

The first updated checklist of novel fungi in Pakistan (1947–2021)

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Abstract

The role of fungi in both natural and managed ecosystem processes is unequivocal with mycotaxa being key drivers of soil, plant and animal health. Recent advances in DNA-based species identification and classification have enforced mycologists to update national checklists for proper exploitation of fungal traits and functions. However, in some countries like Pakistan, a comprehensive checklist of fungal diversity, distribution, and their host range is still lacking. Herein, we summarize novel fungal species (including both macro- and micro-fungi) for the first time from distinct geographical locations of Pakistan. A total of 742 novel fungal species in 7 phyla have been reported in Pakistan since 1947, including 136 ambiguous species (as a result of cryptic species, taxonomy revisions, and lack of DNA sequence data) and 113 species with DNA sequence data. The compilation of the fungal name list provides an overview of the currently known fungal taxa in Pakistan and enables the assessment of the knowledge gap on the fungal biodiversity in comparison to the rest of the world. The current checklist will serve as a foundation for new fungi names to be added in the future and can be used as a reference by mycologists to retrieve fungal species from existing culture banks in Pakistan mentioned on the website, www.fungiofpakistan.com, to exploit their functional traits in the food industry, health sectors and for sustainable agriculture in Pakistan.

Keywords: Asia, macro- and micro-fungi, nomenclature, novel species list, taxonomy

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Introduction

Fungal classification, as one of seven kingdoms in two superkingdoms of living organisms, all with equal status in taxonomy, has been a useful one until recently (Williams et al. 2013, Ruggiero et al. 2015). It has

been shown in detail how fungi differ and are similar throughout the phylogeny during cladistics and molecular studies (Choi et al. 2017, Spatafora et al. 2017, Tedersoo et al. 2018, Naranjo - Ortiz et al. 2019, Lücking et al. 2020, Galindo et al. 2021). Phylogenetic reconstruction methods (parsimony, likelihood and bayesian approaches) have proven to be reliable indicators of evolutionary relationships and this has led to the discovery of new taxa (Barton et al. 2007). As eukaryotes, many fungi can be grown in pure cultures with high growth rates and if necessary, in large amounts (Álvarez-Pérez et al. 2011, Rämä and Quandt 2021). These characteristics (metabolites production and biocontrol of plant diseases) have made fungi as attractive research materials to use in industrial and biotechnological applications. Detailed uses of fungi in fundamental biological research from the standpoint of practical applications are highlighted by Hyde et al. (2019). Fungi, which can cause some of the most serious diseases in agricultural crops (Diao et al. 2017, Liu et al. 2017, Raza et al. 2019), are of particular interest to plant pathologists. Medical and veterinary mycologists deal with fungi that cause diseases in humans and domestic animals (Jabeen et al. 2017, Seyedmousavi et al. 2018). There are many fungi that cause food spoilage (Hussain et al. 2016a, Wu et al. 2019a), damage manufactured goods, and decay timber (Garnier et al. 2017, Snyder and Worobo 2018, Saleh and Al-Thani 2019, Goodell et al. 2020, Tennakoon 2021). The vast majority of fungal species in the fungal kingdom have never been cultivated and studied for their growth characteristics and physiology, which makes them virtually untapped for potential applications. It is necessary for this purpose to develop new methods and protocols, which means extensive basic research should be conducted prior to exploiting these organisms.

The number of species discovered so far represents only a small fraction of all the species that exist (Hawksworth 2001, Blackwell 2011, Hawksworth and Lücking 2017, Wu et al. 2019b, Baldrian et al. 2021, Lücking et al. 2021, Phukhamsakda et al. 2022). This is because only a few habitats and regions have been extensively studied. The Yungui Plateau (Guizhou Province and Yunnan Province) in southwestern China and various areas of Thailand and countries in West Africa such as Bennis Burkina Faso, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo are well known for their biodiversity (Hyde et al. 2018, Piepenbring et al. 2020, Wijayawardene et al. 2021). It is further proposed that a large proportion of new species are yet to be discovered, perhaps in more tropical areas such as Bangladesh, India, Laos, Pakistan, Sri Lanka, Thailand and Vietnam (Hyde et al 2018, Kaur et al. 2019, Raza et al. 2021, Wijayawardene et al. 2022a).

Pakistan is extremely diverse with respect to geography and climate. The climate mainly varies from tropical to temperate with the existence of hot deserts and the Himalayan peaks with a cold climate (Khan 2019). With such diverse conditions, Pakistan has only scant information on the diversity of micro- and macro-fungi. The reason is likely due to lack of human capacities while most national monographs on biodiversity have not included fungi. The lack of an up-to-date checklist for the country is one of the largest gaps in knowledge concerning fungal conservation. There is also a bias in assessing biodiversity, lack of awareness of fungi as important components of ecosystem functioning, and frustration among end-users due to a lack of information. It is still not possible to provide a complete picture of fungi in Pakistan without a comprehensive checklist of all taxa reported from the country.

A number of fungal species have previously been combined based on morphological observations and reported in the printed book "Fungi of Pakistan" by Sultan and co-authors in 1997 (Ahmad et al. 1997). Since then, there have been changes and improvements to the methodology for the classification of fungi, which have led to continuous updates in taxonomy and systematics of fungi in the 21st century, and checklists are essential tools for these endeavors (Amrani et al. 2019, Abdel-Azeem et al. 2020). In order

to help mycologists, pathologists, microbiologists, ecologists, farmers, we compiled a first up-to-date checklist of all reported novel fungal species based on current knowledge and resources. Moreover, this list could help in further research on the biogeography and endemism of fungi.

Materials and methods

The list was compiled using a literature search of fungi in Pakistan (sourced from library data, personal data of specific authors, or books that were not easily accessible to the public), and only novel fungal species from the region were included in this list. The phyla, orders, families, genera, and species are listed alphabetically according to Kirk et al. (2008) and Index Fungorum (2022). Fungal taxa whose taxonomy is not well established are placed under '*incertae sedis*'. Index Fungorum (www.indexfungorum.org) Index Fungorum (2022) was used to verify fungal taxa that are reported in this study.

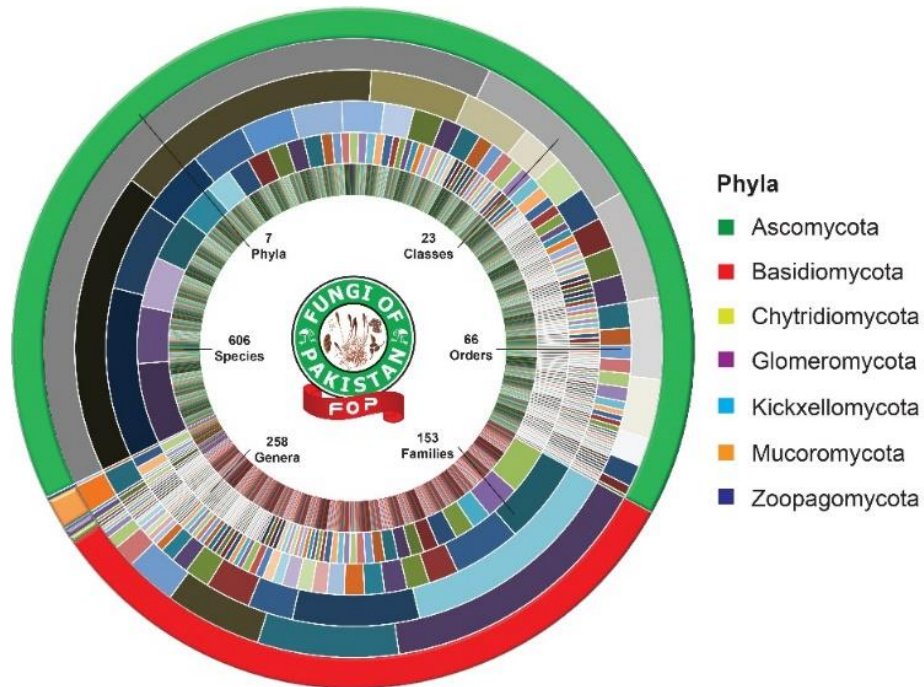
Results and the checklist

A checklist of novel macro- and micro-fungal species reported from Pakistan is presented for the first time in this paper. This checklist includes current names of fungal species with updated taxonomy, host records, and localities (Table 1). Nevertheless, the fungal species previously described based on morphological observations (136 ambiguous species) are also presented (Table 2). There are a total of 742 reported new species in the Pakistan checklist which represents 258 genera, 153 families, 66 orders, 23 classes, and 7 phyla (Fig. 1).

The Ascomycota with 393 species were divided into 165 genera and 96 families. Within Ascomycota, at the class level, Dothideomycetes had the greatest number of species (237 species), genera (51 genera), and families (35 families), accounting for 53.09 % of all novel species. According to the statistics, most of the species were found in Pleosporales (109 species), followed by Amphisphaeriales (10 species), Botryosphaeriales (96 species), Capnodiales (24 species), Diaporthales (11 species), Helotiales (12 species), Rhytismatales (9 species), Sordariales (15 species) and Teloschistales (12 species). Asterinales, Dothideales, Cephalothecales, Chaetothyriales, Eurotiales, Lecideales, Leprocaulales, Microascales, Microthyriales, Patellariales, Phaeotrichales, Phomatosporales, Saccharomycetales, Tubeufiales, and Verrucariales were reported as the orders with one species. Furthermore, there are other listed orders in the checklist, each one having less than ten species.

Basidiomycota was the second most abundant phylum, with 198 species belonging to 83 genera and 49 families. A total of 89 types were found in the Basidiomycetes, 32 in the Bartheletiomycetes, 45 in the Pucciniomycetes, 16 in the Triticariomycetes, and less than 10 in Agaricostilbomycetes, Basidiomycetes, Exobasidiomycetes, Microbotryomycetes, Ustilaginomycetes, and Tremellomycetes (Fig. 1B, Table 1). Furthermore, phyla Chytridiomycota, Glomeromycota, Kickxellomycota, Mucoromycota, and Zoopagomycota possess 2, 2, 1, 9, and 1 species, respectively (Table 1). Indicated with an asterisk, a total of 113 novel species with DNA sequence data are represented.

A



B

Classes/Higher rank taxa	Orders	Families	Genera	Species
Dothideomycetes	12	35	51	237
Eurotiomycetes	3	3	3	3
Laboulbeniomycetes	2	4	5	7
Lecanoromycetes	4	4	6	19
Leotiomycetes	5	13	21	25
Pezizomycetes	1	5	9	9
Saccharomycetes	1	1	1	1
Sordariomycetes	11	30	42	57
Ascomycota <i>incertae sedis</i>	1	1	27	35
Basidiomycetes	2	17	34	89
Agaricostilbomycetes	1	1	1	1
Bartheletiomycetes	7	13	22	32
Basidiomycetes	1	1	1	1
Exobasidiomycetes	3	3	3	4
Microbotryomycetes	2	2	2	7
Pucciniomycetes	1	7	12	45
Tremellomycetes	1	1	1	1
Tritirachiomycetes	1	2	5	16
Ustilaginomycetes	1	2	2	2
Synchytriomycetes	1	1	1	1
Chytridiomycetes <i>incertae sedis</i>	1	1	1	1
Glomeromycetes	1	1	1	2
Kickxellomycetes	1	1	1	1
Mucoromycete	1	3	5	9
Zoopagomycetes	1	1	1	1

Fig. 1 Taxonomic distribution of novel fungal species reported from Pakistan since 1947. (A) Total number of fungal taxa at different taxonomic ranks. (B) Number of orders, families, genera and species within different classes/higher rank taxa belonging to seven phyla.

Checklist

There are two sections of this checklist: i. novel species with updated taxonomy or current status (Table 1) and ii. novel ambiguous species with their current status (Table 2).

In the first section, we present 258 genera with 606 species based on current fungal classification, however, there are a few *incertae sedis* genera and their species need further clarification. For example, *Septogloeum dalbergiae* (current name: *Colletogloeum dalbergiae*). *Colletogloeum* morphologically resembles *Pseudocercospora* and *Ahmadia* (Videira et al. 2017). The genus is typified by *Colletogloeum dalbergiae* but this species lacks DNA sequence data. Crous et al. (2009) showed that *C. sissoo* (IMI 119162), is closely related to *Pseudocercospora*. Hence, Kirk et al. (2013) and Wijayawardene et al. (2020) did not list this genus in their studies. One species (the type of *Colletogloeum*) has been reported from Pakistan but the accuracy of this needs to be restudied based on new collections and epitypification.

Table 1 Checklist of novel fungal species reported from Pakistan. Species with DNA sequence data are indicated with *.

Taxon	Current name/status	Host	Localities	References
<i>Ascomycota</i>				
<i>Dothideomycetes</i>				
<i>Capnodiales</i>				
<i>Capnodiaceae</i>				
<i>Capnodium</i>				
<i>C. berberidis</i>		Leaves and branches of <i>Berberis</i> sp.		Ahmad 1978b
<i>Cladosporiaceae</i>				
<i>Cladosporium</i>				
<i>C. heterophragmatis</i>		Leaves of <i>Heterophragma adenophyllum</i>	Tandojam	Khan and Kamal 1962c
<i>C. neriicola</i>		Leaves of <i>Nerium indicum</i>		Khan and Kamal 1974
<i>Mycosphaerellaceae</i>				
<i>Cercospora</i>				
<i>C. tandojame-nsis</i>	<i>Pseudocercospora tandojamensis</i>	Leaves of <i>Ziziphus nummularia</i>		Khan and Kamal 1974, Crous and Braun 2003
<i>C. ahmadii</i>	<i>Passalora ahmadii</i>	Leaves of <i>Marsdenia roylei</i>		Petrak 1955b, Crous and Braun 2003
<i>C. dichanthii</i>	<i>Zasmidium dichanthii</i>	Leaves of <i>Dichanthium annulatum</i>		Khan and Kamal 1969, Braun et al. 2010
<i>C. ehretiicola</i>		Leaves of <i>Ehretia acuminata</i>		Saleem and Mirza 1977
<i>C. launaeicola</i>		Leaves of <i>Launaea nudicaulis</i>		Khan and Kamal 1974

<i>C. mehran</i>		Leaves of <i>Artocarpus heterophyllus</i>		Khan and Kamal 1974
<i>C. oxystelmatis</i>	<i>Pseudocercospora oxystelmatis</i>	<i>Oxystelma esculentum</i>		Khan and Kamal 1974, Rai and Moses 1991
<i>C. pakistanica</i>		Leaves of <i>Phyllanthus niruri</i>	Tandojam	Khan and Kamal 1963
<i>C. pentatropidis</i>	<i>Pseudocercospora pentatropidis</i>	Leaves of <i>Pentatropis cynanchoides</i>		Khan 1962, Deighton 1976
<i>C. phyllanthicola</i>		Leaves of <i>Phyllanthus niruri</i>		Khan and Kamal 1962a
<i>Cercospora</i>				
<i>Ce. justiciae</i>		Leaves of <i>Justicia simplex</i>	Jhelum	Ahmad 1967
<i>Ce. cadabae</i>	<i>Pseudocercospora ahmadiana</i>	Leaves of <i>Cadaba farinosa</i>		Ahmad 1960, Braun 1995
<i>Passalora</i>				
<i>P. foeniculi</i>		Leaves, stem, and pedicels of <i>Foeniculum vulgare</i>		Kamal and Khan 1962
<i>P. heliotropiigena</i>		Leaves of <i>Heliotropium eichwaldii</i>	Oderolal Farm, Tandojam	Braun 2002
<i>P. tephrosiae</i>		Leaves of <i>Tephrosia tenuis</i>		Khan and Kamal 1962d
<i>Ramularia</i>				
<i>R. pakistanica</i>		Leaves of <i>Rumex dentatus</i>		Khan and Kamal 1969
<i>Septoria</i>				
<i>S. ahmadii</i>		<i>Abelia trifloral</i>		Petrak and Ahmad 1954
<i>S. hederahimalaicae</i>		Leaves of <i>Hedera himalaica</i>		Ahmad 1964a
<i>S. launaeae</i>		<i>Launaea nudicaulis</i>		Khan and Kamal 1962b
<i>S. leptosphaeriicola</i>		<i>Leptosphaeria rumicis</i>		Cavalc and Iqbal 1967
<i>S. salvadorae</i>		Dead branch of <i>Salvadora persica</i>		Abbas et al. 2000b
<i>Dothideales</i>				
<i>Sacotheciaceae</i>				
<i>Selenophoma</i>				
<i>S. scrophulariae</i>		Dead stems of <i>Scrophularia</i> sp.		Sutton 1980a
<i>Microthyriales</i>				
<i>Microthyriaceae</i>				
<i>Microthyrium</i>				
<i>M. nerii</i>		Fallen leaves of <i>Nerium odorum</i>	Gujrat	Ahmad 1971b

