFLU 19-0465, **new host and regional record**). a–b. The

appearance of ascomata on the dead branch of *Corylus avellana*. c. Longitudinal sections of ascomata. d. A longitudinal section of ostiole. e. Peridium. f. Paraphyses. g–i. Asci. j–l. Ascospores. Scale bars: a–c = 100 µm, d–f = 20 µm, g–l = 5 µm.

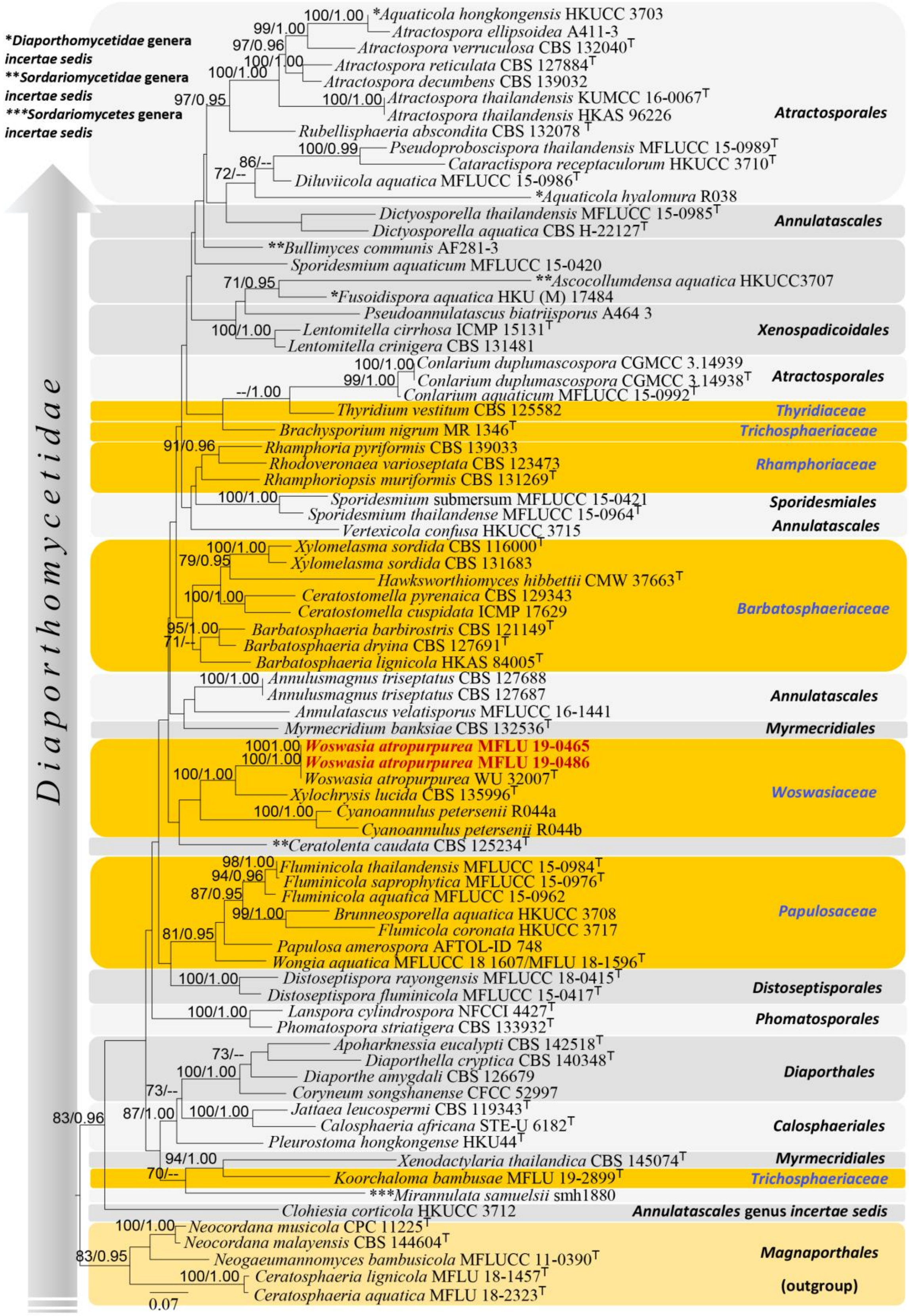

Fig. 27 – Phylogram generated from maximum likelihood analysis based on combined LSU, SSU, ITS, and *rpb*2 sequenced data. Seventy-eight strains were included in the combined sequence

analysis, which comprised 3286 characters with gaps (LSU = 850, SSU = 880, ITS = 528, *rpb*2 = 1062). Single gene analyses were also performed, and topology and clade stability were compared from the combined gene analyses. *Neocordana musicola* (CPC 11225), *N. malayensis* (CBS 144604), *Neogaeumannomyces bambusicola* (MFLUCC 11-0390), *Ceratosphaeria lignicola* (MFLU 18-1457) and *C. aquatica* (MFLU 18-2323) in Magnaporthales were used as the outgroup taxa. Final ML optimization likelihood is - 44234.915686. The matrix included 1836 distinct alignment patterns, with 41.80 % undetermined characters or gaps. Estimated base frequencies were obtained as follows: A = 0.250089, C = 0.241201, G = 0.286405, T = 0.222304; substitution rates AC = 1.580297, AG = 3.075761, AT = 1.536900, CG = 1.483017, CT = 7.828009, GT = 1.0; gamma distribution. Bootstrap support values for ML (first set) equal to or greater than 70% and BYPP equal to or greater than 0.95 are given above the nodes. The strains from the current study are in red bold and the type strains are indicated with ^{T}. Families in *Diaporthomycetidae* families *incertae sedis* were labeled in blue.

