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Occurrence and geographical distribution of mangrove fungi

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Abstract
This is a multidimensional review of mangrove fungi occurring as saprobes, pathogens and endophytes of a wide range of host substrates and those isolated from the water columns and sediments in mangroves. Eight-hundred and fifty taxa including 658 that are supported by both morphology and molecular data and 192 with only morphological data are listed. These constitute Ascomycota, the dominant group with 773 species, and 58 Basidiomycota, one Blastocladiomycota, five Chytridiomycota, and 13 Mucoromycota. This study also includes data on mangrove yeasts 103 Ascomycota, 39 Basidiomycota and 193 taxa isolated from sediments. Endophytes isolated from submerged parts of mangrove plants total 38. The most specious orders of mangrove fungi are Pleosporales 133, Saccharomycetales 102, Microascales 101, Eurotiales 87, Hypocreales 60 and Xylariales 54. Speciose genera include *Candida* 39, *Aspergillus* 53, *Penicillium* 17 and *Corollospora* 16. The highest number of mangrove fungi have been recorded from the Pacific Ocean 553, which is the largest ocean, followed by Indian 408 and Atlantic Oceans 259. Geographical distribution of mangrove fungi varied from ocean to ocean with only 109 taxa common to the Atlantic, Indian and Pacific Oceans. Of the various countries reported for mangrove fungi, India accommodates the highest number (339) followed by Thailand 303, Malaysia 171, Florida Everglades, USA 134 and Brunei 134. A total of 60 different mangrove plants and their associates have been surveyed for mangrove fungi. These results are discussed and compared with previous studies.

Keywords Host preference · Marine ecology · Marine fungi · World distribution

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Introduction to mangroves and mangrove fungi

In this manuscript we use the term 'mangrove fungi' *to refer to those marine fungi documented from various mangrove subtrates*, *thus avoiding the need to state that all taxa listed are marine*. Approximately 75% of the world's tropical coastlines between 25° N and 25° S, support a rich diversity of mangrove plants, while other areas having a lower diversity further from the equator, for example the east coasts of Africa, Australia, and New Zealand where mangroves occur 10–15° further south. On the northern side of the equator, mangroves extend to 5–7° which includes the coastlines of Japan, Florida, Bermuda, and the Red Sea. Mangroves in the Indo-West Pacific are the most diverse with more than 30 plant species, while those in Saudi Arabia and Florida comprise one and plant tree species, respectively. Australia and New Zealand comprise six and one plant species, respectively (https://www.floridamuseum.ufl.edu/southflorida/habitats/mangroves/geographical-distribution/).

Mangroves are salt-tolerant evergreen forests found along sheltered coastlines, shallow-water lagoons, estuaries, rivers or deltas in 124–127 tropical and subtropical countries and areas mainly growing on soft muddy substrates (FAO 2007). Mangroves are distributed along the equator encompassing the Atlantic, Indian and Pacific Oceans. Fungi occurring on mangrove forest have been reported since the 1920's (Stevens 1920), while Cribb and Cribb (1955) studied mangrove fungi on Australian mangrove plants and introduced a number of new taxa. Kohlmeyer (1969) listed 75 mangrove fungi of which 39 were ascomycetes, 27 asexual morphs and nine basidiomycetes, along with their host preferences. Hyde and Jones (1988) reported 90 species of mangrove fungi from the intertidal zone collected from 26 different mangrove trees. These early studies involved the description of new taxa based on morphology with observation on their ecological distribution. Schmit and Shearer (2003) detailed a historical account of the occurrence of mangrove fungi, when they listed 625 species, but many of these included freshwater and terrestrial taxa. Only 287 species could be regarded as growing on submerged to intertidal mangrove substrata (Alias and Jones 2009; Sridhar et al. 2012; Loilong et al. 2012).

Marine fungi have been well-documented, especially over the past 50 years, when numbers ranged from 174 species (Kohlmeyer 1969) to 530 species (Jones et al. 2009) and later to 1112 species (Jones et al. 2015) and currently total 1692 species (Jones et al. 2019, www.marinefungi.org 12/05/2020). A significant number of marine fungi from mangroves account for this increase. Over the past 25 years there has been great activity in documenting mangrove fungi from around the world (Fig. 1), with studies in the Pacific (Jones and Abdel-Wahab 2005; Pang et al. 2011), Indian (Hyde and Jones 1986; Sarma et al. 2001; Sridhar et al. 2012) and Atlantic Oceans (Jones and Puglisi 2006; Fell et al. 2011). Seas sampled for mangrove fungi include the Red Sea (Abdel-Wahab 2005; Abdel-Wahab et al. 2014, 2019a), Arabian Sea (Chinnaraj 1993; Ananda and Sridhar 2004; Maria and Sridhar 2003) and Bay of