Patellariales				
Patellariaceae				
Haematomyxa				
<i>H. pakistani</i>	<i>Tryblidaria pakistani</i>	Branches of <i>Berberis</i> sp.		Müller and Ahmad 1955, Kutorga and Hawksworth 1997
Phaeotrichales				
Phaeotrichaceae				
Echinoascotheca				
<i>E. duploofor- mis</i>		Soil		Matsushima 1995
Pleosporales				
Camarosporiaceae				
Camarosporium				
<i>C. acaciigen- um</i>		Dead branches of <i>Acacia arabica</i>	Sheikhupura	Ahmad 1967
<i>C. boerhaviae</i>		Branches of <i>Boerhavia verticillata</i>	Karachi	Ahmad 1967
<i>C. capparis</i>	<i>Camarosporiopsis capparis</i>	<i>Capparis aphylla</i>	Ladhar, Sheikhupura	Ahmad 1951, Abbas et al. 2000a
<i>C. farsetiana</i>	<i>Camarosporium farsetianum</i> (orthographic variant)	Dead branches of <i>Farsetia jacquemontii</i>	Bhakar	Ahmad 1967
<i>C. ficina</i>	<i>Camarosporium ficinum</i> (orthographic variant)	Branches of <i>Ficus palmata</i>	Muzaffarabad	Ahmad 1967
<i>C. fruticosae</i>		Dead branches of <i>Suaeda fruticosa</i>		Ahmad 1967
<i>C. fruticosae</i> var. <i>minus</i>		Dead branches of <i>Suaeda fruticosa</i>		Ahmad 1967
<i>C. javanicae</i>		Branches of <i>Aerva javanica</i>	Bahawalpur	Ahmad 1967
<i>C. lonicerae</i>		Branches of <i>Lonicera</i> sp.	Doonga Gali	Ahmad 1971b
<i>C. pentatropi- dis</i>		Dead branches of <i>Pentatropis cynanchoides</i>		Ahmad 1964a
<i>C. plectranthi</i>		Branches of <i>Plectranthus rugosus</i>	Swat	Ahmad 1971b
<i>C. sarcinosporum</i> var. <i>microsporum</i>		Dead branches of <i>Haloxylon recurvum</i>		Ahmad 1967
<i>C. solani</i>		Branches of <i>Solanum melongena</i>	Hangu	Ahmad and Arshad 1972b
<i>C. suaedae</i>		<i>Suaeda fruticosa</i>		Ahmad 1967
<i>C. suaedaefru- tiosae</i>		Dead branches of <i>Suaeda fruticosa</i>		Ahmad 1967

<i>C. vernoniae</i>		Branches of <i>Vernonia cinerascens</i>	Fort Monro	Ahmad 1971b
<i>C. viniferum</i>		Dead branches of <i>Vitis vinifera</i>		Ahmad 1967
Coniothyriaceae				
Coniothyrium				
<i>C. calotropidis</i>		Dead branches of <i>Calotropis procera</i>		Ahmad 1964a
<i>C. capparicola</i>		Branches of <i>Capparis aphylla</i>		Ahmad 1967
<i>C. capparis</i>		Branches of <i>Capparis aphylla</i>		Ahmad 1971b
<i>C. clerodendri</i>		Dead branches of <i>Clerodendrum inerme</i>		Ahmad 1964c
<i>C. grewiae</i>		Dead branches of <i>Grewia villosa</i>		Ahmad 1964c
<i>C. indicum</i>		Twigs of <i>Salix</i> sp.		Cooke and Masseur 1888
<i>C. ismailii</i>		Dead stem of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. leptadeniae</i>		Dead branches of <i>Leptadenia spartium</i>		Ahmad 1967
<i>C. macrosporum</i>		Dead roots of <i>Cenchrus biflorus</i>		Ahmad 1964a
<i>C. maqsoodii</i>		Dead twigs of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. moricola</i>		Branches of <i>Morus alba</i>		Ahmad 1971b
<i>C. pakistanicum</i>		Dead twigs of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. pentatropidis</i>		Dead branches of <i>Pentatropis cynanchoides</i>		Ahmad 1964a
<i>C. punithalingamii</i>		Dead stem of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. salvadorina</i>	<i>Avettaea salvadorae</i>	Dead branches of <i>Salvadora oleoides</i>		Ahmad 1964a, Abbas and Sutton 1988a
<i>C. sivanesianii</i>		Dead twigs of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. sultanii</i>		Dead stem of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. suttonii</i>		Dead stem of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. truncatum</i>		Dead stem of <i>Salvadora oleoides</i>		Abbas et al. 1999
<i>C. undulatum</i>		Dead twigs of <i>Salvadora persica</i>		Abbas et al. 1999
<i>C. withaniae</i>		<i>Withania somnifera</i>		Ahmad 1951
<i>C. ziziphinum</i>		Leaves of <i>Ziziphus jujuba</i>		Ahmad 1968a
Cucurbitariaceae				
Cucurbitaria				
<i>C. ahmadii</i>		Dead branches of <i>Caragana</i>		Mirza 1968a
<i>C. indigoferae</i>		Branches of <i>Indigofera gerardiana</i>		Müller and Ahmad 1957
<i>C. pakistanica</i>		Dead <i>Acacia modesta</i>		Petrak and Ahmad 1954
<i>C. pilosa</i>		Dead branches of <i>Hedera helix</i>		Mirza 1968a

Cyclothyriellaceae				
Massariosphaeria				
<i>M. websteri</i>		Decaying culms of <i>Phragmites karka</i> submerged in fresh water		Tanaka et al. 2011
<i>M. pakistana</i>		Dried stem		Crivelli 1983
Delitschiaceae				
Semidelitschia				
<i>S. tetraspora</i>		Dung of <i>Capra hircus</i>		Mirza and Khan 1979
Diademaceae				
Diadema				
<i>D. ahmadii</i>		Dead branches of <i>Rosa moschata</i>	Lalazar, Kaghan Valley	Tanaka et al. 2010
Didymellaceae				
Ascochyta				
<i>A. ahmadii</i>		Runner of <i>Sporobolus arabicus</i>		Punithalingam 1979
<i>A. cymbopogonis</i>		Dead leaves of <i>Cymbopogon iwarancusa</i>		Punithalingam 1979
<i>A. pegani</i>		Branches of <i>Peganum harmala</i>		Ahmad 1971b
<i>A. skimmiae</i>		Fallen leaves of <i>Skimmia laureola</i>		Ahmad 1960
<i>A. typhaeangustatae</i>		Leaves of <i>Typha angustata</i>		Punithalingam 1988
Didymella				
<i>D. rhododendri</i>		Dead leaves of <i>Rhododendron arboreum</i>	Kaghan valley	Ahmad 1972c
Phoma				
<i>P. acaciigena</i>		Fallen pods of <i>Acacia modesta</i>	Attock	Ahmad and Arshad 1972a
<i>P. cadabae</i>		Dead branches of <i>Cadaba fruticosa</i>	Changa manga	Ahmad 1967
<i>P. changana</i>		Dead stem of <i>Atriplex crassifolia</i>		Ahmad 1954
<i>P. cryptostegiae</i>		Branches of <i>Cryptostegia grandiflora</i>		Ahmad 1964c
<i>P. mangiferae</i>		<i>Mangifera indica</i>		Ahmad 1948
<i>P. nyctaginea</i> var. <i>boerhaaviae</i>	<i>Phoma nyctaginea</i>	<i>Boerhavia diffusa</i>		Tassi 1900, Ahmad 1948,
<i>P. pyrenophoricola</i>		<i>Pyrenophora</i> sp.		Peres and Iqbal 1967
<i>P. saccharicola</i>		Dead culms of <i>Saccharum munja</i>		Ahmad 1960
<i>P. ziziphina</i>		Dead branch of <i>Ziziphus jujuba</i>		Ahmad 1948

Didymosphaeriaceae				
Didymosphaeria				
<i>D. casuarinae</i>		Stems of <i>Casuarina equisetifolia</i>		Wehmeyer and Ahmad 1964
<i>D. culmicola</i>		Dead stem of <i>Panicum antidotale</i>		Müller and Ahmad 1959
<i>D. spinosa</i>		Unknown		Müller and Ahmad 1959
<i>D. verrucispora</i>	<i>Phaeosphaerella verrucispora</i>	Dead branches of <i>Gossypium</i> sp.	Ladhar, Sheikhpura	Ahmad 1948, Batista and Vital 1959
Karstenula				
<i>K. capparisi</i>		<i>Capparis aphylla</i>		Petrak and Ahmad 1954
Leptosphaeriaceae				
Leptosphaeria				
<i>L. ahmadii</i>		<i>Capparis aphylla</i>		Petrak and Ahmad 1954
Lophiostomataceae				
Platystomum				
<i>P. compressum</i> var. <i>macrosporum</i>	<i>Lophiostoma compressum</i>	Unknown		Cesati and De Notaris 1863, Ahmad 1978b
Massarinaceae				
Helminthosporium				
<i>H. ahmadii</i>		Dead branches of <i>Quercus</i> sp.	Murree	Ellis 1961
<i>H. dalbergiae</i>		Dead branches of <i>Dalbergia sissoo</i>		Ellis 1961
Massarina				
<i>M. albiziae</i>		Branches of <i>Albizia lebbek</i>	Lahore	Ahmad 1971b
<i>M. oleina</i>		Branches of <i>Olea cuspidate</i>	Tret	Ahmad and Arshad 1972b
Stagonospora				
<i>S. alhagiae</i>		Leaves, stem, and spines of <i>Alhagi maurorum</i>		Mirza et al. 1967
<i>S. alhagicola</i>		Branches of <i>Alhagi maurorum</i>		Ahmad 1971a
<i>S. asparagi</i>		Dead branches of <i>Asparagus adscendens</i>		Ahmad 1969a
<i>S. doemiae</i>		Branches of <i>Doemia extensa</i>		Ahmad 1971a
<i>S. eriobotryae</i>		Fallen leaves of <i>Eriobotrya japonica</i>		Ahmad 1960
<i>S. pyricola</i>		Branches of <i>Pyrus communis</i>	Lahore	Ahmad 1971b
<i>S. saccharicola</i>		Culms of <i>Saccharum spontaneum</i>		Ahmad 1971a
<i>S. saccharina</i>		Culms of <i>Saccharum spontaneum</i>	Hasan abdal	Ahmad 1971a

Melanommataceae				
Aposphaeria				
<i>A. lignicola</i>		Dead wood of <i>Acacia arabica</i>		Ahmad 1964c
<i>A. pakistanica</i>		Dead wood		Ahmad 1971b
Phaeosphaeriaceae				
Nodulosphaeria				
<i>N. setosa</i>		Dead branches of <i>Sambucus ebulus</i>		Müller and Ahmad 1958
Ophiobolus				
<i>O. indigoferae</i>		Associated with bark of <i>Indigofera</i> sp.		Müller and Ahmad 1955
<i>O. spirosporus</i>		<i>Saccharum spontaneum</i>		Ahmad 1948
Pleosporaceae				
Alternaria				
<i>A. cassia</i>		Leaves of <i>Cassia holosericea</i>		Jurair and Khan 1960
<i>A. cicina</i>		Leaves of <i>Ricinus communis</i>		Simmons 1994
<i>A. enydrae</i>		Leaves of <i>Enydra fluctuans</i>		Khan and Kamal 1974
Curvularia				
<i>C. ellisii</i>		Air		Ahmad and Quraishi 1960
<i>C. siddiquii*</i>		Air		Ahmad and Quraishi 1960, Marin-Felix et al. 2020
Roussoellaceae				
Cytoplea				
<i>C. mangiferae</i>		Branches of <i>Mangifera indica</i>	Bhopalwala	Ahmad 1971b
<i>C. ziziphina</i>		Dead branches of <i>Ziziphus oxyphylla</i>		Ahmad 1961
Sporormiaceae				
Sporormia				
<i>S. fimicola</i>		Dung of <i>Capra aegagrus hircus</i>		Ahmed and Asad 1967a
Sporormiella				
<i>Sp. hexamera</i>		Goat dung		Ahmed et al. 1985
<i>Sp. inaequalis</i>		Dung of <i>Capra aegagrus hircus</i>		Ahmed and Asad 1967a
<i>Sp. sultanii</i>	<i>Preussia sultanii</i>	Camel dung		Sultana and Malik 1980, Guarro et al. 1997
Teichosporaceae				
Teichospora				

<i>T. ellipsoidea</i>		Decorticated wood of <i>Perovskia abrotanoides</i>		Wehmeyer and Ahmad 1964
<i>T. fusiformis</i>		Decorticated wood of <i>Perovskia abrotanoides</i>		Wehmeyer and Ahmad 1964
Trematosphaeriaceae Trematosphaeria				
<i>T. verrucosa</i>		Wood		Müller and Ahmad 1959
Zopfiaceae Rechingeriella				
<i>R. eutypoides</i>	<i>Monosporascus eutypoides</i>	Dead roots		Petrak and Ahmad 1954, Von Arx 1975
Zopfia				
<i>Z. pakistanica</i>		Soil of <i>Juniperus</i> sp.		Matsushima 1995
Pleosporales genera <i>incertae sedis</i> Chaetodiplodia				
<i>C. grewiae</i>		Decorticated branches of <i>Grewia populifolia</i>	Kharian	Ahmad 1971a
Pyrenochaeta				
<i>P. dalbergiae</i>		Branches of <i>Dalbergia sissoo</i>	Sohawa	Ahmad 1972b
<i>P. grewiae</i>		Decorticated branches of <i>Grewia populifolia</i>	Kharian	Ahmad 1971a
<i>P. origani</i>		Dead branches of <i>Origanum vulgare</i>		Ahmad 1964a
<i>P. saccharina</i>		Culms of <i>Saccharum griffithii</i>	Parachinar	Ahmad 1971a
Pleosporomycetidae genus <i>incertae sedis</i> Hysterographium				
<i>H. dalbergiae</i>		<i>Dalbergia sissoo</i>		Ahmad 1950a
<i>H. pleosporoides</i>		Decayed wood		Wehmeyer and Ahmad 1964
Tubeufiales Tubeufiaceae Acanthostigma				
<i>A. lahorensis</i>		Wood		Ahmad 1954
Dothideomycetes genus <i>incertae sedis</i> Bactrodesmium				
<i>B. cedricola</i>		Branches of <i>Cedrus deodara</i>		Ellis 1959
Dothideomycetes orders <i>incertae sedis</i> Asterinales Morenoinaceae Morenoina				
<i>M. parvula</i>		Dead leaves of <i>Hedera nepalensis</i>	Ghora Gali	Cannon 1986