Taxonomic notes for classes of *Ascomycota* reported in this study

Classes of *Ascomycota* reported on *Fagales* hosts were categorized in *Pezizomycotina*, *Saccharomycotina* and *Taphrinomycotina*. The updated taxonomic notes are provided for each class and *incertae sedis* genera. The taxonomic ranks with doubtful placements and taxonomic confusions are described below with short notes.

Subphylum: *Pezizomycotina*

Arthoniomycetes O.E. Erikss. & Winka

In the past, both lichenized and non-lichenized fungi belonged to *Loculoascomycetes* (Luttrell 1955). *Arthoniomycetes* was introduced by Eriksson and Winka (1997) with *Dothideomycetes*. Later, Schoch et al. (2009a, b) used molecular data to identify the phylogenetic placement of lichenized *Arthoniomycetes* and indicated that lichenized *Arthoniomycetes* form a monophyletic clade sister to *Dothideomycetes*. Therefore, the superclass *Dothideomyceta* was proposed for *Arthoniomycetes* (Schoch et al. 2009a, b). Currently, *Arthoniomycetes* consist of a monotypic order *Arthoniales*, which is the largest primarily lichenized group except for *Lecanoromycetes* (Schoch & Grube 2015). Several *Arthoniales* taxa are non-lichenized, lichenicolous, and saprotrophic (Lücking et al. 2017, Ertz et al. 2018, Wijayawardene et al. 2020, Thiyagaraja et al. 2020). *Arthoniales* comprises seven families with 98 genera, and 21 genera are accepted in *Arthoniales* genera *incertae sedis* (Wijayawardene et al. 2022). The distribution of *Arthoniales* taxa on *Fagales* hosts was identified in Canada, France, Germany, Southern Africa, the United Kingdom, Vermont, and Yugoslavia (Farr & Rossman 2022). Our study revealed 20 records of *Arthoniales* belonging to *Arthoniaceae*, *Chrysotrichaceae*, *Opegraphaceae, Roccellaceae*, and *Arthoniales* genera *incertae sedis* on *Fagales* hosts (Table 4).

Candelariomycetes Voglmayr & Jaklitsch

Candelariomycetes contains a monotypic order *Candelariales*, with two families *Candelariaceae* and *Pycnoraceae* (Voglmayr et al. 2019). *Candelariaceae* taxa are found on rock surfaces, rarely on bryophytes, soil, and barks, while *Pycnoraceae* are found on wood (Voglmayr et al. 2019). *Candelariaceae* comprises seven genera, and *Pycnoraceae* comprises a single genus, *Pycnora* (Wijayawardene et al. 2022). *Candelariella* taxa have been reported from France on *Fagales* hosts (Farr & Rossman 2022). Our current study revealed five records of *Candelaria* and *Candelariella* (*Candelariomycetes, Candelariales, Candelariaceae*) on *Fagales* hosts in Italy (Table 4).

Coniocybomycetes M. Prieto & Wedin

Coniocybomycetes was introduced by Prieto et al. (2013) to accommodate lichen-forming ascomycetes. The family is made up of two genera: *Chaenotheca* and *Sclerophora* (Wijayawardene et al. 2022). The inclusion of *Chaenotheca* and *Sclerophora* in *Coniocybaceae* was based on a sixlocus phylogeny (Prieto et al. 2013). Our current study revealed six records of *Chaenotheca* taxa on *Fagales* hosts. In addition, we reported a taxonomically uncertain record of *Embolus*, classified in *Coniocybaceae* (Table 4), and the following note is provided.

Embolus clavus Sacc. & Speg. (1878)

Embolus clavus was initially considered a discomycete by Saccardo (1877). The species was collected from a rotten, decorticated wood of *Castanea vesca* in Italy, and the holotype was provided as a dried culture and deposited at the University of Padua (PAD) (Saccardo 1877, Farr 1973, Farr & Rossman 2022). In Mycobank (2022), *E. clavus* is listed under *Myxomycota*. In the database of Global access to knowledge about life on Earth (https://eol.org/), *Embolus* is reported as an extinct genus of amoebas, and we couldn't find any additional references for the taxon. However, we retain *E. clavus* in *Coniocybaceae* by following the Index Fungorum (2022), and further taxonomic studies would be necessary to clarify the placement of this species.