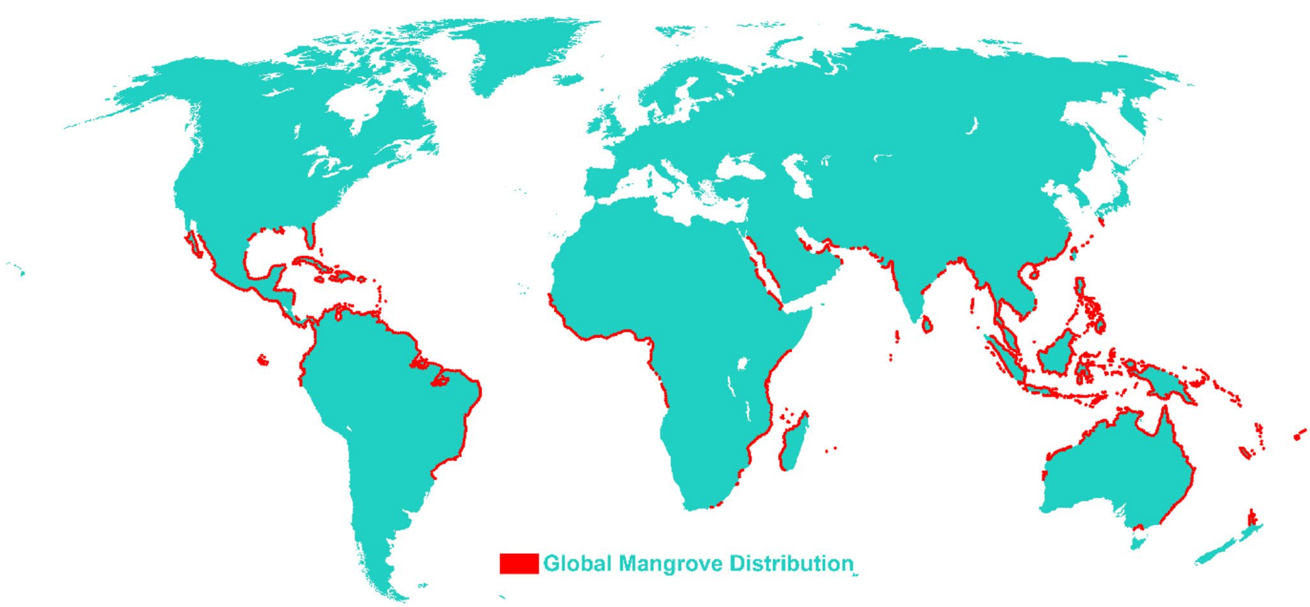


Fig. 1 World distribution of mangroves in 2020 *Source* Reproduced from CoastalWiki, Flanders Marine Institute