Botryosphaeriales				
Aplosporellaceae				
Aplosporella				
<i>A. astragalina</i>		Branches of <i>Astragalus</i> sp.	Rawalpindi	Ahmad 1971a
<i>A. beaumontiana</i>		Dead branches of <i>Beaumontia grandiflora</i>		Ahmad 1962
<i>A. cadabae</i>		Dead branches of <i>Cadaba farinosa</i>		Ahmad 1962
<i>A. cephalandrae</i>		Dead branches of <i>Cephalandra indica</i>		Ahmad 1964c
<i>A. cupressicola</i>		Branches of <i>Cupressus</i>	Lahore	Ahmad 1971a
<i>A. cynanchina</i>		Dead branches of <i>Cynanchum</i>		Ahmad 1962
<i>A. doemiae</i>		Branches of <i>Doemia extensa</i>	Changa manga	Ahmad 1971a
<i>A. ephedricola</i>		Branches of <i>Ephedra foliata</i>	Changa manga	Ahmad 1971a
<i>A. grewiae</i>		Branches of <i>Grewia villosa</i>	Kharian	Ahmad 1969a
<i>A. ipomoeae</i>		Dead branches of <i>Ipomoea carnea</i>		Ahmad 1964c
<i>A. leucaenicola</i>		Branches of <i>Leucaena glauca</i>	Lahore	Ahmad 1969a
<i>A. lonicerae</i>		Branches of <i>Lonicera</i> sp.		Ahmad 1971b
<i>A. madablota</i>		Dead branches of <i>Hiptage madablota</i>		Ahmad 1962
<i>A. maloti</i>		Dead branches of <i>Mallotus philippensis</i>		Ahmad 1972b
<i>A. murrayae</i>		Dead branches of <i>Murraya exotica</i>		Ahmad 1962
<i>A. pentatropidis</i>		Dead branches of <i>Pentatropis cynanchoides</i>		Ahmad 1962
<i>A. peristrophes</i>		Dead branches of <i>Peristrophe bicalyculata</i>		Ahmad and Arshad 1972a
<i>A. prosopidina</i>		<i>Prosopis juliflora</i>		Petrak and Ahmad 1954
<i>A. prosopidicola</i>		<i>Prosopis juliflora</i>		Petrak and Ahmad 1954
<i>A. quisqualidis</i>		Dranches of <i>Quisqualis indica</i>		Ahmad 1962
<i>A. salvadorae</i>		<i>Salvadora oleoides</i>		Petrak and Ahmad 1954
<i>A. tabernaemontanae</i>		<i>Tabernaemontana dichotoma</i>		Ahmad 1962
<i>A. vallaridis</i>		Dead branches of <i>Vallaris heynii</i>		Ahmad 1962
<i>A. vernoniae</i>		Dead branches of <i>Vernonia elaeagnifolia</i>		Ahmad 1962
<i>A. xanthii</i>		Branches of <i>Xanthium strumarium</i>		Ahmad 1971b
<i>A. ziziphina</i>		Dead branches of <i>Ziziphus jujuba</i>		Ahmad 1962
Botryosphaeriaceae				

Diplodia				
<i>D. abutilonis</i>		Dead branches of <i>Abutilon indicum</i>	Zafarwal	Ahmad 1967
<i>D. adhatodae</i>		Dead branches of <i>Adhatoda vasica</i>	Shakargar	Ahmad 1967
<i>D. alhagi</i>		Dead branches of <i>Alhagi pseudalhagi</i>	Salt Range, Rawal	Ahmad 1967
<i>D. andrachnes</i>		<i>Andrachne cordifolia</i>	Swat	Ahmad 1967
<i>D. bombacina</i>		<i>Bombax malabaricum</i>		Ahmad 1951
<i>D. buteae</i>		Dead branches of <i>Butea frondosa</i>		Ahmad 1964b
<i>D. calotropidis</i>		Dead branches of <i>Calotropis procera</i>		Ahmad 1962
<i>D. carissae</i>		Branches of <i>Cariss spinarum</i>	Shakargar	Ahmad 1967
<i>D. cedrelae</i>		Branches of <i>Cedrela toona</i>	Dargai	Ahmad and Arshad 1972b
<i>D. compressa</i> var. <i>pakistanii</i>		Dead branches of <i>Maclura aurantiicola</i>		Ahmad 1962
<i>D. ehretiae</i>		Branches of <i>Ehretia laevis</i>	Kharian	Ahmad 1971a
<i>D. ficina</i>		Dead branches of <i>Ficus palmata</i>	Changa manga	Ahmad 1967
<i>D. ficireligiosae</i>		Fallen leaves of <i>Ficus religiosa</i>	Kharian	Ahmad 1969b
<i>D. grevilleae</i>		Leaves of <i>Grevillea robusta</i>	Changa manga	Ahmad 1972b
<i>D. gymnosporiae</i>		<i>Maytenus royleana</i>		Ahmad 1967
<i>D. gymnosporina</i>		Branches of <i>Gymnosporia</i> sp.		Ahmad 1971a
<i>D. ipomoeae</i>		Branches of <i>Ipomoea carnea</i>		Ahmad 1971b
<i>D. lantanicola</i>		Dead branches of <i>Lantana indica</i>		Ahmad 1967
<i>D. maloti</i>		Dead branches of <i>Mallotus philippensis</i>	Tret	Ahmad and Arshad 1972a
<i>D. mimosae</i>		Branches of <i>Mimosa himalayana</i>		Ahmad 1971b
<i>D. mimosae-himalayanae</i>		Branches of <i>Mimosa himalayana</i>		Ahmad 1971b
<i>D. myrsines</i>		Dead branches of <i>Myrsine Africana</i>		Ahmad 1964c
<i>D. oxystelmatis</i>		Branches of <i>Oxystelma esculentum</i>		Ahmad 1971b
<i>D. pentatropidis</i>		Dead branches of <i>Pentatropis cynanchoides</i>		Ahmad 1969a
<i>D. peristrophe</i>		Dead branches of <i>Peristrophe bicalyculata</i>		Ahmad 1962
<i>D. prosopidina</i>		Dead branches of <i>Prosopis juliflora</i>		Ahmad 1967
<i>D. prunicola</i>		Branches of <i>Prunus amygdalus</i>		Ahmad 1971b
<i>D. psidii</i>		Dead branches of <i>Psidium guajava</i>		Ahmad 1967

<i>D. rumicina</i>		Branches of <i>Rumex hastatus</i>		Ahmad 1971a
<i>D. saccharina</i>		Culms of <i>Saccharum officinarum</i>		Ahmad 1971a
<i>D. saccharispontanei</i>		Culms of <i>Saccharum spontaneum</i>		Ahmad 1971a
<i>D. salvadorina</i>		<i>Salvadora oleoides</i>		Ahmad 1951
<i>D. sarocococcae</i>		Branches of <i>Sarcococca pruniformis</i>		Ahmad 1971b
<i>D. suttonii</i>		Dead branches of <i>Cocculus villosus</i>		Ahmad 1962
<i>D. withaniae</i>		<i>Withania somnifera</i>		Ahmad 1951
<i>D. xanthii</i>		Branches of <i>Xanthium strumarium</i>		Ahmad 1967
<i>D. ziziphina</i>		Dead branches of <i>Ziziphus sativa</i>		Ahmad 1962
<i>Dothiorella</i>				
<i>Do. arundinacea</i>		Dead culms of <i>Phragmites karka</i>		Ahmad 1964c
<i>Do. calotropidis</i>		Branches of <i>Calotropis procera</i>		Ahmad 1972b
<i>Do. carthami</i>		Branches of <i>Carthamus oxyacantha</i>	Sheikhupura	Ahmad 1971a
<i>Do. cephalandrae</i>		Branches of <i>Cephalandra indica</i>	Lahore	Ahmad 1969b
<i>Do. chenopodii</i>		Stem of <i>Chenopodium album</i>		Ahmad 1954
<i>Do. chrysopogonis</i>		Culms of <i>Chrysopogon fulvus</i>	Kharian	Ahmad 1971a
<i>Do. desmostachyae</i>		Rhizomes of <i>Desmostachya bipinnata</i>	Khanke headworks	Ahmad 1971a
<i>Do. erythrinae</i>		Branches of <i>Erythrina suberosa</i>	Lahore	Ahmad 1971a
<i>Do. ficina</i>		Dead <i>Ficus palmata</i>		Ahmad 1951
<i>Do. graminicola</i>		Dead stem of <i>Cynodon dactylon</i>		Ahmad 1951
<i>Do. ipomoeae</i>		Branches of <i>Ipomoea carnea</i>	Attock	Ahmad 1972b
<i>Do. ladharensis</i>		<i>Mangifera indica</i>		Ahmad 1954
<i>Do. lagerstroemiae</i>		Bark of <i>Lagerstroemia alba</i>		Ahmad 1951
<i>Do. leucaenicola</i>		Branches of <i>Leucaena glauca</i>	Lahore	Ahmad 1969b
<i>Do. meliae</i>		Leaf rachis of <i>Melia azedarach</i>	Changa manga	Ahmad 1972b
<i>Do. peucedani</i>		<i>Peucedanum graveolens</i>		Ahmad 1954
<i>Do. phoenicis</i>		Rachides of <i>Phoenix dactylifera</i>	Lahore	Ahmad 1971a
<i>Do. pinicola</i>		Needles of <i>Pinus excelsa</i>	Murree	Ahmad 1971a
<i>Do. prosopidina</i>		Fallen pods of <i>Prosopis glandulosa</i>	Kharian	Ahmad 1969b
<i>Do. pyricola</i>		Branches of <i>Pyrus</i> sp.	Fort Monro	Ahmad 1971b

<i>Do. saccharina</i>		Peelings of <i>Saccharum officinarum</i>	Lahore	Ahmad 1971a
<i>Do. tecomae</i>		Branches of <i>Tecoma stans</i>	Lahore	Ahmad 1971a
<i>Do. viticis</i>		Branches of <i>Vitex negundo</i>	Lahore	Ahmad 1971a
<i>Sphaeropsis</i>				
<i>S. cadabae</i>		Branches of <i>Cadaba farinose</i>	Changa manga	Ahmad 1971b
<i>S. capparisi</i>		Branches of <i>Capparis aphylla</i>	Changa manga	Ahmad 1971b
<i>S. carthami</i>		Branches of <i>Carthamus oxyacantha</i>	Kasur	Ahmad 1971b
<i>S. cordiana</i>		Branches of <i>Cordia rothii</i>	Karachi	Ahmad 1971b
<i>S. karachiensis</i>		Dead stem of <i>Salvadora persica</i>	Karachi	Abbas et al. 2000c
<i>S. leptadeniae</i>		Branches of <i>Leptadenia spartium</i>	Bahawalpur	Ahmad 1971b
<i>S. polianthina</i>		Stems of <i>Polianthes tuberosa</i>		Ahmad 1960
<i>S. salvadorae</i>	<i>Avettaea salvadorae</i>	Branches of <i>Salvadora oleoides</i>	Kasur	Ahmad 1971b, Abbas and Sutton 1988a
<i>Phyllostictaceae</i>				
<i>Phyllosticta</i>				
<i>P. ambigua</i>	<i>Phyllosticta ambiguella</i>	Branches of <i>Salvadora oleoides</i>		Saccardo 1912, Saccardo and Trotter 1913
<i>P. ficina</i>		Leaves of <i>Ficus elastica</i>		Ahmad 1948
<i>P. kausarica</i>		Leaves of <i>Ophiopogon japonicus</i>		Khan 1962
<i>P. graminis</i>		<i>Capparis aphylla</i>	Bhakar	Ahmad 1971a
<i>P. zeina</i>		Leaves of <i>Zea mays</i>		Panas 1929, Ahmad et al. 1997
<i>Eurotiomycetes</i>				
<i>Chaetothyriales</i>				
<i>Herpotrichiellaceae</i>				
<i>Capronia</i>				
<i>C. pinicola</i>	<i>Tyrannosorus pinicola</i>	Decorticated wood of <i>Pinus</i> immersed in stream		Müller et al. 1987, Untereiner et al. 1995
<i>Eurotiales</i>				
<i>Aspergillaceae</i>				
<i>Penicillium</i>				
<i>P. mole</i>		Soil		Pitt 1979
<i>Verrucariales</i>				
<i>Verrucariaceae</i>				
<i>Plurisperma</i>				
<i>P. dalbergiae</i>		Dead twigs of <i>Dalbergia sissoo</i>	Bhagat, West Pakistan	Sivanesan 1970

Laboulbeniomycetes				
Laboulbeniales				
Laboulbeniaceae				
Eucantharomyces				
<i>E. ohbae</i>		Agonums sp.		Sugiyama 1982
Stigmatomyces				
<i>S. mosilli</i>		<i>Mosillus subsultans</i>	Gilgit	Rossi and Weir 2011
Lecanoromycetes				
Lecanorales				
Catillariaceae				
Placolecis				
<i>P. kashmirensis*</i>		Calcareous rocks	Azad Jammu & Kashmir	Kousar et al. 2021
Lecanoraceae				
Lecanora				
<i>L. pachyrrhiza</i>		In pasture and on rocks		Poelt and Grube 1993
Parmeliaceae				
Protoparmelia				
<i>P. badia</i> var. <i>nectans</i>		Rocky slopes		Poelt and Grube 1992
<i>P. gesamia</i>		In pasture and on rocks		Poelt and Grube 1992
Ramalinaceae				
Bacidina				
<i>B. iqbalii*</i>		Granitic (crystalline) rock	Different sites of Pakistan	Fatima et al. 2020
<i>B. margallensis*</i>		Bark of <i>Ficus infectoria</i>	Different sites of Pakistan	Fatima et al. 2020
Lecideales				
Lecideaceae				
Lecidea				
<i>L. aptrootii*</i>		Rocks	Gabin Jabba valley, Swat district	Khan et al. 2018b
Leprocaulales				
Leprocaulaceae				
Halecania				
<i>H. pakistanica</i>		Calcareous rocks		Boom and Elix 2005
Ostropales				
Stictidaceae				
Acarosporina				

<i>A. berberidis</i>		Dead branch of <i>Berberis ceratophylla</i>	Muzarrarabad	Sherwood 1977a
<i>Schizoxylon</i>				
<i>S. crissum</i>		<i>Quercus</i> sp.		Sherwood 1977a
<i>S. juniperinum</i>		Dead branches of <i>Juniperus</i> sp.		Sherwood 1977a
<i>S. pseudocyanosporum</i>		Decorticated wood of <i>Pinus excelsa</i>		Sherwood 1977b
<i>Stictis</i>				
<i>St. lumbricus</i>		Decorticated wood of <i>Pinus</i> sp.		Sherwood 1977a
<i>Teloschistales</i>				
<i>Teloschistaceae</i>				
<i>Caloplaca</i>				
<i>C. ahmadiana</i>		Rocks		Poelt and Hinteregger 1993
<i>C. atranulata</i>		Rocks		Poelt and Hinteregger 1993
<i>C. cerina</i> var. <i>swatica</i>		Bark of <i>Quercus ilex</i>		Poelt and Hinteregger 1993
<i>C. cyanotrophaha</i>		Unknown		Poelt and Hinteregger 1993
<i>C. juniperi</i>		Hard dry bark of <i>Juniperus indica</i>		Poelt and Hinteregger 1993
<i>C. lecidellae</i>		<i>Lecidella stigmatea</i>		Poelt and Hinteregger 1993
<i>C. microsporella</i>		Siliceous rock		Poelt and Hinteregger 1993
<i>C. psammophila</i>		Fine sand		Poelt and Hinteregger 1993
<i>C. reducta</i>		Siliceous rock		Poelt and Hinteregger 1993
<i>C. rinodinae</i>		<i>Rinodina milvina</i>		Poelt and Hinteregger 1993
<i>C. scrobiculata</i> var. <i>igneae</i>	<i>Caloplaca anularis</i>	Unknown		Poelt and Hinteregger 1993, Clauzade and Poelt 1972
<i>C. stipulate</i>		On rock		Poelt and Hinteregger 1993
<i>Leotiomyces</i>				
<i>Chaetomellales</i>				
<i>Chaetomellaceae</i>				
<i>Chaetomella</i>				
<i>C. acutiseta</i>		Rotting leaves of <i>Acer</i> sp.		Sutton and Sarbhoy 1976