Dothideomycetes O.E. Erikss. & Winka

Dothideomycetes is the largest and most ecologically diverse class (Kirk et al. 2008, Schoch & Grube 2015, Hongsanan et al. 2020a). They comprise endophytes, saprobes, pathogens, epiphytes, lichens, and lichenicolous taxa on different hosts and substrates (Hongsanan et al. 2020a). These taxa are characterized by ascolocular ascomata development with bitunicate and fissitunicate asci (Hyde et al. 2013, Hongsanan et al. 2020a). Bitunicate ascomycetes are classified into three different classes, among which the majority belong to *Arthoniomycetes* and *Dothideomycetes*, while others belong to *Eurotiomycetes* (Schoch & Grube 2015). *Dothideomycetes* comprises 47 orders, some *incertae sedis* genera in different orders, and *Dothideomycetes incertae sedis* with 42 families (Wijayawardene et al. 2022). Also, 274 *Dothideomycetes* genera *incertae sedis* were accepted (Wijayawardene et al. 2022). Our current study revealed 189 records of *Dothideomycetes* taxa belonging to 19 orders, 52 families, and 97 genera on *Fagales* hosts (Table 4). In addition, we discuss the taxonomic updates of *Botryosphaeria corticola*, *Diplodia mutila* with *Mycosphaerellales* and *Trypetheliales* taxa by providing the following notes.

Botryosphaeria corticola A.J.L. Phillips, A. Alves & J. Luque (2004)

Botryosphaeria-canker is one of the most serious diseases of cork production in the Mediterranean basin caused by *Diplodia corticola* (Franceschini et al. 1999, Serrano et al. 2015). This species is also reported as the main pathogen of holm oak decline (*Quercus ilex*) in Caprera Island (Linaldeddu et al. 2014). This pathogen was originally described as an asexual morph of *Botryosphaeria corticola* (Alves et al. 2004) and was also misidentified as *B. stevensii* (asexual: *D. mutila*) (Serrano et al. 2015). Serrano et al. (2015) and molecular identification by Alves et al. (2004) confirmed that *D. corticola* is different from *D. mutila* (in Spain).

Diplodia mutila (Fr.) Mont. (1834)

Diplodia mutila was identified as an asexual morph of *Botryosphaeria stevensii* (Stevens 1933, Shoemaker 1964, Alves et al. 2004). This species is associated with dieback and canker diseases of oak (Alves et al. 2004). Recently, Zhang et al. (2021) synonymized *D. magnoliigena* and *D. pyri* under *D. mutila* based on multigene phylogenetic analyses.

Mycosphaerellales P.F. Cannon (2001)

Hawksworth et al. (1995) introduced *Mycosphaerella* in *Dothideales*, and Kirk et al. (2001) elevated the family to *Mycosphaerellales*. Later on, Schoch et al. (2006) and Kirk et al. (2008) transferred *Mycosphaerellaceae* to *Capnodiales*. However, updated phylogenetic analyses based on LSU, *tef*1-α, and *rpb2* gene regions by Abdollahzadeh et al. (2020) revealed that *Capnodiales sensu lato* is polyphyletic. In their analyses, *Capnodiales sensu stricto* was redefined, and *Mycosphaerellales* was resurrected by introducing novel orders, viz., *Cladosporiales*, *Comminutisporales*, *Neophaeothecales*, *Phaeothecales*, and *Racodiales*. Abdollahzadeh et al. (2020) accepted *Mycosphaerellaceae* in *Mycosphaerellales* based on the studies of *Mycosphaerella*. Therefore, we considered all *Mycosphaerella* taxa in *Mycosphaerellales*.

The asexual genus *Asteromella* was previously included in *Dothideomycetes* genera *incertae sedis* by Wijayawardene et al. (2014) and Ruszkiewicz-Michalska (2016). The sexual morph of *Asteromella* was assigned to *Mycosphaerella sensu lato* (Crous et al. 2007, Ruszkiewicz-Michalska 2016). However, Videira et al. (2017) reported that *Mycosphaerella sensu stricto* has *Ramularia* asexual morphs. Therefore, *Mycosphaerella* taxa were synonymized under *Ramularia* with respect to the older name based on one fungus-one name (Wijayawardene et al. 2014, 2020, 2022, Rossman et al. 2015).

Trypetheliales Lücking, Aptroot & Sipman (2008)

Initially, *Arthopyreniaceae* was assigned to *Pleosporales* (Hongsanan et al. 2020a). Based on multigene phylogenetic analyses conducted by Thiyagaraja et al. (2021), *Arthopyreniaceae* was synonymized under *Trypetheliaceae* and included in *Trypetheliales* by considering the type species of *Arthopyrenia*. Therefore, in this study, we included *Arthopyrenia* taxa associated with *Fagales* under *Trypetheliaceae*.