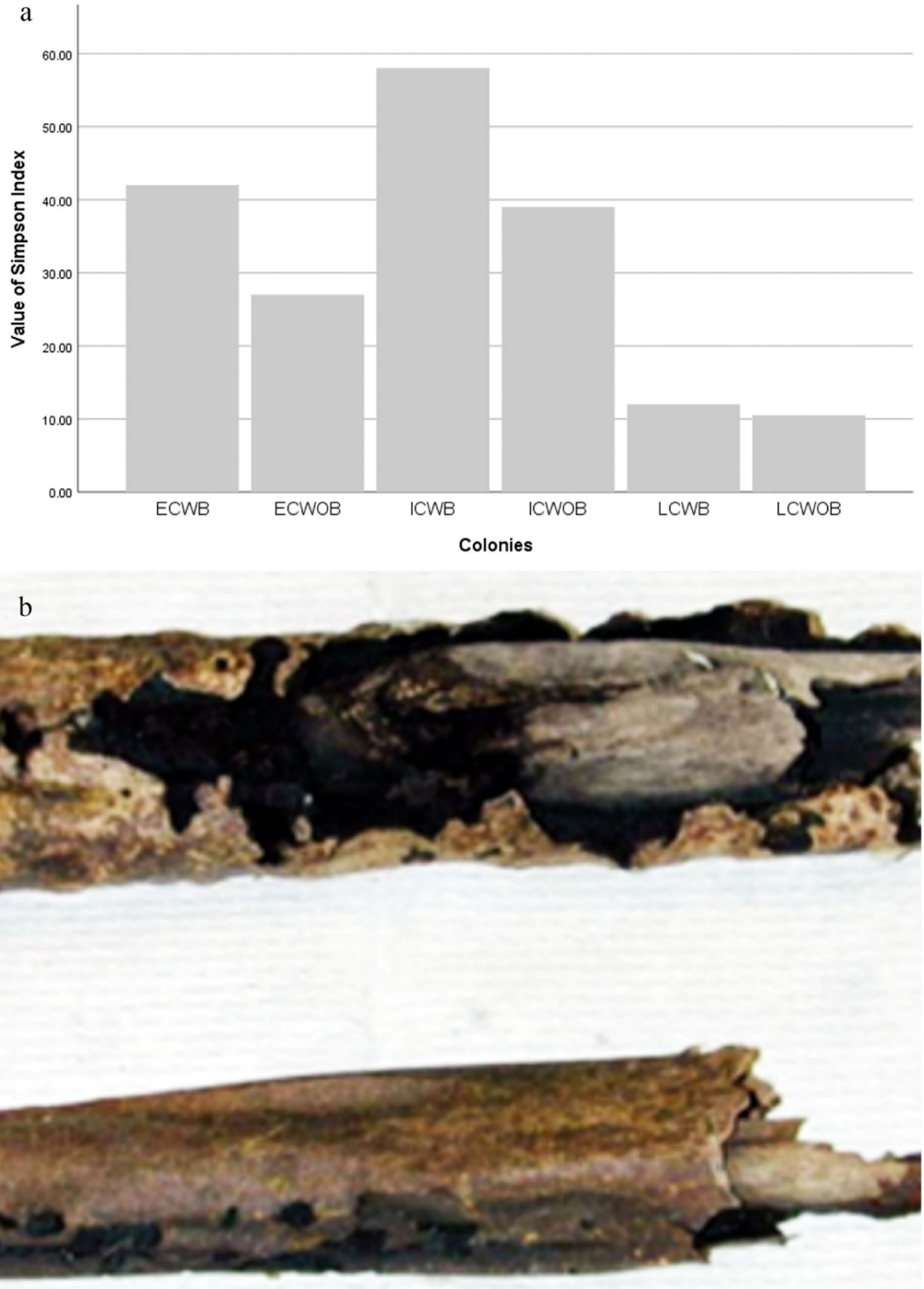
Bengal (Ravikumar and Vittal 1996; Sarma and Vittal 1998–99, 2000; Devadatha et al. 2017, 2018a, b, 2019). Our understanding of mangrove fungal diversity and discovery rate of new mangrove fungal species are growing rapidly. The current taxonomic approaches include powerful molecular methods to reveal the evolutionary relationships of marine fungi (Hongsanan et al. 2017, 2020a, b). A total of 850 mangrove fungi are included in our list of which 649 are known by both morphology and molecular phylogeny, while the remaining have only morphological information.

Spatafora and Blackwell (1994) were the first to study the phylogeny of the marine fungus, *Halosphaeriopsis mediosetigera* (Halosphaeriaceae). Subsequently, phylogenetic analyses examined the relationships of a number of marine fungal taxa at the ordinal level and at the genus/species level. The order Halosphaeriales was introduced by Hawksworth and Eriksson (1986) and then accepted by Spatafora et al. (1998), Sakayaroj et al. (2005), Zhang et al. (2006) and Tang et al. (2007). Hibbett et al. (2007) rejected the ordinal position of Halosphaeriales and referred it as a family Halosphaeriaceae in Microascales. Over the past two decades, the application of molecular techniques to study the evolutionary relationship of organisms has advanced considerably with the higher order classification of the group supported by molecular data (Jones et al. 2009, 2015, 2019a, b; Hongsanan et al. 2017, 2020a, b). Hongsanan et al. (2017) updated backbone phylogenetic tree for Sordariomycetes and suggested changes to this class based on divergence times. Hyde et al. (2020) listed 45 orders, 167 families and 1499 genera and provided an updated phylogenetic tree for Sordariomycetes. Liu et al. (2017) updated strategies of using divergence estimates in the classification of Dothideomycetes. Hongsanan et al. (2020a) accepted three orders with 25 families in Dothideomycetidae and four orders with 94 families in Pleosporomycetidae based on a multigene phylogenetic tree. Hongsanan et al. (2020b) listed 31 orders comprising 50 families as orders *incertae sedis* in Dothideomycetes and 41 families are assigned as families *incertae sedis* due to lack of morphological and molecular evidence. Chemotaxonomy utilizes secondary metabolite profiling for differentiation among filamentous fungi (Frisvad et al. 2008). Species of filamentous fungi in most genera of ascomycetes and basidiomycetes, produce highly species-specific profiles of secondary metabolites (Frisvad et al. 2008). Chemotaxonomy appears to be a decent source for fungal classification, generally in combination with polyphasic methods and multi-locus phylogeny (Frisvad 2015). Pyrosequencing and metagenomics have added another dimension in the characterization of the marine fungal communities, although much remains to be done in coastal waters and particularly mangrove ecosystems (Richards et al. 2012; Arfi et al. 2012a, b; Amend et al. 2019).