Helotiales				
Cenangiaceae				
Moellerodiscus				
<i>M. berberidis</i>		Leaves of <i>Berberis</i> sp.		Dumont 1976
Dermateaceae				
Coleophoma				
<i>C. mangiferae</i>		<i>Mangifera indica</i>		Petrak and Ahmad 1954
Erysiphaceae				
Erysiphe				
<i>E. sambuci</i>		<i>Sambucus ebulus</i>		Ahmad 1960
Phyllactinia				
<i>P. dalbergiae</i>		Leaves of <i>Dalbergia sissoo</i>		Pirozynski 1965
Godroniaceae				
Ascocalyx				
<i>A. asiaticus</i>		Bark of <i>Abies pindrow</i>		Groves 1968
Hyaloscyphaceae				
Hyaloscypha				
<i>H. luteola</i>		Branch of <i>Prosopis juliflora</i>		Ahmad 1978a
Myxotrichaceae				
Myxotrichum				
<i>M. dendromorphum</i>		Soil of coniferous forest		Matsushima 1995
Pezizellaceae				
Chalara				
<i>C. emodensis</i>		Leaves of <i>Quercus incana</i>		Raj and Kendrick 1976
Ploettnerulaceae				
Pyrenopeziza				
<i>P. lavaterae</i>		Dead stems of <i>Lavatera kashmiriana</i>		Müller and Ahmad 1955
Solenopeziaceae				
Lasiobelonium				
<i>L. parksii</i> var. <i>album</i>	<i>Lasiobelonium parksii</i>	Fallen branches		Raitviir 1980
Mycofalcella				
<i>M. iqbalii</i>		Decaying culm of <i>Saccharum munja</i> submerged in canal		Firdaus-e-Bareen and Braun 2007
Leotiales genus <i>incertae sedis</i>				
Flagellospora				
<i>F. minuta</i>		Decaying leaves submerged in fresh water		Iqbal and Bhatti 1980

Rhytismatales				
Rhytismataceae				
Coccoomyces				
<i>C. papillatus</i>		Dead bark of <i>Pinus excelsa</i>		Ahmad 1978a
Hypoderma				
<i>H. skimmiae</i>	<i>Davisomycella skimmiae</i>	Leaves of <i>Skimmia laureola</i>		Peres and Iqbal 1967, Ahmad 1978a
Hypodermella				
<i>Hy. quercina</i>	<i>Myriophacidium quercinum</i>	Fallen leaves of <i>Quercus incana</i>	Ghora Gali	Ahmad 1971b, Cannon and Minter 1986
Lirula				
<i>L. pakistanensis</i>		Needles of <i>Abies pindrow</i>		Kaneko 1993
Lophodermium				
<i>Lo. hedericola</i>		Leaves of <i>Hedera himalaica</i>	Ghora Gali	Ahmad 1971b
<i>Lo. orientale</i>		Needles of <i>Pinus excelsa</i>		Minter 1981
<i>Lo. Piniexcelsae</i>		Dying needles of <i>Pinus excelsa</i>		Ahmad 1954
Leotiomyces genera incertae sedis				
Holwaya				
<i>H. salicis</i>	<i>Durandiella salicis</i>	Stem of <i>Salix</i> sp.		Müller and Ahmad 1959, Korf and Abawi 1971
Trullula				
<i>T. pulvinata</i>		Dead branches of <i>Spiraea</i> sp.		Ahmad 1960
Pezizomycetes				
Pezizales				
Ascodesmidaceae				
Lasiobolus				
<i>L. trichoboloides</i>		Dung		Bezerra and Kimbrough 1975
Discinaceae				
Gyromitra				
<i>G. khanspurensis</i> *		<i>Cedrus deodara</i>		Krisai-Greilhuber et al. 2017
Morchellaceae				
Morchella				
<i>M. pakistanicca</i> *		Loamy soil		Hernández-Restrepo et al. 2016
Pezizaceae				
Ahmadea				

<i>A. dalanensis</i> *		Sorghum fields	Dera Ghazi Khan, Lahore	Aman et al. 2020
Pyronemataceae				
Aleuria				
<i>A. murreana</i>		Ground soil		Ahmad 1955a
Aleurina				
<i>Al. pakistanica</i>	<i>Peziza pakistanica</i>	Ground soil		Ahmad 1955c, Ahmad 1978a
Anthracobia				
<i>An. korfii</i>				Ahmad 1978a
Geopora				
<i>G. ahmadii</i> *		Soil		Saba et al. 2019b
Humaria				
<i>H. ahmadii</i>	<i>Scutellinia ahmadii</i>	Ground soil	Lahore	Cash 1948, Kaushal et al. 1983
Saccharomycetes				
Saccharomycetales				
Dipodascaceae				
Geotrichum				
<i>G. candidum</i> var. <i>thermoideum</i>	<i>Dipodascus geotrichum</i>	Camel dung		Qureshi and Mirza 1981, Von Arx 1977
Sordariomycetes				
Amphisphaeriales				
Amphisphaeriaceae				
Amphisphaeria				
<i>A. pakistanae</i>		Dead stems of <i>Indigofera</i> sp.	Kalam, Swat	Müller and Ahmad 1957
Pseudomassariaceae				
Leiosphaerella				
<i>L. phoenicis</i>		On dead rachis of <i>Phoenix dactylifera</i>		Müller and Ahmad 1957
Sporocadaceae				
Broomella				
<i>B. excelsa</i>		Dead branches of <i>Clematis</i> sp.		Shoemaker and Müller 1963
Discosia				
<i>D. jambolanae</i>		Fallen leaves of <i>Eugenia jambolana</i>		Ahmad 1960
Monochaetia				
<i>M. dalbergiae</i>		Dead branches of <i>Dalbergia sissoo</i>	Sohawa	Ahmad 1972b
<i>M. vernoniae</i>		Branches of <i>Vernonia cinerascens</i>	Salt Range, Rawal	Ahmad 1971b

<i>Neopestalotiopsis</i>				
<i>N. guajavae</i> *		Fruit and branches of <i>Psidium guajava</i>	Punjab	Ul haq et al. 2021
<i>N. guajavicola</i> *		Fruit and branches of <i>Psidium guajava</i>	Punjab	Ul haq et al. 2021
<i>N. perukae</i> *		Fruit and branches of <i>Psidium guajava</i>	Punjab	Ul haq et al. 2021
<i>N. psidii</i> *		From fruit and branches of <i>Psidium guajava</i>	Punjab	Ul haq et al. 2021
<i>Cephalothecales</i> <i>Cephalothecaceae</i> <i>Cephalotheca</i>				
<i>C. pakistanica</i>		Soil of <i>Juniperus</i> wood		Matsushima 1995
<i>Chaetosphaeriales</i> <i>Chaetosphaeriaceae</i> <i>Dendrophoma</i>				
<i>D. arundinacea</i>		Culms of <i>Phragmites karka</i>	Swat	Ahmad 1971b
<i>Polynema</i>				
<i>P. triaristatum</i>		Decorticated branch	Salt Range, Rawal	Ahmad 1968c
<i>Coronophorales</i> <i>Ceratostomataceae</i> <i>Melanospora</i>				
<i>M. fusispora</i> var. <i>parvispora</i>	<i>Microthecium fusisporum</i> *	Soil of coniferous forest		Matsushima 1995, Marin- Felix et al. 2018
<i>Nitschkiaceae</i> <i>Nitschkia</i>				
<i>N. salvadorae</i>		<i>Salvadora oleoides</i>		Ahmad 1954
<i>Diaporthales</i> <i>Coryneaceae</i> <i>Coryneum</i>				
<i>C. pyricola</i>		Dead branches of <i>Pyrus</i> sp.		Ahmad 1960
<i>Cytosporaceae</i> <i>Cytospora</i>				
<i>C. ipomoeae</i>		Dead branches of <i>Ipomoea carnea</i>		Ahmad and Arshad 1972a
<i>C. woodfordiae</i>		Dead branches of <i>Woodfordia floribunda</i>		Ahmad 1972b
<i>Diaporthaceae</i> <i>Diaporthe</i>				
<i>D. ahmadii</i>		Stems of <i>Hedera nepalensis</i>		Wehmeyer and Ahmad 1964

<i>D. indigoferae</i>		Dead branches of <i>Indigofera gerardiana</i>		Müller and Ahmad 1958
Gnomoniaceae Dictyoportha				
<i>D. ahmadii</i>		Dry stems of <i>Spiraea</i> sp.		Petrak 1955a
Lamproconiaceae Hercospora				
<i>H. ahmadii</i>		Branches of <i>Morus alba</i>		Petrak 1968
Schizoparmaceae Coniella				
<i>C. oryzae</i>		Culms of <i>Oryza sativa</i>		Ahmad 1968a
Stilbosporaceae Stegosporium				
<i>S. fici</i>		Dead branches of <i>Ficus palmata</i>		Ahmad 1960
<i>S. parrotiae</i>	<i>Stigmia parrotiae</i>	Dead branches of <i>Parrotia jacquemontiana</i>		Ahmad 1960, Sutton 1972
<i>S. sophorinum</i>		Dead branches of <i>Sophora mollis</i>	Fort Monro	Ahmad 1967
Hypocreales Bionectriaceae Acremonium				
<i>A. phoenicis</i>		Leaf of <i>Phoenix dactylifera</i>		Gams 1971
Nectriaceae Fusarium				
<i>F. humicola</i> *		Soil		Lombard et al. 2019
Thyronectria				
<i>T. lamyi</i> var. <i>Pakistani</i>	<i>Thyronectria lamyi</i>	Dead stems of <i>Berberis</i> sp.		Seeler 1940, Müller and Ahmad 1962
Niessliaceae Pseudonectriella				
<i>P. ahmadii</i>		Dead twigs of <i>Cadaba farinose</i>		Petrak 1959
Stachybotryaceae Didymostilbe				
<i>D. coprophila</i>		Dung of <i>Bubalus bubalis</i>	Lyallpur or Faisalabad	Mirza 1970
Microascales Microascaceae Scopulariopsis				
<i>S. striata</i>	<i>Penicillium restrictum</i>	Soil		Gilman and Abbott 1927, Müller and Pacha-Aue 1969

Phomatosporales				
Phomatosporaceae				
Phomatospora				
<i>P. salvadorina</i>		<i>Salvadora oleoides</i>		Ahmad 1948
Phyllachorales				
Phyllachoraceae				
Diachora				
<i>D. lepedezae</i>	<i>Vitreostroma desmodii</i>	<i>Lespedeza</i> sp.		Müller 1986, Cannon 1991
Linochora				
<i>L. lasiuri</i>		<i>Lasiurus hirsutus</i>	Bahawalpur	Ahmad 1971a
<i>L. rhododendri</i>		Leaves of <i>Rhododendron arboreum</i>	Kaghan Valley	Ahmad 1971b
Sordariales				
Chaetomiaceae				
Achaetomium				
<i>A. variosporum</i>		Leaf litter		Sultana et al. 1988
Chaetomium				
<i>C. giganigros-porum</i>		Dung of <i>Capra hircus</i>		Millner 1975
<i>C. muelleri</i>		From twig		Von Arx et al. 1986
Collariella				
<i>Co. virescens*</i>		Soil		Von Arx 1970, Wang et al. 2016
Subramaniula				
<i>S. thielavioides</i>		Leaves of <i>Typha angustata</i>		Von Arx 1985
Thielavia				
<i>T. pakistanica</i>		Dung of <i>Canis aureus</i>		Batra et al. 1975
Lasiosphaeriaceae				
Lasiosphaeria				
<i>L. disjuncta</i>	<i>Sporormia disjuncta</i>	Dead wood		Ahmad and Lodhi 1953, Petrak 1955b
Strattonia				
<i>S. karachiensis</i>	<i>Zopfiella karachiensis</i>	Dung of <i>Capra hircus</i>		Ahmed and Asad 1967b, Guarro and Cano 1988
Zygopleurage				
<i>Z. multicaudata</i>		Dung of <i>Bos taurus</i>		Mirza and Nasir 1968
Podosporaceae				
Podospora				

<i>P. badia</i>		Dung of <i>Capra hircus</i>		Sultana 1987
<i>P. clavispora</i>	<i>Camptosphaeria clavispora</i>	Dung of <i>Bos taurus</i>	Chittagong, East Pakistan	Mirza and Ahmed 1970, Krug and Jeng 1977
<i>P. karachiensis</i>		Dung of <i>Equus asinus</i>		Mirza and Cain 1969
<i>P. pseudoinquinata</i>		Dung of camel		Ahmed et al. 1993
Sordariaceae				
Neurospora				
<i>N. lineolate</i>		Soil	Lahore	Frederick et al. 1969
<i>N. udagawae</i>		Soil		Khan and Krug 1989
Xylariales				
Diatrypaceae				
Anthostoma				
<i>A. nannorrhopsis</i>	<i>Anthostomella nannorrhopsis</i>	Leaf rachis of <i>Nannorrhops ritchieana</i>	Parachinar	Ahmad 1971b, Hyde 1996
Hypoxylaceae				
Daldinia				
<i>D. graminis</i>		Burnt stems of grass		Dargan and Thind 1985
<i>D. sacchari</i>		Burnt stems of <i>Saccharum munja</i>		Dargan and Thind 1985
Myelospermataceae				
Myelosperma				
<i>M. muellerianum</i>		Dead branches of <i>Grewia tenax</i>	Nagar Parker	Ahmad 1971b
Xylariaceae				
Anthostomella				
<i>A. lodhii</i>		<i>Palmae</i> sp.		Ahmad 1948
Xylariales genus incertae sedis				
Leptomassaria				
<i>L. capparidis</i>	<i>Anthostoma capparidis</i>	Dead branches of <i>Capparis aphylla</i>		Ahmad and Lodhi 1953, Ahmad 1969
Ascomycota genera incertae sedis				
Ahmadia				
<i>A. pentatropidis</i>		Living leaves of <i>Pentatropis cynanchoides</i>		Sydow 1939, Ahmad et al. 1997
Ahmadinula				
<i>Ah. excelsa</i>	<i>Truncatella excelsa</i>	<i>Clematis</i> sp.		Petrak 1953a, Shoemaker et al. 1989
Alpakesiopsis				