Eurotiomycetes O.E. Erikss. & Winka

Eurotiomycetes is a monophyletic group of filamentous ascomycetes, including *Eurotiomycetidae* and *Chaetothyriomycetidae* (Geiser et al. 2006). The majority of *Chaetothyriomycetidae* and *Mycocaliciomycetidae* taxa are lichenized and produce small thalli on trees and rocks (Geiser et al. 2006, 2015). Based on morphology and multigene phylogeny (Geiser et al. 2006, Schoch et al. 2006, Spatafora et al. 2006), *Eurotiomycetidae*, *Chaetothyriomycetidae*, and *Mycocaliciomycetidae* were proposed (Geiser et al. 2015). *Eurotiomycetes* consists of coelomycetous and hyphomycetous asexual morphs (Geiser et al. 2015). Fewer plant pathogens are available in *Eurotiomycetes* when compared to *Sordariomycetes* and *Dothideomycetes* (Geiser et al. 2015). It comprises ten orders, some *incertae sedis* genera in different orders, and *Eurotiomycetes incertae sedis* with one family (Wijayawardene et al. 2022). In our current study, we revealed 25 records of *Eurotiomycetes* taxa under six orders, eight families, and 16 genera on *Fagales* hosts (Table 4).

Lecanoromycetes O.E. Erikss. & Winka

Lecanoromycetes was introduced by Eriksson and Winka (1997). It consists of more than 14,000 recognized species, the majority of which are lichenized (Miadlikowska et al. 2014, Gueidan et al. 2015) and several lichenicolous taxa. *Lecanorales* is the most diverse order in *Lecanoromycetes* with 18 families and 230 accepted genera (Rambold & Triebel 1992, Lawrey & Diederich 2003, Gams et al. 2004b, Pino-Bodas et al. 2017, Wijayawardene et al. 2022). *Lecanoromycetes* taxa typically form bi-membered symbiotic associations with coccoid and filamentous green algae or cyanobacteria and tri-membered with two photobionts, a green alga and a cyanobacterium (Miadlikowska et al. 2014). The majority of the taxa in the class are distributed worldwide in terrestrial habitats on different substrates, such as barks, wood, leaves, rocks, soil, mosses, and other lichens (Miadlikowska et al. 2014, Gueidan et al. 2015). *Lecanoromycetes* comprises 20 orders, 83 families and 773 genera, and 15 genera in *Lecanoromycetes* genera *incertae sedis* (Wijayawardene et al. 2022). Our current study revealed 124 records of *Lecanoromycetes* taxa belonging to 11 orders, 28 families, and 67 genera on *Fagales* hosts (Table 4).

Leotiomycetes O.E. Erikss. & Winka

Leotiomycetes was introduced by Eriksson and Winka (1997) to accommodate inoperculate discomycetes which were characterized by apothecial ascomata and the unitunicate asci with a simple pore to release spores (Eriksson 2005, Zhang & Wang 2015, Ekanayaka et al. 2019).

However, based on molecular data analyses, this concept was changed and *Leotiomycetes* taxa were identified as morphologically diverse with different fruiting structures (Ekanayaka et al. 2019, Johnston et al. 2019). Saprobes, endophytes, plant pathogens, and mycorrhizae are included in *Leotiomycetes* (Wang et al. 2006a, b, Jaklitsch et al. 2016, Ekanayaka et al. 2019, Johnston et al. 2019). *Leotiomycetes* taxa were mainly reported from the temperate Northern Hemisphere, however, *Helotiales* and *Rhytismatales* taxa show a worldwide distribution (Ekanayaka et al. 2017, Wang et al. 2006a, b, McLaughlin & Spatafora 2015, Ekanayaka et al. 2019). The class includes 11 orders, 55 families, and 662 genera, whereas 21 genera are treated as *Leotiomycetes* genera *incertae sedis* (Wijayawardene et al. 2022). Our current study revealed 87 records of *Leotiomycetes* taxa under seven orders, 29 families, and 44 genera on *Fagales* hosts (Table 4). In addition, we discuss the taxonomic confusion of *Strossmayeria basitricha* with the following note.

Strossmayeria basitricha (Sacc.) Dennis (1960)

Quijada et al. (2017) included *Strossmayeria basitricha* in *Helotiaceae* based on a detailed morphological analysis. Further, Quijada et al. (2017) mentioned that the morphology of *S. basitrichia*, *S. alba*, and *S. bakeriana* are overlapping. Later, Wijayawardene et al. (2022) accepted 20 taxa of *Strossmayeria* into *Helotiales* genera *incertae sedis*. Index Fungorum (2022) listed 24 epithets under *Strossmayeria*. Based on the above taxonomic confusion, we retain *S. basitricha* under *Helotiaceae* according to Quijada et al. (2017).