Sampling methods, strategies and limitations

Samples commonly collected for mangrove fungi include: algae, corals, dead animals, driftwood, living and decaying leaves, roots and submerged branches, mangrove wood, soil or sediment and water (Kohlmeyer and Kohlmeyer 1979; Jones et al. 2009). There are limitations to the sampling methods used to document the occurrence and distribution of mangrove fungi. Generally, they are a one-off collection at a location and a limited number of samples taken e.g. Southern China (Vrijmoed et al. 1996). However, a number of locations have been repeatedly studied: Australia (Hyde 1990a; Kohlmeyer and Volkmann-Kohlmeyer 1991), Kampong Danu and Kampong Kapok mangroves, Brunei (Hyde 1990b, 1991), Kuala Selangor and Morib mangroves, Malaysia (Alias and Jones 2000a, Alias et al. 2010), Mai Po, Hong Kong (Vrijmoed et al. 1994a, b; Sadaba et al. 1995), Seychelles (Hyde and Jones 1989), India (Sarma et al. 2001; Devadatha et al. 2017, 2019) and Thailand (Sangtiean et al. 2014; Suetrong et al. 2016), however, in most cases only lignicolous substrates were sampled.

Numerous factors determine the biodiversity of mangrove fungi: sample size; diversity and size of the mangrove forest, availability of decayed wood; nature of the host tissue; time exposed to seawater; tidal amplitude, succession on the substrate; fungal interaction and horizontal or vertical zonation of fungi, physical and chemical parameters such as hydrostatic pressure, light, osmotic effects, oxygen level, pH, pollutants, salinity and temperature (Kohlmeyer and Volkmann-Kohlmeyer 1989; Jones 2000; Schmit and Shearer 2004). Kohlmeyer and Kohlmeyer (1979) recommended to collect the wood samples that have been in a marine habitat for many weeks as indicated by the attack of marine fouling or boring organisms. Jones and Hyde (1988) discussed the disadvantage of random collections, namely only sporulating species can be identified, the method does not give good qualitative data, and host substrate is not known unless subjected to anatomical examination of the host substrate. However, in the case of identifying unknown living substrates, molecular methods are accurate. Most of the studies on mangrove fungi involve the collection of the trapped or decayed wood, all variable in sample number and size (Kohlmeyer and Kohlmeyer 1979; Hyde 1990b; Alias and Jones 2000a). Besitulo et al. (2002) advocated 400 samples for each site to establish the total diversity at that location. Sarma and Hyde (2001) have suggested a protocol for sampling of marine fungi in a mangrove, namely all the key mangrove trees should be sampled by collecting equal number of samples, with collections from three vertical zones, three


a
Value of Simpson Index
60.00
50.00
40.00
30.00
20.00
10.00
0.00
ECWB
ECWOB
ICWB
ICWOB
LCWB
LCWOB
Colonies
b

◂**Fig. 2** **a** Species diversity on exposed barked and debarked *Rhizophora apiculata* twigs ECWB early colonizers with bark; ECWOB early colonizers without bark; ICWB intermediate colonizers with bark; ICWOB intermediate colonizers without bark; LCWB late colonizers with bark: LCWOB late colonizers without bark, **b** Twigs after exposure showing a loose bark layer surrounding a central xylem core

salinity zones and three seasons resulting in the need to make 270 samples per tree species. They further advised that the minimum samples over a 2-year (seasons) period should be of the order of 1000 to 2000. However, only a few studies on the occurrence of mangrove fungi come any way near to this total number of samples due to the logistics involved.

Mangrove sediments or soil samples are rich in organic matter and are collected with a soil-hole borer from a depth of 2 cm, placed in sterile plastic bags and stored at 4 °C until use (Rai et al. 1969; Nayak et al. 2011). Water specimens under the surface can be collected in sterile plastic bottles at the intertidal zone, at a distance of 1 m from the shore and depth of 0.5 m (Nayak et al. 2011).