<i>Al. ghaffarii</i>		Dead twigs		Abbas et al. 2003
<i>Amphididymella</i>				
<i>Am. ahmadii</i>	<i>Keissleriella cladophila</i>	Dead stems of <i>Smilax parvifolia</i> and <i>Berberis</i>		Müller and Corbaz 1955, Corbaz 1956
<i>Aphanofalx</i>				
<i>Ap. irregularis</i>		Dead twigs of <i>Salvadora oleoides</i>		Sutton and Abbas 1986
<i>Chaetopyrena</i>				
<i>C. rumicina</i>		Branches of <i>Rumex</i> sp.	Baragali	Ahmad 1971a
<i>Cryptosporium</i>				
<i>Cr. capparis</i>		Dead branches of <i>Capparis aphylla</i>		Ahmad 1968c
<i>Cytospora</i>				
<i>Cy. corticola</i>		<i>Cordia obliqua</i>		Ahmad 1951
<i>Cy. lignicola</i>		<i>Acacia arabica</i>		Ahmad 1951
<i>Cy. panicina</i>		Culms of <i>Panicum antidotale</i>	Daska	Ahmad 1971a
<i>Cy. verrucosa</i>		Bark of <i>Salvadora oleoides</i>		Petrak and Ahmad 1954
<i>Davisiella</i>				
<i>D. botryodiplodiae</i>		Dead branches of <i>Botryodiplodias</i>		Ahmad 1961
<i>Euryachora</i>				
<i>E. paeoniae</i>		Dead stems of <i>Paeonia</i> sp.		Müller and Ahmad 1955
<i>Gilmaniella</i>				
<i>G. thermophila</i>		Goat dung		Qureshi and Mirza 1983
<i>Hendersonula</i>				
<i>H. dalbergiae</i>		Branches of <i>Dalbergia sissoo</i>	Changa manga	Ahmad and Arshad 1972b
<i>H. saccharina</i>		Culms of <i>Saccharum</i> sp.	Zafarwal	Ahmad 1971a
<i>H. tecomae</i>		Branches of <i>Tecoma</i> sp.	Hasan abdal	Ahmad and Arshad 1972b
<i>Leptostromella</i>				
<i>L. dichanthii</i>		Leaves of <i>Dichanthium annulatum</i>	Sheikhupura	Ahmad 1971a
<i>L. lasiuri</i>		Culms of <i>Lasiurus hirsutus</i>	Bahawalpur	Ahmad 1971a
<i>Leptothyrium</i>				
<i>Le. gleditsiae</i>		Spines on <i>Gleditsia triacanthos</i>		Ahmad 1955d
<i>Libertella</i>				
<i>Li. aeluropodis</i>		Leaf sheaths of <i>Aeluropus repens</i>	Bahawalpur	Ahmad 1968b
<i>Li. asparagine</i>		Branches of <i>Asparagus adscendens</i>	Changa manga	Ahmad 1971b
<i>Li. moricola</i>		Branches of <i>Morus alba</i>	Changa manga	Ahmad 1971b

<i>Myrotheciastrum</i>				
<i>M. salvadorae</i>		Dead twigs of <i>Salvadora oleoides</i>	Karachi	Abbas and Sutton 1988b
<i>Pleurophomopsis</i>				
<i>P. strictae</i>		Branch of <i>Rhazya stricta</i>		Ahmad 1967
<i>Pseudodiplodia</i>				
<i>Ps. farsetiae</i>		Dead stems of <i>Farsetia linearis</i>		Riedl 1966
<i>Pucciniopsis</i>				
<i>Pu. quercina</i>	<i>Acantharia sinensis</i>	Leaves of <i>Quercus dilatata</i>		Wakefield 1931, Von Arx 1954
<i>Pycnoharknessia</i>				
<i>Py. pakistanicca</i>		Cultivated soil		Matsushima 1996
<i>Seimatosporiopsis</i>				
<i>S. salvadorae</i>		Stems of <i>Salvadora oleoides</i>		Sutton et al. 1972
<i>Selenosira</i>				
<i>Se. unica</i>		Dead stems of <i>Scrophularia</i>		Sutton 1980a
<i>Septogloeum</i>				
<i>Sep. dalbergiae</i>	<i>Colletogloeum dalbergiae</i>	Pods of <i>Dalbergia sissoo</i>		Ahmad and Lodhi 1953, Petrak 1953b
<i>Sirophoma</i>				
<i>Si. grewiae</i>		Branches of <i>Grewia villosa</i>	Kharian	Ahmad 1969b
<i>Stagonopsis</i>				
<i>St. psidii</i>		Dead branches of <i>Psidium guajava</i>	Bahawalpur	Ahmad 1967a
<i>Stagonostromella</i>				
<i>Sta. sacchari</i>		Culms of <i>Saccharum spontaneum</i>	Gujrat	Ahmad 1971
<i>Verrucariella</i>				
<i>V. capparicola</i>		Dead branches of <i>Capparis aphylla</i>	Kasur	Ahmad 1967
<i>Basidiomycota</i>				
<i>Basidiomycetes</i>				
<i>Agaricales</i>				
<i>Agaricaceae</i>				
<i>Agaricus</i>				
<i>A. atroumbonatus*</i>		Decomposing needles under <i>Abies pindrow</i>	Swat District, Miandam valley	Bashir et al. 2021
<i>A. bambusetorum*</i>		Thick layer of dry leaf litter under Bamboo trees	Changa Manga Forest	Bashir et al. 2021
<i>A. bisporiticus*</i>		Grass leaf litter on rich loamy soil of garden		Thongklang et al. 2014

<i>A. campestris</i> var. <i>pleurocystidiatus</i> *	<i>Agaricus campestris</i>	Humicolous, grassy soil		Kaur et al. 2016 Linné 1753
<i>A. fumidicolor</i> *		Forest ground near bamboo trees	Changa Manga Forest, Kasur	Bashir et al. 2021
<i>A. glabriusculus</i> *		Unknown	Malakand	Hussain and Sher 2019
<i>A. griseovariatus</i> *		Decomposing needles	Khanspur	Bashir et al. 2021
<i>A. latiumbonatus</i> *		Unknown	Malakand	Hussain and Sher 2019
<i>A. macropeplus</i> *		Grass under deciduous trees	Swat District	Bashir et al. 2021
<i>A. pakistanicus</i> *			Lahore, Toba Tek Singh and Malakand	Bashir et al. 2018
<i>A. parviniveus</i> *		Rich loamy soil	Lahore	Bashir et al. 2021
<i>A. porphyrocephalus</i> var. <i>cheilocystidiatus</i> *	<i>Agaricus porphyrocephalus</i>	Wet leaf litter and humicolous soil		Møller 1952, Kaur et al. 2016,
<i>A. punjabensis</i> *		Rich loamy soil		Chen et al. 2016
<i>A. sparsisquamosus</i> *		Unknown	Lahore, Toba Tek Singh and Malakand	Bashir et al. 2018
<i>A. swaticus</i> *		Ground under <i>Cedrus deodara</i>	Swat	Bashir et al. 2021
<i>A. xanthochromaticus</i> *		<i>Pinus wallichiana</i>	Khanspur	Bashir et al. 2021
<i>Lepiota</i>				
<i>L. albogranulosa</i> *		Decaying litter and wood		Qasim et al. 2015b
<i>L. cholistanensis</i> *		Sandy soil	Bahawalpur	Bashir et al. 2020b
<i>L. himalayensis</i> *		Moist ground under <i>Abies pindrow</i>		Razaq et al. 2012
<i>L. lahorensis</i> *		Rich loamy soil	Lahore	Qasim et al. 2016
<i>L. vellingana</i> *		Rich loamy soil in garden		Nawaz et al. 2013
<i>Leucoagaricus</i>				
<i>Le. lahorensis</i> *		Rich loamy soil	Lahore	Qasim et al. 2015a
<i>Le. asiaticus</i> *		Soil	Lahore	Ge et al. 2015
<i>Le. brunneus</i> *		Soil associated with <i>Quercus oblongata</i>	Swat district	Zia et al. 2019
<i>Melanophyllum</i>				

<i>M. globisporum</i>		Unknown		Baroni 1981
Tulostoma				
<i>T. ahmadii</i> *		Soil associated with <i>Justicia adhatoda</i> and <i>Convolvulus</i> sp.	Qaldara Dargai	Hussain et al. 2016b
<i>T. crassipes</i>		Unknown		Long and Ahmad 1947
<i>T. exitum</i>		Unknown		Long and Ahmad 1947
<i>T. hygrophilum</i>		Unknown		Long and Ahmad 1947
<i>T. innotum</i>		Unknown		Long and Ahmad 1947
<i>T. perplexum</i>		Unknown		Long and Ahmad 1947
<i>T. pluriosteum</i>		Unknown		Long and Ahmad 1947
<i>T. puncticulosum</i>		Unknown		Long and Ahmad 1947
<i>T. vulgare</i>		Unknown		Long and Ahmad 1947
Amanitaceae				
Amanita				
<i>A. ahmadii</i> *		Forests	Swat district, Gabin Jabba, Kumrat valley, Mashkun	Jabeen et al. 2019
<i>A. cinis</i> *		Soil, associated with <i>Abies pindrow</i>	District Shangla, Mansehra	Ullah et al. 2019
<i>A. emodotrygon</i> *		Sandy soil under <i>Pinus roxburghii</i>	Shangla District	Ullah et al. 2019
<i>A. glareata</i> *		Soil associated with <i>Cedrus deodara</i>	Swat district, Mashkun	Jabeen et al. 2017a
<i>A. mansehraensis</i> *		<i>Pinus roxburghii</i>	Mansehra District, Batrasi	Saba et al. 2019a
<i>A. olivovaginata</i> *		Sandy to loamy soil under <i>Pinus roxburghii</i>	Shangla District	Ullah et al. 2019
<i>A. pakistanica</i>		<i>Abies pindrow</i>	Northwest Frontier Province	Tulloss et al. 2001
Zhuliangomyces				
<i>Z. pakistanicus</i> *		Unknown		Usman and Khalid 2020b
Bolbitiaceae				
Descolea				
<i>D. quercina</i> *		<i>Quercus</i> sp.	Malam Jabba, Toa valley	Khan et al. 2017b

Cortinariaceae				
Cortinarius				
<i>C. brunneocarpus*</i>		Soil, associated with <i>Abies pindrow</i> , and <i>Pinus wallichiana</i>	Khanspur	Song et al. 2019
<i>C. longistipitatus*</i>		<i>Pinus wallichiana</i>	Swat, Mankial	Saba et al. 2017
Hygrophoraceae				
Hygrophorus				
<i>H. alboflavescens*</i>		Soil under <i>Quercus incana</i>	Swat, Shawar Valley	Naseer et al. 2019a
<i>H. scabrellus*</i>		Soil under <i>Quercus incana</i>	Swat, Toa	Naseer et al. 2019a
Hymenogastraceae				
Gymnopilus				
<i>G. dunensis*</i>		Wood of <i>Eucalyptus camaldulensis</i>	Bahawalpur, Narowal.	Bashir et al. 2020a
<i>G. swaticus*</i>		Decomposing cavities of <i>Picea smithiana</i>	Swat district	Khan et al. 2017a
Phaeocollybia				
<i>P. pakistanic*</i>		Forest soil near <i>Abies pindrow</i> and <i>Pinus wallichiana</i>		Khan et al. 2016
Inocybaceae				
Inocybe				
<i>I. ahmadii*</i>		On ground associated with <i>Pinus wallichiana</i>	Khanspur, Miandam	Farooqi et al. 2017
<i>I. kohistanensis*</i>		On soil	Swat	Jabeen et al. 2016
<i>I. shawarensis*</i>		On soil, associated with <i>Quercus oblongata</i>	Swat district	Naseer et al. 2018
Pseudosperma				
<i>P. brunneoumbonatum*</i>		On the forest floor in stands of <i>Pinus roxburghii</i>	Abbottabad, Shimla	Saba et al. 2020
<i>P. flavorimosum*</i>		On soil under <i>Pinus wallichiana</i>	Kaghan valley, Hazara division, Mansehra district	Jabeen and Khalid 2020
<i>P. pinophilum*</i>		Under <i>Pinus wallichiana</i>	Abbottabad, Shimla	Saba et al. 2020
<i>P. triaciculare*</i>		Under <i>Pinus roxburghii</i>	Mansehra, Batrasi	Saba et al. 2020
Lycoperdaceae				
Bovista				
<i>B. concinna</i>		On ground, associated with <i>Taxus baccata</i>		Ahmad 1949
<i>B. himalaica*</i>		Grass in moist temperate forests		Yousaf et al. 2013
Calvatia				
<i>C. ahmadii*</i>		Ground soil		Khalid and Iqbal 2004

<i>Lycoperdon</i>				
<i>L. lahorensis</i> *		Soil, associated with <i>Poaceae</i>	Lahore	Yuan et al. 2020
<i>L. pseudocurtisii</i> *		Soil associated with <i>Poaceae</i>	Lahore	Yuan et al. 2020
<i>L. setiferum</i>		Unknown	Murree	Demoulin 1976
<i>Lyophyllaceae</i>				
<i>Termitomyces</i>				
<i>T. acriumbonatus</i> *		Moist soil, associated with <i>Acacia modesta</i>	Gujrat	Usman and Khalid 2020a
<i>T. sheikhपुरensis</i> *		Honeycomb pieces	Sheikhपुरa	Izhar et al. 2020
<i>Omphalotaceae</i>				
<i>Marasmiellus</i>				
<i>M. longistipes</i> *		Unknown	Abbottabad District, Ayubia National Park	Haelewaters et al. 2020
<i>Rhodocollybia</i>				
<i>R. utrorensis</i> *		Forest	Swat District, Utror valley	Sattar et al. 2018
<i>Physalacriaceae</i>				
<i>Xerula</i>				
<i>X. japonica</i> var. <i>ahmadii</i> *	<i>Hymenopellis ahmadii</i>	Soil		Dörfelt 1984, Petersen and Hughes 2010
<i>Psathyrellaceae</i>				
<i>Coprinellus</i>				
<i>C. campanulatus</i> *		Wood chip	Qaldara, Dargai, Malakand	Hussain et al. 2018
<i>C. disseminat-esimilis</i> *		Leaf litter under <i>Populus alba</i> and <i>Morus alba</i>	Malakand, Sarogai	Hussain et al. 2018
<i>C. ovatus</i> *		Soil under broadleaf trees	Islamabad, Murree Express Road	Kamran and Jabeen 2020
<i>C. pakistanicus</i> *		Moist soil, under trees of <i>Acacia nilotica</i> and <i>A. modesta</i>	Pabbi Forest Park, Punjab	Hussain et al. 2018
<i>C. punjabensis</i> *		On soil, associated with <i>Acacia modesta</i>	Pabbi forest park, Punjab	Saranyaphat et al. 2021
<i>C. tenuis</i> *		Leaf litter under <i>Acacia modesta</i>	Malakand, Qaldara	Hussain et al. 2018
<i>Parasola</i>				
<i>P. lilatinctoides</i>		Unknown		Voto 2019
<i>P. malakandensis</i> *		Leaf litter of <i>Acacia modesta</i>	Qaldara Dargai - Malakand	Hussain et al. 2017

Strophariaceae				
Stropharia				
<i>S. atroferruginea</i> *		In forests of <i>Pinus roxburghii</i>	Battagram district	Khan et al. 2019
Agaricales genera incertae sedis				
Infundibulicybe				
<i>I. macrospora</i> *		Woody debris in moist temperate forest	Abbottabad district, Ayubia National Park	Ali et al. 2020
Melanoleuca				
<i>M. dirensis</i> *		Rich loamy soil near river	Dir Upper district, Kumrat Valley	Nawaz et al. 2017
Mucronella				
<i>Mu. pulchra</i>		Burnt wood		Corner 1970
Boletales				
Boletaceae				
Boletus				
<i>B. himalayensis</i> *		Soil	Swat District	Sarwar et al. 2018
<i>B. Pakistanicus</i> *		<i>Pinus</i> sp.		Sarwar and Khalid 2014
Butyriboletus				
<i>Bu. parachinarenensis</i>		<i>Quercus baloot</i>	Parachinar	Crous et al. 2021
Hortiboletus				
<i>H. kohistanensis</i> *		<i>Quercus incana</i>	Swat Valley, Toa	Naseer et al. 2019b
Tylopilus				
<i>T. sultanii</i> *		Ground soil		Sarwar et al. 2014
Xerocomellus				
<i>X. fulvus</i> *		Soil	Swat, Ushu Kalam	Hernández-Restrepo et al. 2016
Gomphidiaceae				
Chroogomphus				
<i>C. pruinosis</i> *		Moisture rich loamy soil	Kumrat valley	Kiran et al. 2020
<i>C. Pakistanicus</i> *		Forest floor	Kumrat valley	Kiran et al. 2020
Suillaceae				
Suillus				
<i>S. marginievatus</i> *		Ground under <i>Quercus incana</i>	Dunga Gali	Sarwar et al. 2015