Orbiliomycetes O.E. Erikss. & Baral

Orbiliomycetes consists of many inoperculate discomycetes identified as members of *Orbiliaceae*, which was previously classified in *Helotiales* (*Leotiomycetes*) (Kimbrough 1970, Spooner 1987, Baral et al. 2018, Baral et al. 2020, Baral & Quijada 2020). Later *Orbiliaceae* was accepted in *Orbiliomycetes* based on morphology and molecular phylogeny (Eriksson et al. 2003, Baral et al. 2018). Phylogenetically, the class forms a basal monophyletic group within *Ascomycota*, closer to *Pezizomycetes* (Baral et al. 2018). A comprehensive study by Baral et al. (2018) provided all updated generic names connected with *Orbiliomycetes*. Based on Wijayawardene et al. (2022), the class consists of a single order *Orbiliales*, comprising *Orbiliaceae* with 14 genera. Two genera were accepted under *Orbiliales* genus *incertae sedis* and one genus for *Orbiliomycetes* genus *incertae sedis* (Wijayawardene et al. 2022). Our study revealed only one record of *Orbiliomycetes*, namely *Dactylellina ellipsospora* on *Quercus ilex* (*Fagales*) (Table 4).

Pezizomycetes O.E. Erikss. & Winka

Discomycetes produce cup-shaped apothecia that uniquely use their fruiting bodies to drag air from the environment (Trail & Seminara 2014). *Pezizomycetes* consists of apothecial discomycetes of epigeous, semi-hypogeous to hypogeous origin (Ekanayaka et al. 2018). The asci of these fruiting structures are operculate (Boudier 1885, Trail & Seminara 2014, Ekanayaka et al. 2017, 2018). Eriksson and Winka (1997) introduced *Pezizomycetes* to accommodate *Pezizales*, including operculate discomycetes and *Tuberales*. They occur on different substrates, such as soil, wood, dung, and charcoal. They live in forest habitats as saprobes, mycorrhizal, or plant parasites, and their diversity is high in temperate regions and at high elevations (Ekanayaka et al. 2018). *Pezizomycetes* comprises *Pezizales* with 20 families, 17 genera in *Pezizales* genera *incertae sedis* and one genus in *Pezizomycetes* genus *incertae sedis* (Wijayawardene et al. 2022). In the current study, we found 22 Italian records of *Pezizomycetes* belonging to *Pezizales* under six families and 11 genera on *Fagales* hosts (Table 4).

Sordariomycetes O.E. Erikss. & Winka

Sordariomycetes is the second largest class in *Ascomycota*. Its members are non-lichenized and are characterized by flask-shaped fruiting bodies or, less frequently, cleistothecial ascomata with unitunicate asci (Zhang et al. 2006, Hyde et al. 2013, Maharachchikumbura et al. 2016, Hyde et al. 2020b). They have a cosmopolitan distribution in different ecosystems (Pratibha et al. 2014, Jones et al. 2015, Hyde et al. 2020c). *Sordariomycetes* comprises entomopathogens, phytopathogens, endophytes, saprobes, and fungicolous taxa (Norphanphoun et al. 2019, Sun et al. 2019, Hyde et al. 2020c). Maharachchikumbura et al. (2015, 2016) published an outline for *Sordariomycetes* taxa, and two more were published later by Hongsanan et al. (2017) and Hyde et al. (2020c). The first of the latter two studies, updated the phylogeny with a backbone tree and divergence times, while the most recent update provided taxonomic notes for *Sordariomycetes* families. In a subsequent study, Wijayawardene et al. (2022) accepted 46 orders, 84 families, 1,461 genera, and other 131 genera in *Sordariomycetes* genera *incertae sedis*. In this study, we revealed 264 records of *Sordariomycetes* taxa on *Fagales* hosts, belonging to 20 orders, 61 families, and 135 genera (Table 4). In addition, we discuss the taxonomic updates of *Apiognomonia* and *Discula* taxa as well as *Anungitea* taxa, with the following notes.

***Apiognomonia* and *Discula* taxa**

The correct nomenclature of the type species of *Apiognomonia* and *Discula* was debatable in the past. von Höhnel (1917) described *Apiognomonia* based on *A. veneta* as the type species. However, there has been a disagreement on *A. veneta* as a possible synonym for *A. errabunda* (Sogonov et al. 2007). The asexual morph of *Apiognomonia* generally has been recognized in *Discula* by Klebahn (1902, 1918). The type species of *Discula* is *D. nervisequa*. However, *D. umbrinella* was erroneously used as the type species by Sutton (1980) and also as the asexual morph of *A. errabunda* (Sogonov et al. 2007, Li et al. 2020). Later, *A. veneta* was assigned as the type species of *Apiognomonia*, while *D. nervisequa* was assigned as the type species of *Discula* (Sogonov et al. 2007, Li et al. 2020). However, Hanifeh et al. (2019) reported *D. quercina* as the asexual morph of *A. quercina*. Many phylogenetic analyses revealed that *Discula* is not monophyletic with *Apiognomonia* (Sogonov et al. 2008, Senanayake et al. 2017b, 2018, Li et al. 2020). Thus, we considered *A. errabunda*, *A. quercina*, *D. umbrinella* and *D. quercina* as different species.

***Anungitea* taxa**

Anungitea was introduced by Sutton (1973), with the type species *A. fragilis*. Twenty-four taxa are listed under *Anungitea*, belonging to *Venturiaceae* in the Index Fungorum (2022). Crous et al. (2016a, 2017) included *Anungitea eucalyptigena* and *A. nullicana* in *Phlogicylindriaceae*, while *A. grevilleae* was included in *Xylariales incertae sedis* by Crous et al. (2016b) based on morpho-molecular analyses. Recently, Wijayawardene et al. (2022) also accepted *Anungitea* under *Xylariales* genera *incertae sedis*.