Meyers and Reynolds (1958) were the first to advocate baiting techniques to investigate the colonization and succession of mangrove fungi, which was later followed by Jones (1963) and Byrne and Jones (1974). The advantage of baiting includes: sequence of colonization and sporulating stages can be followed; fungi present at specific locations and species or type of substrate can be determined and physical and physiological activities of fungi can be measured. However, Kohlmeyer and Kohlmeyer (1979), Jones and Hyde (1988) and Tan et al. (1989a) noted that fewer species are identified from baits than randomly collected samples. Clearly, a number of sampling strategies are required in the study of the ecology of marine fungi (Amend et al. 2019; Overy et al. 2019).

Studies on frequency of mangrove fungi have differences in the number of samples collected and examined. A study with a larger number of samples results in a distinct percentage of occurrence than a study with a smaller number of samples. Sarma and Hyde (2001) proposed that a minimum 540–1060 samples should be collected for one season and 1000–2000 for 2 seasons (wet and dry). However, the number of samples collected will depend on the accessibility of substrata and other logistics. Different mangrove plant samples should be collected in order to avoid duplication and uniform sample size should be followed. The discovery of new species rate increases with examination of more samples, different substrata collected, mangrove plant species, site with local environmental factors and microcosms (Sarma and Hyde 2001).

Succession studies of mangrove fungi

A number of studies have exposed submerged test panels/blocks of mangrove wood of fixed dimensions in the field and their recovery at regular intervals up to 60 weeks (Tan et al. 1989a; Leong et al. 1991; Sadaba et al. 1995; Alias and Jones 2000a). For example, Leong et al. (1991) exposed wood samples by splitting young *Bruguiera cylindrica* and *Rhizophora apiculata* stems (5–7 cm girth, 8 cm length), into quarters so that each sample contained two sides of wood pieces with intact bark or exposed wood on surfaces, at Mandai mangrove, Singapore. Some species were early colonisers (6–18 weeks) e.g. *Verruculina enalia* (as *Didymosphaeria enalia*, ≡ *Lojkania enalia*), *Lignincola laevis*, *Payosphaeria minuta*, others appeared in the intermediate phase (22–32 weeks) e.g. *Halosarpheia marina*, *Halorosellinia oceanica* (as *Hypoxlyon oceanicum*), *Savoryella paucispora*, while others were late colonisers (37–60 weeks) e.g. *Nais inornata*, *Sclerococcum haliotrephum* (as *Dactylospora haliotrepha*) and *Aigialus mangrovis* on *B. cylindrica*.

Tan et al. (1989a) also noted that dominant species on two other timbers (*Avicennia alba* and *A. lanata*) were *V. enalia*, *Lulworthi*a sp.1, and *Lignincola laevis.* The mangrove fungi inhabiting the two timbers exhibited a pattern of succession, with *L. laevis* as an early colonizer, *V. enalia* and *Lulworthia* sp. 1 as intermediate colonizers and *A. parvus* a late colonizer (Tan et al. 1989a). These studies showed a succession in the sporulation of the fungi with distinct differences between the timbers investigated. Fewer species and a lower occurrence were recorded on the *Avicennia* timber samples (21 species) with 32 fungi colonising the *B. cylindrica* and *Rh. apiculata* timbers. Random collections of 188 drift mangrove wood at the same site yielded 42 species with *Natantispora retorquens* and *Lignincola laevis* the most common taxa (Tan et al. 1989a).

Alias and Jones (2000a) conducted a similar study by exposing test blocks (5 × 1 × 1 cm) of *Avicennia marina* and *Bruguiera parviflora* at Kuala Selangor mangrove, Malaysia, and their retrieval at intervals of 6–18 weeks. Sixty-one taxa were identified from 486 test blocks. The percentage occurrence of fungi on wood was very high, 50% colonization in the early stage (6–18 weeks) and 100% at the intermediate stage (26–54 weeks) and the late stage (60–96 weeks). The number of fungi per sample was lower at the early stage 1.8–4.2; with 6–8 at the intermediate stage and 4–7 during the late stages. Total number of species on *Avicennia marina* and *Bruguiera parviflora* were 45 and 54 species, respectively, with little evidence of host specificity. There was a clear pattern of colonisation on both timbers, with *Halosarpheia marina*, *Lignincola laevis*, *Natantispora* *retorquens*, *Neptunella longirostris* and *Sammeyersia grandispora* as early colonizers. Intermediate colonisers were *Halocyphina villosa*, *Saagaromyces ratnagiriensis*, *Savoryella lignicola* and *Verruculina enalia*, while late colonisers included *Aigialus parvus*, *Dyfrolomyces marinospora* (as *Saccardoella marinospora*) and *Quintaria lignatilis*. There were clear differences between the fungi colonising timbers at Kuala Selangor and those on twigs exposed at Mandai (Singapore) mangrove.