Agaricostilbomycetes Agaricostilbales Chionosphaeraceae Stilbum				
<i>S. mycetophilum</i>		<i>Poria</i> sp.		Ahmad 1960
Bartheletiomycetes Geastrales Geastraceae Geastrum				
<i>G. lageniforme</i> var. <i>ahmadii</i>	<i>Geastrum lageniforme</i>	Unknown		Staněk 1958, Vittadini 1842
<i>G. panjabense</i>		In deserts		Ahmad 1950b
Gomphales Clavariadelphaceae Clavariadelphus				
<i>C. pakistanicus</i> *		Moist temperate forests	Khanspur-Ayubia	Hanif et al. 2014
Gomphaceae Gomphus				
<i>G. megaspores</i>		Unknown		Corner 1970
Ramaria				
<i>R. flavescens</i> *		Unknown		Hanif et al. 2019
Hymenochaetales Hymenochaetaceae Inonotus				
<i>I. peristrophidis</i>		Branches of <i>Peristrophe bicalyculata</i>		Ahmad 1972a
Phallales Phallaceae Lysurus				
<i>L. pakistanicus</i>		Grass lawn		Iqbal et al. 2006
Phallus				
<i>P. calongei</i>		Ground soil		Moreno et al. 2009
Polyporales Podoscyphaceae Podoscypha				
<i>P. petalodes</i> sub sp. <i>rosulata</i>		Unknown		Reid 1965
Polyporaceae Fomes				

<i>F. ajazii</i>		<i>Lonicera quinquelocularis</i>		Hussain 1952
Ganoderma				
<i>G. ahmadii</i>		<i>Dalbergia sissoo</i>		Steyaert 1972
Perenniporia				
<i>P. ahmadii</i>	<i>Pseudopiptoporus chocolatus</i>	Wood		Ryvarden 1983, Decock and Ryvarden 2003
Trametes				
<i>T. sultan-ahmadii</i>		Dead trunk of <i>Dalbergia sissoo</i>		Corner 1989
Russulales				
Albatrellaceae				
Albatrellopsis				
<i>A. flettioides</i> *		Soil under <i>Pinus wallichiana</i>	Miandam valley, District Swat	Haelewaters et al. 2020
Albatrellus				
<i>A. roseus</i> *		Ground under <i>Picea smithiana</i>	Gabin Jabba Valley, District Swat	Khan et al. 2018a
Bondarzewiaceae				
Heterobasidion				
<i>H. amyloideo-opsis</i> *		Stump of <i>Pinus wallichiana</i>	Mansehra, Chattar Plain	Zhao et al. 2017
Peniophoraceae				
Peniophora				
<i>P. sedimentico-las</i>	<i>Phlebia sedimenticola</i>	Silt on sides of watercourses		Ahmad 1955b, Ahmad 1972a
Scytinostroma				
<i>S. ahmadii</i>		Wood		Boidin and Lanquetin 1987
<i>S. cystidiatum</i>		Stump of <i>Morus alba</i>		Boidin 1960
Russulaceae				
Russula				
<i>R. abbotabadensis</i> *		<i>Pinus roxburghii</i>	Abbottabad, Shimla	Caboň et al. 2019
<i>R. ahmadii</i> *		Ground under <i>Cedrus deodara</i>	Abbottabad district, Kuzah Gali	Jabeen et al. 2017c
<i>R. aurantioflava</i> *		Mixed coniferous forest	Dir upper district, Kumrat	Adamčík et al. 2019
<i>R. brunneopurpurea</i> *		Soil under <i>Cedrus deodara</i>	Malakand division, Swat district, Kalam	Jabeen et al. 2017b
<i>R. foetentoides</i> *		Ground near <i>Abies pindrow</i>		Razaq et al. 2014

<i>R. quercus-floribundae</i> *		Unknown		Munazza et al. 2019
<i>R. rubricolor</i> *		On soil, associated with <i>Cedrus deodara</i>	Hazara division Abbottabad district, Shimla Hill	Jabeen et al. 2020
<i>R. shanglaensis</i> *		Humus soil	District Shangla	Ullah et al. 2020
<i>R. shawaren-sis</i> *		Floor of <i>Quercus floribunda</i>	Swat district, Lower Shawar	Crous et al. 2020
Stereaceae				
Aleurodiscus				
<i>A. jacksonii</i>		Bark of <i>Abies pindrow</i>		Ahmad 1962
Stereum				
<i>S. ahmadii</i>	<i>Acanthofungus ahmadii</i>	Rotten wood		Boidin 1956, Wu et al. 2000
Thelephorales				
Thelephoraceae				
Thelephora				
<i>T. iqbalii</i> *		Unknown		Khalid and Hanif 2017
Tomentella				
<i>T. griseocinnamomea</i>	<i>Tomentella asperula</i>	Ground, fallen branches and leaves	Patriata	Höhnel and Litsch 1906, Wakefield 1966
Cantharellales				
Aphelariaceae				
Aphelaria				
<i>A. ceracea</i>		Dead wood of <i>Quercus dilatata</i>		Corner 1970
Exobasidiomycetes				
Entylomatales				
Entylomataceae				
Entyloma				
<i>E. cyperi</i>		Leaves of <i>Cyperus rotundus</i>		Ahmad 1960
<i>E. medicaginis</i>		Leaves of <i>Medicago polymorpha</i>		Vánky 2002
Microstromatales				
Microstromataceae				
Microstroma				
<i>M. cassiicola</i>		Leaves of <i>Cassia holosericea</i>		Khan and Kamal 1969
Tilletiales				
Tilletiaceae				
Tilletia				

<i>T. eleusines</i>		Ovaries of <i>Eleusine aegyptiaca</i>		Sydow 1934, Ahmad et al. 1997
<i>Microbotryomycetes</i> <i>Microbotryales</i> <i>Microbotryaceae</i> <i>Sphacelotheca</i>				
<i>S. consueta</i>		Flowers of <i>Cymbopogon parkeri</i>		Sydow and Ahmad 1939, Ahmad et al. 1997
<i>S. microstegii</i> *	<i>Sporisorium microstegii</i>	Inflorescence of <i>Microstegium nudum</i>		Ahmad 1956d, Guo 2001
<i>S. pakistanica</i>		Inflorescence of <i>Capillipedium parviflorum</i>		Ahmad 1956d
<i>S. panjabensis</i>		Ovaries of <i>Cenchrus biflorus</i>		Sydow 1939, Ahmad et al. 1997
<i>S. pennisetina</i> *	<i>Anthracoystis pennisetina</i>	Inflorescence of <i>Pennisetum flaccidum</i>		Ahmad 1956d, McTaggart et al. 2012
<i>S. stewartii</i>		<i>Pennisetum flaccidum</i>		Mundkur 1944, Ahmad et al. 1997
<i>Sporidiobolales</i> <i>Sporidiobolaceae</i> <i>Sporobolomyces</i>				
<i>S. coprophilus</i>		Dung of <i>Capra aegagrus hircus</i>		Sugiy and Goto 1967
<i>Pucciniomycetes</i> <i>Pucciniales</i> <i>Melampsoraceae</i> <i>Melampsora</i>				
<i>M. euphorbia- epilosae</i>		Leaves of <i>Euphorbia Pilosa</i>		Vattiprolu and Agarwal 2001
<i>M. pakistanica</i> *		Leaves of <i>Euphorbia helioscopia</i>	Islamabad	Ali et al. 2016
<i>Phakopsoraceae</i> <i>Phakopsora</i>				
<i>P. anaphalidi- sahnatae</i>		<i>Anaphalis adnate</i>		Khalid and Iqbal 1996a
<i>Phragmidiaceae</i> <i>Phragmidium</i>				
<i>P. punjaben- se</i> *		<i>Rosa brunonis</i>		Ali et al. 2017b
<i>P. shogranen- se</i>		Leaves of <i>Rubus</i> sp.		Petrak and Ahmad 1954
<i>Pucciniaceae</i> <i>Puccinia</i>				

<i>P. agrostidis-caninae</i>		<i>Agrostis canina</i>		Afshan et al. 2008
<i>P. aizazii</i> *		<i>Jasminum humile</i>	Islamabad	Ali et al. 2017a
<i>P. anaphalidis-virgatae</i>		Stems of <i>Anaphalis virgate</i>		Afshan et al. 2010b
<i>P. carthami</i> var. <i>oxyacanthae</i>	<i>Puccinia oxyacanthae</i>	<i>Carthamus</i> sp.	<i>Oxyacantha</i>	Ahmad 1960, Savile 1970
<i>P. chitralensis</i>		<i>Pleurospermum</i> sp.	<i>stylosum</i>	Jørstad 1952
<i>P. cypericola</i>		<i>Cyperus rotundus</i>		Ahmad 1960
<i>P. deosaiensis</i>		Leaves of <i>Epipactis helleborine</i>	Deosi Plains, northern Pakistan	Khalid and Iqbal 1997
<i>P. dichanthii</i>		Leaves of <i>Dichanthium annulatum</i>	Nathia Gali	Afshan et al. 2010c
<i>P. eriocyclae</i>		Lower surface of leaves of <i>Eriocycla stewartii</i>	Gilgit Agency, Naltar Valley	Khalid and Iqbal 1996b
<i>P. helictotrichi</i> var. <i>pakistanica</i> *	<i>Puccinia helictotrichi</i>	Leaves of <i>Helictotrichon virescens</i>	Northern Areas, Fairy Meadows	Afshan et al. 2010b, Jørstad 1959
<i>P. khanspurica</i>		<i>Sorghum halepense</i>	Khanspur	Khalid and Afshan 2009
<i>P. leersiae</i>		Leaves of <i>Leersia oryzoides</i>	Nathia Gali	Afshan et al. 2010c
<i>P. narcissi</i>		<i>Narcissus</i> sp.		Laundon 1965
<i>P. pakistani</i>		<i>Narcissus</i> sp.		Laundon 1965
<i>P. pennisetilana</i>		Leaves of <i>Pennisetum lanatum</i>		Ahmad 1960
<i>P. ranunculifalcati</i>		<i>Ranunculus falcatus</i>		Ahmad 1954
<i>P. silenigena</i>		<i>Silene</i> sp.	Fairy Meadows	Iqbal et al. 2009
<i>P. sporoboliarabici</i>		Leaves of <i>Sporobolus arabicus</i>		Afshan et al. 2008
<i>P. sporobolioromandelianii</i>		Leaves of <i>Sporobolus coromandelianus</i>		Afshan et al. 2010c
<i>P. stapfiolae</i>		Leaves of <i>Stapfiola bipinata</i>		Mundkur and Thirumalachar 1946
<i>P. subepidermalis</i>		<i>Carex curta</i>		Afshan et al. 2009
Uromyces				
<i>U. ciceris-soongaricae</i>		<i>Cicer songaricum</i>		Ahmad 1960

<i>U. heteromallus</i>		Stems and on leaves of <i>Haloxylon recurvum</i>		Sydow and Ahmad 1939, Ahmad et al. 1997
<i>U. klotzschianus</i>		Leaves of <i>Rumex dentatus</i>		Song et al. 2019
<i>U. lespedezae-sericeae</i>		Leaves of <i>Lespedeza sericea</i>		Ahmad 1956c
<i>U. longipedicellaris</i>		Leaves of <i>Rumex vesicarius</i>		Ramachar and Rao 1985
<i>U. penniseti</i>		<i>Pennisetum lanatum</i>		Ahmad 1960
Pucciniastraceae				
Hyalopsora				
<i>H. nodispora</i>		<i>Adiantum capillus-veneris</i>	Dunga Gali	Saba et al. 2012
Milesia				
<i>M. kashmiriana</i>		<i>Athyrium dentigerum</i>	Jammu-Kashmir	Afshan et al. 2010a
Raveneliaceae				
Diorchidium				
<i>D. digitariae</i>		Leaves of <i>Digitaria bicornis</i>		Ahmad 1956a
Ravenelia				
<i>R. mimosae-himalayanae</i>		Leaves of <i>Mimosa himalayana</i>		Ahmad 1956c
Pucciniales genera incertae sedis				
Aecidium				
<i>A. colchici</i>		Leaves of <i>Colchicum luteum</i>		Ahmad 1956c
<i>A. haqii</i>		Leaves of <i>Rosa</i> sp.		Sultan et al. 2008
<i>A. hederiae</i>		Leaves of <i>Hedera helix</i>		Wakefield 1931, Ahmad et al. 1997
<i>A. pakistanicum</i>		<i>Spiraea tomentosa</i>		Sultan et al. 2008
Caeoma				
<i>C. ahmadii</i>		Leaves of <i>Rosa microphylla</i>	Kozshawar Swat district	Afshan et al. 2012
<i>C. khanspure-nse</i>		Leaves or stems of <i>Rosa webbiana</i>	Kozshawar Swat district	Afshan et al. 2012
<i>C. rosicola</i>		Leaves or petioles of <i>Rosa webbiana</i>	Kozshawar Swat district	Afshan et al. 2012
Uredo				
<i>U. capillus-veneris</i>		<i>Adiantum capillus-veneris</i>		Jørstad and Iqbal 1967
<i>U. otostegiae</i>		Leaves of <i>Otostegia limbata</i>		Ahmad 1956c
Tremellomycetes				
Tremellales				
Cryptococcaceae				
Cryptococcus				

<i>C. albidus</i> var. <i>ovalis</i> *	<i>Naganishia albida</i>	Dung of <i>Capra hircus</i>		Sugiyama and Goto 1967, Liu et al. 2015
<i>Tritirachiomycetes</i>				
<i>Ustilaginales</i>				
<i>Anthracoideaceae</i>				
<i>Anthracoidea</i>				
<i>A. mulenkoi</i>		Ovaries of inflorescence of <i>Kobresia capillifolia</i>	Kashmir	Marcin 2006
<i>Cintractia</i>				
<i>C. kobresiae</i>		<i>Kobresia laxa</i>		Mundkur 1944
<i>Tolyposporium</i>				
<i>T. aristidae</i>	<i>Sporisorium aristidae</i>	Inflorescence of <i>Aristida cyanantha</i>		Ahmad 1956d, Vanky 2001
<i>T. evernium</i>		Ovaries of <i>Paspalum distichum</i> , of <i>Dalbergia sissoo</i> , of <i>Peganum harmala</i> , and of <i>Cynodon dactylon</i>		Sydow 1939, Ahmad et al. 1997
<i>Ustilaginaceae</i>				
<i>Sporisorium</i>				
<i>S. divisum</i>		Spikelets of <i>Pennisetum divisum</i>		Vánky 2003
<i>S. murreeanum</i>		<i>Microstegium</i> sp.		Kakishima and Ono 1993
<i>S. pakistanense</i>		Shoots of <i>Pennisetum lanatum</i>		Denchev et al. 2013
<i>Ustilago</i>				
<i>U. boissierae</i>		Ovary of <i>Boissiera squarrosa</i>		Vánky 1997
<i>U. combensis</i> *	<i>Kalmanago combensis</i>	Flowers of <i>Commelina benghalensis</i>		Vánky 1994, Denchev et al. 2020
<i>U. chrysopogonis</i>	<i>Macalpinomyces chrysopogonis</i>	Inflorescence of <i>Chrysopogon gryllus</i>		Ahmad 1956d, Vanky 1997
<i>U. euphorbiae</i>	<i>Ahmadiago euphorbiae</i>	<i>Euphorbia dracunculoides</i>		Mundkur 1940, Vanky 2004
<i>U. idonea</i>		Flowers of <i>Eleusine aristate</i>		Sydow and Ahmad 1939, Ahmad et al. 1997
<i>U. merxmuelle-rana</i>		<i>Trisetaria cavanillesii</i>		Scholz 1980
<i>U. pulveracea</i>		Male florettes of <i>Zea mays</i>		Cooke 1876, Ahmad et al. 1997
<i>U. stewartii</i>	<i>Microbotryum stewartii</i>	<i>Rheum webbiana</i>		Zundel 1944, Vánky 1998
<i>U. trachyniae</i>		Inflorescence of <i>Trachynia beludshistanica</i>		Karjagin and Uljanishchev 1948