Pezizomycotina genera incertae sedis

Eleven genera have been accepted into this group by Wijayawardene et al. (2022). In this study, we recorded two taxa, namely *Biatoridium monasteriense* and *Wadeana dendrographa* on *Fagales* hosts (Table 4).

Ascomycota* genera *incertae sedis

Ascomycota genera *incertae sedis* consist of 1,466 records. This group needs further studies using DNA-based phylogenetic analyses as it might unravel new fungal lineages (Wijayawardene et al. 2021, 2022). Our study revealed 23 taxa on *Fagales* hosts belonging to 22 genera (Table 4).

Subphylum: *Saccharomycotina*

Saccharomycetes O.E. Erikss. & Winka

Saccharomycetes consists of a monotypic order *Saccharomycetales* and 14 families. Twenty-two genera were accepted into *Saccharomycetales* genera *incertae sedis* by Wijayawardene et al. (2022). In our study, two records of *Candida* sp. and *Eremothecium coryli* were reported under

Saccharomycetales genera *incertae sedis* and *Saccharomycetaceae* on *Fagales* hosts, respectively (Table 4).

Subphylum: *Taphrinomycotina*

Taphrinomycetes O.E. Erikss. & Winka

Taphrinomycotina consists of five classes, viz., *Archaeorhizomycetes*, *Neolectomycetes*, *Pneumocystidomycetes*, *Schizosaccharomycetes*, and *Taphrinomycetes* (Wijayawardene et al. 2022). The latter consists of a single order *Taphrinales*, consisting of two families and seven genera (Wijayawardene et al. 2022). In our study, five taxa, viz., *Taphrina alni*, *T. caerulescens*, *T. carpini*, *T. kruchii* and *T. ostryae*, were recorded on *Fagales* under *Taphrinaceae* in *Taphrinomycetes* (Table 4).

Discussion

Checklist of *Ascomycota* associated with *Fagales* hosts

Plant diversity, especially plant species richness and composition over different biomes and habitats positively affect fungal richness (Gao et al. 2016, Saitta et al. 2018). In this study, we mainly focused on *Ascomycota* associated with *Fagales* species. The predominant occurrence of a specific fungus on a certain host or range of hosts is referred to as ‘host-recurrence’ (Zhou & Hyde 2001). However, occasionally, the host recurrence taxa may be found on other host plants in the same habitat (Zhou & Hyde 2001). Based on our study, *Quercus* species have a greater distribution in Italy and also host the highest fungal taxa in *Fagales* (Table 1, Fig. 16). However, we cannot conclude that *Ascomycota* species have a greater host recurrence on *Quercus* species than other different genera in *Fagales*, because much more studies on other *Fagales* species such as birch, beech, hazel, hornbeam, and chestnut are necessary to have a clearer picture of host recurrence and *Ascomycota* diversity.

Many investigations on wood-decaying *Ascomycota* were carried out at different Italian sites because of the significant dead wood biomass in the native forests. Sordariomycetous taxa have a cosmopolitan distribution and mainly inhabit wood and other plant debris (Hyde et al. 2020c, Vandergrift 2021). In *Sordariomycetes*, a number of xylarialean taxa were previously reported as significant fungal communities in Italian decaying wood ecosystems (Spatafora et al. 2006, Saitta et al. 2011). Accordingly, in our study, *Sordariomycetes* was identified as having the highest number of records on Italian *Fagales* hosts (Table 4, Figs. 15 and 16), with 264 taxa belonging to 135 genera, 61 families, and 20 orders. Among them, the majority of *Xylariales* species are saprobes (54 records) and very few are endophytes (four records) and pathogens (five records) (Table 5). Generally, xylarialean taxa consist of various stromatic characters, such as anthostomelloid, hypoxyloid, rosellinioid, and xylarioid (Samarakoon et al. 2022). This stromatic nature is assumed to have evolved for successful parasitism and saprotrophism in dry sites as it might assure moisture conservation (Rogers 1979, Samarakoon et al. 2021). Additionally, the stromatic form has been found to produce various chemical compounds that prevent insect predation (Becker & Stadler 2021). Therefore, these taxa have protective mechanisms to survive in different environmental conditions. This might be one of the reasons affecting the predominance of xylarialean taxa in Italian dead wood and other forest environments.

Previously taxonomic studies were mainly based on morphology, and currently, many taxa have been synonymized based on their phylogenetic affiliations. The majority of *Fagales*-inhabiting *Ascomycota* are morphological species, and the addition of sequence data is still necessary and desirable to determine their accurate taxonomic placements. In this checklist, species for which sequence data are available were marked with a star symbol (*) (Table 4).

Based on the data available in the original publications, we recorded the life modes of related taxa (Table 3, 4). Some taxa exhibit a single life mode on *Fagales*, while some have different life modes on the same or different hosts. For example, *Botryosphaeria dothidea* was reported as an endophyte and a pathogen on *Ostrya carpinifolia*, but as a pathogen only on the *Quercus* species.