Alias and Jones (unpublished data) compared the fungal colonization of *Rhizophora apiculata* twigs (with and without bark-decorticated) exposed at Kuala Selangor mangrove stand (Malaysia) for up to 92 weeks. The sequence of colonization was divided into three arbitrary stages: early (6–18 weeks of exposure), intermediate (26–54 weeks) and late colonization (60–96 weeks). They showed that the presence of bark on the wood markedly affected the development of fungal communities. Not only were there more fungi present on the barked wood, but percentage colonization was also much higher in contrast with the decorticated wood (Fig. 2). However, there was no evidence that these were restricted to the barked substratum as these fungi have also been collected on other woody tissues. Hyde (1991) also noted that more fungi were present on the bark of *R. apiculata* poles exposed in Kampong Kapok mangrove, Brunei, while the fungi on *Xylocarpus granatum* were more numerous on the exposed xylem tissue.

The healthy growth of mangrove tree seedlings is vital for the regeneration of forests, especially those destroyed by hurricanes, and discarded fish and prawn ponds. Twenty-one fungi are reported from mangrove seedlings (Table 1). However, the most comprehensive study on *Rhizophora mangle* seedlings is that of Newell (1976) who listed 84 fungi, but not all were identified to species level and many occurred only very infrequently. The three most common fungi were *Cladosporium cladosporioides*, *Pestalotia* sp., and *Sammeyersia grandispora* (Newell 1976). Newell (1976) identified four seral stages in the colonisation of *Rhizophora* seedlings: Seral stage 1: Phyloplane fungi as on the parent trees; seral stage 2: a decrease in the number of phylloplane fungi and emergence of a number of new species: *Septonema* sp., *Aspergillus repens*, *Cephalosporium* sp., *Colletotrichum* sp. and a *Phoma* sp. None of these were present on the pre-abscission seedlings; seral stage 3: *Sammeyersia grandispora* and *Lulwoana uniseptata* (as *Zalerion maritima*) appeared on the seedlings and rose to dominant frequency; seral stage 4: the dominant species in stage 3 showed a marked increase in frequency with the appearance of two new species: *Trichoderma viride* and *Penicillium roseopurpureum*. In the initial phases phylloplane and terrestrial asexual fungi were dominant. In the last phases these fungi disappeared and were substituted by facultative and obligate marine fungi (Newell 1976). The percentage of occurrence of sexual and asexual morphs according to the succession stages were not studied yet based on the earlier studies. However, frequent mangrove fungi on different stages of succession of mangrove wood were recorded in various studies. Alias and Jones (2000a) reported the succession patterns of mangrove fungi on *Avicennia marina* and *Bruguiera parviflora* wood: early and late colonization of sexual morphs and intermediate colonization of both sexual and asexual morphs. Leong et al. (1991) reported the colonization of sexual morphs in different stages of succession in the decomposition of *Avicennia alba* wood. Both sexual and asexual morphs are involved in the different stages of succession of *Avicennia officinalis* wood (Maria and Sridhar 2003). Poonyth et al. (2001) found both sexual and asexual morphs during the various stages of decomposition of *Bruguiera gymnorrhiza* and *Rhizophora mucronata.* Sarma and Vittal (2017) have studied the seasonal occurrence of sexual and asexual morphs of marine fungi in Godavari and Krishna mangroves. They found that the percentage occurrence of sexual morphs is higher during dry season and that of asexual morphs in wet season. Fungi colonising various mangrove seeds are illustrated in Fig. 3a–d.