<i>Ustilaginomycetes</i> <i>Urocystidales</i> <i>Glomosporiaceae</i> <i>Thecaphora</i>				
<i>T. pakistanica</i>		Capsules of <i>Androsace rotundifolia</i>	Islamabad, Khanspur	Vánky et al. 2007
<i>Urocystidaceae</i> <i>Urocystis</i>				
<i>U. colchici-lutei</i>		<i>Colchicum luteum</i>		Zundel 1944, Ahmad et al. 1997
<i>Chytridiomycota</i> <i>Chytridiomycetes</i> genus <i>incertae sedis</i> <i>Sagittospora</i>				
<i>S. cameronii</i>		<i>Eudiplodinium maggi</i> in the rumen of goats		Lubinsky 1955
<i>Synchytriomycetes</i> <i>Synchytriales</i> <i>Synchytriaceae</i> <i>Synchytrium</i>				
<i>S. marsileae</i>		<i>Marsilea minuta</i>		Ahmad and Lodhi 1953
<i>Glomeromycota</i> <i>Glomeromycetes</i> <i>Glomerales</i> <i>Glomeraceae</i> <i>Sclerocystis</i>				
<i>S. microcarpus</i>		Rhizosphere of ferns		Iqbal and Bushra 1980
<i>S. pakistanica</i>	<i>Glomus sinuosum</i>	Rhizosphere of <i>Oryza sativa</i>		Iqbal and Bushra 1980, Almeida and Schenck 1990
<i>Kickxellomycota</i> <i>Kickxellomycetes</i> <i>Kickxellales</i> <i>Kickxellaceae</i> <i>Spiromyces</i>				
<i>S. spiralis</i>		Mouse dung		O'Donnell et al. 1998
<i>Mucoromycota</i> <i>Mucoromycete</i> <i>Mucorales</i> <i>Cunninghamellaceae</i> <i>Absidia</i>				

<i>A. inflata</i>		Soil		Mirza et al. 1979
Lichtheimiaceae				
Dichotomocladium				
<i>D. sphaerosporum</i>		Rat dung		Benny and Benjamin 1993
Fennellomyces				
<i>F. gigacellularis</i>		Sheep dung		Mirza et al. 1979
<i>F. verticillatus</i>		Mouse dung		Mirza et al. 1979
Rhizomucor				
<i>R. pakistanicus</i>		Groundnut seeds		Mirza et al. 1979
Mucoraceae				
Mucor				
<i>M. faisalabadensis</i>	<i>Protomyocoladus faisalabadensis</i>	Rodent dung		Mirza et al. 1979, Schipper and Samson 1994
<i>M. lahorensis</i>		Soil		Mirza et al. 1979
<i>M. pakistani-cus</i>		Goat dung		Mirza et al. 1979
<i>M. punjabensis</i>		Bat dung		Mirza et al. 1979
Zoopagomycota				
Zoopagomycetes				
Zoopagales				
Piptocephalidaceae				
Piptocephalis				
<i>P. macrocephala</i>		Horse dung		Mirza et al. 1979

In the second section, 136 species were included and all these species are currently ambiguous that require consideration from fungal taxonomists. Herein, we briefly explained the ambiguous species within genera *Amphichaeta*, *Diplodiella*, and *Diplodina* as examples.

Amphichaeta McAlpine, Proc. Linn. Soc. N.S.W. 29: 118 (1904)

Current name: ***SEIMATOSPORIUM*** Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 3(13): 79 (1837)

Notes: The genus *Amphichaeta* was regarded as a synonym of *Seimatosporium* by Shoemaker (1964). Subsequent publications followed this synonymy (Sutton 1980b, Nag Raj 1993) thus Kirk et al. (2008, 2013) did not list it in the Dictionary of Fungi and the list of without-prejudice list of generic names, respectively. Index Fungorum (2022) listed 17 species epithets, and one novel species has been reported from Pakistan. It is necessary to recollect these fungal taxa and study them to confirm their relationships with *Seimatosporium*.

Diplodiella (P. Karst.) Sacc., Syll. fung. (Abellini) 3: 375 (1884) *nom. dub.*

Notes: Kirk et al. (2008) regarded that this generic name is doubtful. Two novel species have been reported from Pakistan which needs to be resolved.

Diplodina Westend., Bull. Acad. R. Sci. Belg., Cl. Sci., sér. 2 2(7): 562 (1857)

Current name: *PLAGIOSTOMA* Fuckel, Jb. Nassau. Ver. Naturk. 23-24: 118 (1870) [1869-70]

Notes: Rossman et al. (2015), proposed to adopt the younger, sexual typified name, *Plagiostoma* over *Diplodina*, the older, asexual typified name. Twelve novel species have been reported from Pakistan however, it is essential to revisit the older taxa and epitypify them.

Table 2 Checklist of novel fungal species, which are treated as doubtful, reported from Pakistan.

Species	Current name/status	Host	Localities	References
<i>Amphichaeta gerardiana</i>		Dead branches of <i>Indigofera gerardiana</i>	Muzaffarabad	Ahmad 1968b
<i>Ascochyella albiziae</i>		Fallen pods of <i>Albizia lebeck</i>		Ahmad 1964c
<i>A. asparagi</i>		Dead branches of <i>Asparagus</i>		Ahmad 1969b
<i>A. eremopogonis</i>		Culms of <i>Eremopogon foveolatus</i>		Ahmad 1971
<i>A. sacchari</i>		Peelings of <i>Saccharum officinarum</i>		Ahmad 1971b
<i>A. tephrosiae</i>		Branches of <i>Tephrosia purpurea</i>		Ahmad 1971b
<i>Ascochyta culmicola</i>	<i>Ascochyta culmicola</i>	Culms of <i>Erianthus ravennae</i>		Ahmad 1971b, Punith 1979
<i>Bacillispora inflata</i>		Decaying leaves submerged in fresh water		Iqbal and Bhatti 1980
<i>Benjaminia aristata</i>	<i>Pycnomoreletia aristata</i>	Stems of <i>Poaceae</i>		Ahmad 1967, Rulamort 1990
<i>Botryodiplodia asparagi</i>		Branches of <i>Asparagus</i> sp.		Ahmad and Arshad 1972b
<i>B. capparis</i>		On dead branches of <i>Capparis aphylla</i>		Ahmad 1969b
<i>B. carissae</i>		Branches of <i>Carissae spinarum</i>		Ahmad 1972b
<i>B. deodarae</i>		Dead <i>Cedrus deodara</i>		Petrak and Ahmad 1954
<i>B. gymnosporiae</i>		Branches of <i>Gymnosporia royleana</i>		Ahmad and Arshad 1972b
<i>B. ipomoeae</i>		Branches of <i>Ipomoea carnea</i>		Ahmad 1972b
<i>B. lantanicola</i>		Branches of <i>Lantana indica</i>		Ahmad 1971b

<i>B. opuntiae</i>		Phylloclades of <i>Opuntia</i> sp.	Mingora	Ahmad and Arshad 1972b
<i>B. oxystelmatis</i>		Branches of <i>Oxystelma esculentum</i>		Ahmad 1971b
<i>B. pakistanica</i>		Branches of <i>Aegle marmelos</i>		Ahmad 1971b
<i>B. prosopidina</i>		Branches of <i>Prosopis glandulosa</i>		Ahmad 1969b
<i>B. ricinicola</i>		Dead <i>Ricinus communis</i>		Petrak and Ahmad 1954
<i>B. solani</i>		Branches of <i>Solanum melongena</i>	Hangu	Ahmad and Arshad 1972b
<i>B. xanthii</i>		Branches of <i>Xanthium strumarium</i>	Changa manga	Ahmad 1971a
<i>Botryogene maydis</i>		Culms of <i>Zea mays</i>	Swat	Ahmad 1971a
<i>Catharinia cynodontis</i>		Dead stems of <i>Cynodon dactylon</i>		Müller and Ahmad 1957
<i>Chaetosclerophoma strictae</i>		Dead branches of <i>Rhazya stricta</i>	Bhakar	Ahmad 1967
<i>Chaetosphaeropsis pakistanica</i>		Dead wood		Ahmad 1964a
<i>C. seriata</i>		Branches of <i>Mallotus philippensis</i>	Tret	Ahmad and Arshad 1972a
<i>Cleistobombardia pakistani</i>	<i>Cercophora pakistani</i>	Dung of <i>Equus caballus</i>	Faisalabad	Mirza 1968b, Von Arx 1973
<i>Cytodiplospora alhagi</i>		Branches of <i>Alhagi maurorum</i>	Bahawalpur	Ahmad 1971b
<i>Diaporthopsis spiraeae</i>		Dead stems of <i>Spiraea sorbifolia</i>		Müller and Ahmad 1955
<i>Dichomera gymnosporiae</i>		<i>Gymnosporia royleana</i>		Ahmad 1955d
<i>D. macrospora</i>		Dead branches of <i>Berberis lycium</i>		Ahmad 1955d
<i>D. moricola</i>		Branches of <i>Morus alba</i>	Kohat	Ahmad and Arshad 1972b
<i>D. rosarum</i>		Dead branches of <i>Rosa</i>		Ahmad 1964a
<i>Didymosporium culmicola</i>		Stems of <i>Phragmites karka</i>	Swat	Ahmad 1967
<i>Diplodiella milleri</i>		<i>Ziziphus jujuba</i>		Ahmad 1951
<i>Di. tamaricina</i>		Branches of <i>Tamarix articulata</i>		Ahmad 1968d
<i>Diplodina abutilonis</i>		Dead branches of <i>Abutilon indicum</i>		Ahmad 1967
<i>Dip. aloina</i>		Inflorescence axes of <i>Aloe vera</i>		Ahmad and Arshad 1972b
<i>Dip. capparincola</i>		Dead <i>Capparis aphylla</i>		Petrak and Ahmad 1954

<i>Dip. cymbopogonis</i>		Culms of <i>Cymbopogon schoenanthus</i>		Ahmad 1971a
<i>Dip. doemiae</i>		Branches of <i>Doemia extensa</i>		Ahmad 1971a
<i>Dip. panici</i>		Dead <i>Panicum antidotale</i>		Ahmad 1951
<i>Dip. pentatropidis</i>		Dead branches of <i>Pentatropis cynanchoides</i>		Ahmad 1964a
<i>Dip. phoenicina</i>		Leaves of <i>Phoenix dactylifera</i>	Lahore	Ahmad 1971a
<i>Dip. saccharina</i>	<i>Ascochyta saccharophila</i>	Culms of <i>Saccharum munja</i>	Zafarwal	Ahmad 1971a, Punith 1979
<i>Dip. sorghina</i>		Culms of <i>Sorghum vulgare</i>	Hasanabdal	Ahmad 1971a
<i>Dip. tecomae</i>		Branches of <i>Tecoma</i> sp.	Hasanabdal	Ahmad and Arshad 1972b
<i>Dip. zeicola</i>		Culms of <i>Zea mays</i>	Swat	Ahmad 1971a
<i>Eupenicillium mole</i>	<i>Penicillium molle</i>	Soil		Malloch and Cain 1972, Pitt 1980
<i>Foveostroma salvadorae</i>		Dead branches of <i>Salvadora oleoides</i>		Abbas et al. 2001
<i>Fusicoccum asparagi</i>		Dead <i>Asparagus</i> sp.		Ahmad 1951
<i>F. euphorbiae</i>		Dead branches of <i>Euphorbia pulcherrima</i>		Ahmad 1951
<i>F. lahoreanum</i>		Dead <i>Thevetia neriifolia</i>		Ahmad 1951
<i>Haplovalsaria allantosporiformis</i>	<i>Endoxylina allantosporiformis</i>	Fallen wood		Müller and Ahmad 1957, Müller and von Arx 1962
<i>Helicodendron pinicola</i>	<i>Tyrannosorus pinicola</i>	Submerged decorticated wood of <i>Pinus</i> sp.		Unter and Malloch 1995, Voglmayr and Fisher 1997
<i>Hendersonia abutilonis</i>		Branches of <i>Abutilon indicum</i>	Fort Monro	Ahmad 1967
<i>H. andrachnes</i>		Dead branches of <i>Andrachne cordifolia</i>		Ahmad 1968b
<i>H. buteae</i>		Dead branches of <i>Butea monosperma</i>	Salt Range, Rawal	Ahmad 1967
<i>H. calotropidis</i>		Dead branches of <i>Calotropis procera</i>	Hasanabdal	Ahmad 1968b
<i>H. cenchrina</i>		Culms of <i>Cettchrus ciliaris</i>	Karachi	Ahmad 1971a
<i>H. crotalariae</i>		Dead branches of <i>Crotalaria burhia</i>	Talagang	Ahmad 1967

<i>H. cymbopogonis</i>		Culms of <i>Cymbopogon schoenanthus</i>	Muzaffarabad	Ahmad 1971b
<i>H. cynodontis</i>		Runners of <i>Cynodon dactylon</i>	Hasan abdal	Ahmad 1968c
<i>H. eleusines</i>		Runners of <i>Eleusine compressa</i>	Karachi	Ahmad 1968c
<i>H. eremopogonis</i>		Culms of <i>Eremopogon foveolatus</i>	Kharian	Ahmad 1971a
<i>H. ficina</i>		Branches of <i>Ficus palmata</i>	Fort Monro	Ahmad 1968c
<i>H. leptostromatis</i>		<i>Leptostroma ahmadii</i>		Petrak and Ahmad 1954
<i>H. panici-antidotalis</i>		Culms of <i>Panicum antidotale</i>		Ahmad 1961
<i>H. plectranthi</i>		Branches of <i>Plectranthus rugosus</i>	Swat	Ahmad 1971b
<i>H. sacchari-spontanei</i>		Culms of <i>Saccharum spontaneum</i>		Ahmad 1961
<i>H. salsolicola</i>		Dead branches of <i>Salsola foetida</i>	Kalar kahar	Ahmad 1967
<i>H. viticola</i>		Branches of <i>Vitis vinifera</i>	Zafarwal	Ahmad 1967
<i>Humarina plumbeoatra</i>	<i>Octospora plumbeoatra</i>	Ground soil	Ladhar, Sheikhpura	Cash 1948, Pant and Tewari 1978
<i>Hu. umbrina</i>	<i>Octospora umbrina</i>	Ground soil	Lahore	Cash 1948, Ahmad 1978a
<i>Hu. ziziphi</i>	<i>Komposocypha ziziphin</i>	Dead branches of <i>Ziziphus jujuba</i>		Cash 1948, Pfister 1989
<i>Leptostroma ahmadii</i>	<i>Bifusella ahmadii</i>	<i>Pinus excelsa</i>		Petrak 1954, Rossman et al. 2016
<i>Macrophoma albiziae</i>		Fallen leaves of <i>Albiziae lebbek</i>	Lahore	Ahmad 1971a
<i>M. asphodeli</i>		Dead <i>Asphodelus tenuifolius</i>		Ahmad 1948
<i>M. cruciferarum</i>		Dead branch of <i>Cruciferae</i> sp.	Fort Monro	Ahmad 1967
<i>M. fagoniae</i>		Branches of <i>Fagonia cretica</i>	Bahawalpur	Ahmad 1971a
<i>M. ficina</i>		Fallen leaves of <i>Ficus religiosa</i>	Lahore	Ahmad 1969b
<i>M. graminicola</i>		Stolons of <i>Eleusine compressa</i>	Kasur	Ahmad 1967
<i>M. heptapleuri</i>		Leaves of <i>Heptapleurum venulosum</i>	Lahore	Ahmad 1971a
<i>M. launaeae</i>		Branches of <i>Launaea nudicaulis</i>	Lahore	Ahmad 1971a