According to Zhang et al. (2021), *B. quercus* was recorded as a saprobe on *Quercus* sp. (later synonymized under *B. dothidea*), which shows different life modes on *Fagales* hosts. Also, *Diplodia corticola* was reported on different *Quercus* species as a pathogen. *Dothiorella iberica* was reported only as a pathogen on *Corylus avellana*, *Ostrya carpinifolia*, and *Quercus suber* hosts. *Alternaria alternata* was reported as a saprobe, endophyte, and pathogen on *Juglans*, *Corylus*, and *Quercus* species. At the order level, *Diaporthales* taxa were prominently reported as endophytes (13 records) and pathogens (29 records) on *Fagales* trees, while *Xylariales* accounted for 53 records, followed by *Pleosporales* (41) and *Helotiales* (37 records) as saprobes. In lichen-associated taxa, lichenized species are more predominant than lichenicolous, non-lichenized or non-lichenicolous and fungicolous species, for example, 58 records of *Lecanorales*, 25 records of *Caliciales*, and 20 records of *Arthoniales* have been reported. Based on this study, *Biscogniauxia destructive* (*Graphostromataceae*, *Xylariales*) is the only fungicolous species reported on *Fagus sylvatica* trees. Considering the vast range of mycological data, such as biology, taxonomy, molecular data, and ecology, Italy can be considered a great contributor to world mycology.

Distribution of *Fagales*-associated *Ascomycota*

Italian orography shows two main mountain ranges, the Alps and the Apennines, with alluvial plains, hills, valleys, and different lithological features (Abbate et al. 2015). The Alps broadly stand at the northern border and separate Italy from Europe. The Apennines extend along the length of the Italian peninsula. These mountain areas provide many suitable habitats for mycoflora due to the different biocoenoses, where the majority of *Fagales* species are distributed (Fig. 10). Therefore, deep investigations in these natural areas for fungi are effective.

Knowledge of fungal biology, ecology, and mycogeography is a prerequisite to understanding fungal diversity and distribution patterns. In the case of plant pathogenic fungi, accurate records of hosts and distribution ranges can facilitate their detection, identification, and management (Dugan et al. 2009). Based on our study, 12% of the total fungal count was discovered as pathogens in different Italian regions. This information aids in the management of diseases in *Fagales* trees and other economically relevant crops, as well as the identification of high-risk locations. Eighteen pathogenic taxa in *Botryosphaeriales* were recorded mainly from Sardinia, Trentino-Alto Adige, and Tuscany regions. *Biscogniauxia mediterranea*, *Diplodia corticola*, and *Discula quercina* were reported as endophytic canker-causing agents on declining oak trees in the Mediterranean region (Luque & Girbal 1989, Franceschini et al. 1999, Ragazzi 2009, Linaldeddu et al. 2011, 2014). Based on morphological and molecular analyses, Linaldeddu et al. (2014) conducted a study in holm oak forests on Caprera Island and identified *Botryosphaeriaceae* taxa, viz., *Botryosphaeria dothidea*, *Diplodia corticola*, *D. seriata* and *Neofusicoccum parvum* from perennial V-shaped cankers on declining trees. Additional field studies showed that *Botryosphaeriaceae* taxa are frequently isolated as pathogens from oak cankers, and *Diplodia corticola* is the most prevalent species in the Mediterranean climate (Frisullo et al. 2000, Sánchez et al. 2003, Linaldeddu et al. 2014, Lynch et al. 2013).

In our survey, 29 pathogens in *Diaporthales* were revealed, and among them, *Cryphonectria parasitica* was found on different *Castanea* and *Quercus* species in fifteen Italian regions. *Cryphonectria parasitica* is responsible for chestnut blight in *Castanea sativa*, which has a high economic value in timber and nut production in Europe (Juhásová et al. 2006, Chandelier et al. 2019). This disease was initially discovered in Europe in 1938, in Genova, Italy (Biraghi 1950). Then, in 1958, it arrived in South Tyrol and quickly spread to all areas where chestnuts were produced (Windegger 1994, Ahmad & Baric 2022). With the emergence of hypovirulence, the European chestnut blight disease started to decline in the 1950s, and in South Tyrol, crown dieback and the complete death of the trees increased over time. This happened as a result of the negative effects of *C. parasitica* and climatic stress, such as hot summers and springs and dry winters (Desprez-Loustau et al. 2006, Waldboth & Oberhuber 2009, Ahmad & Baric 2022). Therefore, accurate predictions of fungal diversity and disease prevention based on knowledge of biology, ecology, and the distribution of fungal species are important.

According to the survey on a regional fungal count by Venturella (2011), *Ascomycota* taxa are negligible (near zero) in some regions, including Abruzzo, Friuli-Venezia Giulia, Lazio, Marche, and Molise. Our survey updates the fungal records for those regions except Molise, with 26 additional records from Lazio, 11 from Friuli-Venezia Giulia, seven from Abruzzo, and two from Marche. We suggest that further studies should be conducted to reveal the hidden fungal diversity of these regions, especially in Molise, which has received the least attention.