Vertical and horizontal zonation of mangrove fungi

Another variable to consider when documenting the occurrence of mangrove fungi is whether they are vertically distributed. Alias and Jones (2000b) studied vertical distribution of mangrove fungi on *Rhizophora apiculata* trees at two mangroves in Malaysia. Prop roots, subterranean roots and overhanging branches of *R. apiculata* were collected at three intertidal levels: upper (high water mark), middle and lower. There was evidence that fungi were vertically distributed with *Pyrenographa xylographoides*, *Halojullela avicenniae* and *Aigialus grandis* occurring in the upper level and with *Sammeyersia grandispora*, *Hydea pygmea* (as *Cirrenalia pygmea*) and *Verruculina enalia* more prevalent at the lower level. Some species, such as *Leptosphaeria australiensis* and *Halocyphina villosa* occurring at all levels. These differences can be attributed to several factors and the topic requires further study. Sadaba et al. (1995) observed vertical distribution of fungi on *Acanthus ilicifolius* at Mai Po mangrove, Hong Kong (Fig. 3i, j). The apical portions were colonised by typical terrestrial fungi (*Acremonium* sp, *Colletotrichum gloeosprioides Corynespora cassiicola*, *Fusarium* sp., *Phialophora* sp., *Tubercularia* sp.) and the basal portions by mangrove fungi (*Aniptodera chesapeakensis*, *Halosarphea marina*, *Halosphaeriopsis mediosetigera*, *Lignincola laevis*, *Natantispora retorquens*). They found that the asexual morphs (32) are dominant in contrast to sexual morphs (12) (Sadaba et al. 1995). This was attributed to tissue type and varying degree of exposure to tidal inundation governing species distribution along the vertical line. Similar observations have been made for the intertidal estuarine fungi on *Phragmites communis*, also in Hong Kong (Poon and Hyde 1998). Those occurring in the intertidal level of mangroves can discharge their ascospores forcibly, especially those with bitunicate asci: *Halojullela avicenniae*, *Pyrenographa xylographoides* and *Verruculina enalia*, while those with deliquescing asci discharge their ascospores passively: *Antennospora quadricornuta* and *Torpedospora radiata*. Fungi growing above mean tide are exposed to harsher conditions and they are exposed for long periods and subject to desiccation and sunlight, as well as variation in salinity. During dry periods the salinity is higher, but in the monsoon season, mangroves are subject to freshwater.

Hyde et al. (1990) also investigated the vertical distribution of intertidal fungi on *Rhizophora apiculata* at Ranong mangrove and found *Kallichroma tethys*, *Morosphaeria ramunculicola* (=*Massarina ramunculicola*), *Phialophorophoma* cf. *litoralis* and *Savoryella longispora* as the 'most common' species above mean tide, and *Phomopsis mangrovei*, *Sammeyersia grandispora* and *Verruculina enalia* as 'common' below mean tide. Twenty-two taxa were found restricted to above mean tide, 13 occurred throughout the tidal range and 3 were confined to below mean tide. The presence of bark was also important in determining the fungal community found on *Rhizophora* samples: above mean tide, young roots with bark were colonized by *Dyfrolomyces mangrovei* (=*Saccardoella mangrovei*), *Morosphaeria ramunculicola* and *Rhizophila marina* while below mean tide *Sammeyersia grandispora* and a *Phomopsis* species dominated. Hyde (1988) collected intertidal prop roots, subterranean roots and overhanging branches of *Rhizophora apiculata* and *R. mucronata* at three levels in Kampong Danau mangrove, Brunei (upper level, mid level and low level). Forty-one taxa were identified with some species present at all levels viz., *Halocyphina villosa*, *Leptosphaeria australiensis* and *Sammeyersia grandispora*. Others appeared to be vertically distributed: upper level *Cytospora rhizophorae* and *Lignincola tropica*; mid-level *Aigialus parvus*, *Morosphaeria velatopsora* and lower level *Antennospora quadricornuta* and *Trichocladium alopallonella*. This distribution pattern was attributed to difference in submergence to seawater and exposure to air, especially at the upper level. A similar study was undertaken at Kampong Kapok mangrove, Brunei at four levels. Vertical zonation was less apparent, but *Dictyosporium pelagicum* and *Halorosellinia oceanica* were only recorded at the upper level and *A. quadriconuta* and *Thalassogena sphaerica* present only at the lower level.

Sarma and Vittal (2002) investigated the vertical distribution of fungi on the prop roots of *Rhizophora apiculata* and found that certain fungi have an affinity towards a particular level. Thus *Lulworthia* sp., *Hydea pygmea* and *Halocyphina villosa* had higher percentage occurrence at submerged level, while a *Halosarpheia* sp., *L. australiensis* and *S. ratnagiriensis* in the intertidal region and *Epicoccum purpurascens* and *Trimmatostroma* sp. at high tide level were recorded in more numbers at the respective levels. Some fungi had their occurrence throughout the tidal range, for example, *Hysterium* sp., *Sclerococcum haliotrephum*, *Massarina* sp., *Periconia prolifica*, *Phoma* sp. and *Monodictys pelagica* with differences in percentage occurrence. Besitulo et al. (2002) investigating the vertical distribution on *Rhizophora* spp. found more diversity at the upper tidal level i.e. 25 specie (representing the intertidal level) while only 17 species were found in the lower tidal level (representing the submerged samples). They also investigated the vertical zonation of fungi on *Xylocarpon granatum.* Samples from the lower tidal level supported a higher number of fungal species (17) when compared to the upper tidal level (8). This is in contrast to *Rhizophora* sp. where more species were recorded at upper tidal level. *Acrocordiopsis patilii* and *Lignincola tropica* were confined to the lower level. Species common to both levels were *Coronopapilla mangrovei*, *Passeriniella savoryellopsis*, *Phialophorophoma litoralis* and *Swampomyces* sp.