<i>M. pegani</i>		Capsules of <i>Peganum harmala</i>	Lahore	Ahmad 1971a
<i>M. pentatropidis</i>		Branches of <i>Pentatropis cynanchoides</i>	Fort Monro	Ahmad 1971b
<i>M. prosopidis</i>		Leaves of <i>Prosopis glandulosa</i>		Khan and Kamal 1974
<i>M. rumicicola</i>		Branches of <i>Rumex dentatus</i>	Sheikhupura	Ahmad 1971a
<i>M. sisymbrii</i>		Branches of <i>Sisymbrium irio</i>	Lahore	Ahmad 1971a
<i>M. triticina</i>		Dead <i>Triticum</i> sp.		Ahmad 1948
<i>Marssonina pakistanica</i>		Leaves of <i>Fragaria vesca</i>	Changla Gali	Sutton and Webster 1984
<i>Massarinula dubia</i>		Stems of <i>Tamarix articulata</i>		Wehmeyer and Ahmad 1964
<i>Ma. orientalis</i>		Decayed wood		Wehmeyer and Ahmad 1964
<i>Microdiplodia salvadorina</i>		Dead branches of <i>Salvadora oleoides</i>		Ahmad 1962
<i>Mi. agavicola</i>		Leaves of <i>Agave</i>	Shakargar	Ahmad 1971b
<i>Mi. astragalina</i>		Dead branches of <i>Astragalus</i> sp.		Ahmad 1969a
<i>Mi. cadabae</i>		Branches of <i>Cadaba fruticosa</i>		Ahmad 1964a
<i>Mi. ficina</i>		Branches of <i>Ficus palmata</i>	Swat	Ahmad 1971b
<i>Mi. lonicerae</i>		Dead branches of <i>Lonicera</i> sp.		Ahmad 1964c
<i>Mi. nannorrhopis</i>		Leaves of <i>Nannorrhops ritchieana</i>		Ahmad 1969a
<i>Mi. othonnopsidis</i>		Branches of <i>Othonnopsis intermedia</i>	Ziarat	Ahmad and Arshad 1972b
<i>Mi. prunicola</i>		Branches of <i>Prunus amygdalus</i>	Lahore	Ahmad 1971a
<i>Mycosphaerella adhatodae</i>		Fallen leaves of <i>Adhatoda vasica</i>	Swat	Ahmad 1969b
<i>My. dalbergiae</i>		Dead leaves of <i>Dalbergia sissoo</i>		Müller and Ahmad 1955
<i>My. skimmiae</i>		Dead leaves of <i>Skimmia laureola</i>		Müller and Ahmad 1957
<i>Othiella clavata</i>	<i>Othia clavata</i>	Dead branches of <i>Spiraea lindleyana</i>		Müller and Ahmad 1957, Müller and Von Arx 1962
<i>Peltosphaeria acacia</i>		Branches of <i>Acacia modesta</i>		Müller and Ahmad 1957
<i>Penzigia quercus</i>		Bark of <i>Quercus dilatata</i>		Müller and Ahmad 1955

<i>Phomopsis clematidis</i>		Branches of <i>Clematis</i> sp.	Doonga Gali	Ahmad 1971b
<i>P. daturicola</i>		Branches of <i>Datura alba</i>	Murree	Ahmad 1971b
<i>P. mangiferae</i>		Dead leaves of <i>Mangifera indica</i>		Petrak and Ahmad 1954
<i>P. salmalica</i>		Dead trunk and branches of <i>Bombax malabaricum</i>		Khan 1961
<i>Pilidiella jambolanae</i>		Leaf of <i>Eugenia jambolana</i>	Murree	Ahmad 1967
<i>Pi. tamaricina</i>		Dead branches of <i>Tamarix articulata</i>	Kasur	Ahmad 1967
<i>Pleospora aggregate</i>		Stems of <i>Berberis ceratophylla</i>		Wehmeyer and Ahmad 1964
<i>Pl. cephalandrae</i>		Dead stems of <i>Cephalandra indica</i>		Müller and Ahmad 1957
<i>Pl. iqbalii</i>		Dead branches of <i>Tricholepis furcata</i>		Lucas and Iqbal 1969
<i>Polystigmina pallescens</i>		<i>Prunus cornuta</i>		Petrak and Ahmad 1954
<i>Rhabdospora mirabilis</i>		Dead branches of <i>Mirabilis jalapa</i>	Ghora Gali	Ahmad 1967
<i>R. ranunculacearum</i>		Stems of <i>Ranunculus arvensis</i>	Rawalakot	Ahmad 1971b
<i>R. rumicina</i>		Branches of <i>Rumex dentatus</i>	Shakargar	Ahmad 1971a
<i>R. zeina</i>		Culms of <i>Zea mays</i>		Ahmad 1971a
<i>Sorosporium aeluropidis</i>		Inflorescence of <i>Aeluropus lagopoides</i>		Ahmad 1956d
<i>S. arthraxonis</i>		Inflorescence of <i>Arthraxon lanceolatus</i>		Ahmad 1956d
<i>S. baluchistani</i>		Inflorescence of <i>Bothriochloa</i>		Ahmad 1956d
<i>S. ladharensis</i>		Flowers of <i>Cymbopogon iwarancusa</i>		Sydow and Ahmad 1939
<i>Spilocaea ahmadii</i>	<i>Fusicladium ahmadii</i>	Leaves of <i>Pyrus pashia</i>	Swat, Mingora	Ellis 1976, Ritschel et al. 2003
<i>Suttonia eriobotryae</i>		Fallen leaves of <i>Eriobotrya japonica</i>		Ahmad 1960
<i>Su. gaubae</i>		Unknown		Ahmad 1960
<i>Thielaviella humicola</i>	<i>Boothiella tetraspora</i>	Soil	Lahore	Von Arx and Mahmood 1968, Lodhi and Mirza 1962
<i>Valsella moricola</i>		Dead <i>Morus alba</i>		Ahmad 1948

<i>Vermicularia arthraxonis</i>	<i>Colletotrichum arthraxonis</i>	Leaves of <i>Arthraxon serrulatus</i>	Ahmad 1955d, Ahmad 1956b
<i>Xylospora ahmadii</i>	<i>Mycothyridium ahmadii</i>	Wood	Petrak and Ahmad 1954, Ahmad 1969a
<i>X. pakistani</i>	<i>Mycothyridium pakistani</i>	Dead branches of <i>Astragalus</i>	Müller and Ahmad 1958, Müller and Ahmad 1969

Discussion

This checklist presents, for the first time, an exhaustive overview of novel fungi reported from Pakistan; and a comprehensive outline of those species that have been collected and published so far. In Pakistan, a more complete list of fungi will be possible only by cataloging the existing species and identifying new ones because the fungi of this region are still largely unexplored compared to other regions of the world that were fairly well explored (Tedersoo et al. 2014, Hyde et al. 2018, Piepenbring et al. 2020, Wijayawardene et al. 2021).

Pakistan has a long history of mycology (Raza et al. 2021). Based on what was published in the available field guides on fungi of Pakistan (Mirza and Qureshi 1978, Ahmad et al. 1997, Ahmad et al. 2014), the most common fungal species reported across all the years belong to several genera, including *Ascochyta*, *Aplosporella*, *Caloplaca*, *Camarosporium*, *Cercospora*, *Coniothyrium*, *Diplodia*, *Dothiorella*, *Phoma*, *Sphaeropsis* and *Stagonospora* in Ascomycota, while *Agaricus*, *Amanita*, *Coprinellus*, *Puccinia*, *Russula*, *Sphacelotheca*, *Tulostoma*, *Uromyces* and *Ustilago* in Basidiomycota. It is true that species mentioned in multiple field guides overlap, but each guide also features distinctive species, and none of the guides is complete or comprehensive because of publishing restrictions. However, even these guides do not provide an accurate picture of the diversity of novel species reported from or living in Pakistan.

Over the last decade (2010–2021), several new species were discovered based on both morphology and phylogeny. During this timeframe, a total of 83 species were introduced in Basidiomycota as compared to Ascomycota (13 species). These include genera *Agaricus* (16 species), *Lepiota* (5 species), *Leucoagaricus* (3 species), *Tulostoma* (1 species), *Amanita* (6 species), *Zhuliangomyces* (1 species), *Cortinarius* (2 species), *Hygrophorus* (2 species), *Gymnopilus* (2 species), *Phaeocollybia* (1 species), *Pseudosperma* (4 species), *Bovista* (1 species), *Calvatia* (1 species), *Lycoperdon* (2 species), *Termitomyces* (2 species), *Marasmiellus* (1 species), *Rhodocollybia* (1 species), *Xerula* (1 species), *Coprinellus* (6 species), *Stropharia* (1 species), *Infundibulicybe* (1 species), *Melanoleuca* (1 species), *Hortiboletus* (1 species), *Tylopilus* (1 species), *Chroogomphus* (2 species), *Suillus* (1 species), *Clavariadelphus* (1 species), *Ramaria* (1 species), *Albatrellopsis* (1 species), *Albatrellus* (1 species), *Heterobasidion* (1 species), *Russula* (9 species), *Thelephora* (1 species), *Melampsora* (1 species) and *Phragmidium* (1 species). The *Agaricus* species including *A. atroumbonatus*, *A. bambusetorum*, *A. bisporiticus*, *A. campestris*, *A. fumidicolor*, *A. glabriusculus*, *A. glabriusculus*, *A. griseovariegatus*, *A. latiumbonatus*, *A. macropeplus*, *A. pakistanicus*, *A. parviniveus*, *A. porphyrocephalus*, *A. punjabensis*, *A. sparsisquamosus*, *A. swaticus*, and *A. xanthochromaticus* were described from different ecological regions of Pakistan based on large-subunit ribosomal RNA gene (LSU), internal transcribed spacer (ITS), and translational elongation factor (TEF1) (Thongklang et al. 2014, Chen et al. 2016, Kaur et al. 2016, Hussain and Sher 2019, Bashir et al. 2021). The *Russula* species, *R. abbotabadensis*, *R. ahmadii*, *R. aurantioflava*, *R. brunneopurpurea*, *R. foetentoides*, *R. quercus-floribundae*, *R. rubricolor*, *R. shanglaensis*, and *R. shawarensis*, were found to be associated with coniferous forest in Khyber Pakhtunkhwa (KPK) province (Razaq et al. 2014, Jabeen et al. 2017, Adamčík et al. 2019, Crous et al. 2020, Jabeen et al. 2020, Ullah et al. 2020). The majority of

fungal species in Basidiomycota are reported from northern Pakistan, including KPK provinces. All *Amanita*, *Coprinellus*, and *Pseudosperma* species have been reported from the KPK (Hussain et al. 2018, Jabeen et al. 2019, Saba et al. 2019, Ullah et al. 2019, Kamran and Jabeen 2020, Saba et al. 2020, Jabeen and Khalid 2020, Saranyaphat et al. 2021), whereas the species of *Lepiota* and *Leucoagaricus* (*Le. lahorensis* and *Le. asiaticus*) have been recorded from Punjab province (Razaq et al. 2012, Nawaz et al. 2013, Ge et al. 2015, Qasim et al. 2015, Qasim et al. 2016, Zia et al. 2019, Bashir et al. 2020).

Ascomycota is generally the most dominant fungal phylum in nature compared to Basidiomycota according to mycobiome studies (Trivedi et al. 2020, Bai et al. 2022). Over the last decade, Pakistan has reported more fungi belonging to Basidiomycota (macrofungi) (Table 1). A low rate of discovering new fungi from other phyla might be due to bias on the part of researchers or a lack of interest in investigating microfungi. However, there have been a few studies identifying novel Ascomycota species. For example, Fatima et al. (2020) and Ul haq et al. (2021) introduced 2 species in the genus *Bacidina* from two different habitats and 4 species in the genus *Neopestalotiopsis* from fruit and branches of *Psidium guajava*, respectively, with DNA sequence data. Only one species was introduced in each of the genera *Ahmadea*, *Fusarium*, *Geopora*, *Gyromitra*, *Lecidea*, *Morchella* and *Placolecis* (Hernández et al. 2016, Krisai-Greilhuber et al. 2017, Khan et al. 2018, Lombard et al. 2019, Saba et al. 2019, Aman et al. 2020, Kousar et al. 2021), and Marin-Felix et al. (2020) provided DNA sequence data of a previously reported *Curvularia* species (*C. siddiquii*) from Pakistan. There are many known natural habitats that support fungal species in Pakistan, many of which are still unexplored, and given the vast area of habitats in Pakistan, more species are likely to exist. Unless these fungi are characterized and described, they will disappear before we know them or remain unknown.

Species identification based on morphology is not reliable since some species are cryptic, thus, been incorrectly identified. Consequently, molecular-based approaches are more challenging since many fungal species lack molecular data including reference sequences (Bhunjun et al. 2021). A total of 629 out of 742 fungal species reported from Pakistan lack DNA sequence data. The majority of asexually typified genera are cryptic and polyphyletic (for example, *Coniothyrium*, *Phoma*, *Camarosporium*) (Wijayawardene et al. 2022c). It is, therefore, necessary to recollect these fungal taxa for epitypification and subject them to DNA-based identification and phylogenetic analyses to ensure that species must be identified with precision and that higher-level classifications can be confidently achieved. Since *Camarosporium*-like taxa are highly polyphyletic (Wijayawardene et al. 2014, 2016, Wanasinghe et al. 2017), *Camarosporium* taxa published from Pakistan are doubtful and may belong to other genera (Wijayawardene et al. 2022b), such as *Pseudocamarosporium* or *Paracamarosporium*.

Due to the morphological plasticity of *Diplodia* and *Phoma*, in recent studies, species identification is solely based on DNA sequences. Overall, 37 and 9 species of *Diplodia* and *Phoma* are, respectively, described from Pakistan, but they lack DNA sequence data (de Gruyter et al. 2012, Phillips et al. 2013). Thus, epitypification of these old taxa is crucial. The type specimens of these species, especially holotypes, may be found in herbarium collections. In previous studies, DNA was successfully extracted from herbarium samples older than 100 and 200 years (Larsson and Jacobsson 2004, Lehtonen and Christenhusz 2010, Redchenko et al. 2012). So, the existence of DNA sequence data from these herbarium samples might help to resolve taxonomic controversies since these specimens are the only link to a specific name; these important samples, therefore, have a great scientific value. In addition, the present checklist includes the information on the host or source of isolation of reported fungi, and based on that information these can be isolated again from the same host and habitat.

Concluding remarks

The present checklist has been thoroughly vetted to eliminate potential synonyms, and provide the most recent names for the species listed under previous names (Table 1 and 2; Species Fungorum, 2022). Further, we have shown in table 2 that there are ~130 ambiguous fungal species that may belong to different taxonomic groups. Despite this, there should be a lot of new fungi in Pakistan that have not yet been discovered. Based on the initial working list presented here, it is expected that future revisions and additions will be made, especially if linked to specific targets, priorities, or areas of expertise already in place or newly formed. There is also an observation that most of the reported fungal species lack DNA sequence data, and in some cases, a fungal species has been reported but without an accession number for the culture. In addition, most of the species reported in the last decade belonged to a particular group of fungi, Basidiomycota (macrofungi). Therefore, characterization and description of both macro- and micro-fungi species according to the latest methodology in taxonomic classification are crucial, otherwise, these fungi will remain obscure.

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Conflict of interest

The authors declare no conflict of interest.

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