The assessment of fungal diversity increases the ecological knowledge of each investigated taxon and provides the data to prepare distribution maps and red lists (Gargano et al. 2009, Wagensommer et al. 2018). Maps of the geographic distribution of fungi and their associated hosts (plants, rocks, soil, animals, or artificial substrates) can be seen as more advanced snapshots of fungal research. Given this, it is reasonable to attribute the absence of fungal information on specific *Fagales* hosts to the plant distribution patterns in Italy. For instance, *Arthoniomycetes* has never been reported on *Casuarina* due to its limited distribution in Italy. However, the hidden fungal diversity should be further explored based on those hosts and fungi in different classes for which the mycological data are currently incomplete. The accurate reporting of host-fungal records with the exact geographic position is highly recommended to understand the distribution of *Ascomycota*, especially plant pathogens (Dugan et al. 2009). An awareness of the location gaps for future mycological investigations, such as areas that have not previously been investigated for fungi and hosts, could be aided by comprehensive and precise data collection.

Taxonomy and phylogenetic analyses

In this study, we provided new mycological data from our fungal collection to the Italian checklist and distribution map. We re-collected fungal specimens from two different provinces in Italy, where a considerable number of *Ascomycota* were previously reported, and identified them by combined morphological and molecular data analyses as Sordariomycetes in *Coryneaceae*, *Melanconiellaceae*, and *Diaporthomycetidae* families *incertae sedis*, and to a lesser extent, *Dothideomycetes* in *Valsariaceae*.

Coryneum modonium was collected from *Castanea sativa* (chestnut) in the Emilia–Romagna region, and we provided the first Italian record with the first comprehensive description, color illustrations, and updated taxonomic notes. In Austria, Belgium, Slovakia, and Switzerland, *C. modonium* was recorded on *C. sativa*, *C. vesca* and other *Castanea* species (Sutton 1975,1980, Adamčíková et al. 2013, Farr & Rossman 2022). *Coryneum modonium* was listed as a secondary disease species of chestnut by del Brío (1998), and the endophytic life mode was reported by Bissegger and Sieber (1994). The majority of reported *C. modonium* were from *Castanea* species, and the host preference of the taxon should be studied further. In addition to its ecological value, *C. modonium* has a biochemical significance in antifungal activities. A glycolipid "Corynecandin" was extracted from the cultures of a *C. modonium* strain isolated from *Tradescantia ozarkana* plants in the U.S.A. (Gunawardana et al. 1997).

Among the other studied taxa, *Melanconiella flavovirens* was previously reported on *Corylus avellana* trees in Austria, Italy, Sweden, and Switzerland (Farr & Rossman 2022). Our collection of *M. flavovirens* was found on the same host and reported as a new record from the Emilia–Romagna region. Also, *Melanconiella meridionalis* was previously recorded on *Ostrya carpinifolia* trees in Austria, Croatia, and Italy (Voglmayr et al. 2012, Farr & Rossman 2022), while our collection was found on the same host and same region (Tuscany), and was the second record for Tuscany region and the first record for Arezzo province. *Woswasia atropurpurea* on *C. avellana* and *Valsaria rudis* on *Quercus* sp. were the first reports from the Emilia–Romagna region. Morphology and phylogenetic analyses for these species were matched with previous studies, and sequence data were deposited in the NCBI GenBank for future studies. These new records contribute to taxonomic studies, including the revision of species descriptions and morphological keys for identification (Dugan et al. 2009). New records are important when a geographic region is under-surveyed in terms of a particular fungal group or for taxonomic revisions of a fungal group (Dugan et al. 2009).

The online documentation for plant-associated microfungi in Italy was launched by the Center of Excellence in Fungal Research team (Wijesinghe et al. 2021a). The species identification is processed through ecological and morpho-molecular phylogenetic analyses, taxonomic updates, and descriptive morphologies with mycogeographical data provided (https://italianmicrofungi.org/). The checklist and updated taxonomy in this study will be linked to this online database to provide well-documented mycological data.

Future perspectives

Generally, it is challenging to update the fungal lists reported for a particular biotope and published in a journal. In some cases, these lists are based on a single observation event (Gams 2004a). However, the continuous recording of mycological data by regional or national-level checklists or monographs may lead to updated, accurate numbers of fungal counting in the future (Gams 2004a). According to the "Ascomycete Conservation Specialist Group" (http://www.cybertrufflorg.uk/ascos/index.htm), *Ascomycota* has been seriously overlooked in conservation. Therefore, re-collecting fungal species and providing their molecular data and morphological descriptions would remarkably improve modern taxonomy. The regions for which less mycological data are available, such as Marche and Molise, should be kept on future mycologists' bucket lists. Furthermore, we suggest annual updating of the *Ascomycota* records (both micro and macrofungi) on such a great economically and ecologically valuable vegetation like *Fagales* with higher conservative efforts.

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