Hyde and Sarma (2006) investigated vertical distribution of fungi on fronds and leaves of *Nypa fruticans* at three levels: submerged, intertidal and terrestrial. The greatest number of species (32) were recorded in the submerged zone, followed by intertidal zone (25) and terrestrial zone (9).

Spatial variations in the form of horizontal distribution in aquatic ecosystems are rare and often from none mangrove studies (Jones and Oliver 1964; Shearer 1972; Byrne and Jones 1975; Fryar et al. 2004; Tsui and Hyde 2004). Hyde and Lee (1995) opined that very few investigations consider the effect of salinity on the mycota in mangrove forests. In a study of mangrove fungi on decaying wood samples along five sites on the Tutong River and its tributary, the Sungai Kelakas, Fryar et al. (2004) found that species distributions were correlated to the salinity gradient. Seven species viz., *Annulatascus velatisporus*, *Aquaticola longicola*, *Cancellidium applanatum*, *Fluviatispora reticulata*, *Lasiosphaeria* sp.1, *Sporidesmium cf. anglicum* and *Sungaiicola brachydesmiella* occurred at all sites, 11 species were unique to brackish water sites and 11 to freshwater sites. Hyde and Sarma (2006) reported on the fungi colonizing *Nypa fruticans* samples in Brunei collected at four different sites including freshwater, brackish water and sea water with mangrove fungi found at all sites. However, many fungi are unique to *Nypa* and this can be attributed to both the host itself and the often-low salinities where the palm grows (Loilong et al. 2012). Clearly mangrove fungi have wide tolerance to variation in salinity and further experimental studies are warranted.

Table 1 World wide distribution of marine fungi recorded from various sources of mangrove substrata

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Ascomycota							
#*Acanthostigma minutum* (Fuckel) Sacc	Tubeufiaceae	–	M	W	RA	Ind: AP	291
#*Achaetomium macrosporum* J.N. Rai, Wadhwani & J.P. Tewari	Chaetomiaceae	D	M	S	–	Pac: J	150, 151
Achaetomium raii Locq.-Lin.	Chaetomiaceae	D	M	S	–	Ind: WBI	82
Achaetomium sphaerocarpum J.N. Rai & H.J. Chowdhery	Chaetomiaceae	D	M	S	–	Ind: WBI	82
Acremonium alabamense Morgan-Jones	Bionectriaceae	D	M	S	–	Pac: J	150
#*Acremonium alternatum* Link	Bionectriaceae	–	E	R	RM	Ind: KA	20, 41
#*Acremonium minutisporum* (Sukapure & Thirum.) W. Gams	Bionectriaceae	D	M	S	–	Pac: J	244
Acremonium murorum (Corda) W. Gams	Bionectriaceae	D	M	R, S	AM	Pac: J	151
#*Acremonium persicinum* (Nicot) W. Gams	Bionectriaceae	I	E	L	Ea	Pac: T	310, 311
#*Acremonium rutilum* W. Gams	Bionectriaceae	D	M	S	–	Ind: OD	48
#*Acremonium zonatum* (Sawada) W. Gams	Bionectriaceae	D	M	S	–	Ind: WBI	82
#*Acrocordiopsis patilii* Borse & K.D. Hyde	Salsugineaceae	I	M	W	AA, AM, AO, RA, RM, RU, SA, SG, XG	Atl: Cu Ind: AI, ESA, Md, Mr, MI, NI Pac: A, Br, P, T	16, 18, 37, 49, 53, 54,87, 88, 89, 91, 96, 97, 105, 123, 124, 171, 272, 287, 303, 308, 337, 349
#*Acrocordiopsis sphaerica* Alias & E.B.G. Jones	Salsugineaceae	I	M	W	Sx	Pac: P	16
Acrogenospora sphaerocephala (Berk. & Broome) M.B. Ellis	Acrogenosporaceae	I	M	P	NF	Pac: T	231
#*Acrophialophora fusispora* (S.B. Saksena) Samson	Ascomycota genera *incertae sedis*	D	M	S	–	Ind: WBI	82
#*Acuminatispora palmarum* S.N. Zhang, K.D. Hyde & J.K. Liu	Pleosporales genera *incertae sedis*	I	M	P	NF	Pac: T	342
Adomia avicenniae S. Schatz	Xylariales genera *incertae sedis*	I	M	W	AM	Ind: E Pac: Br, NSW, NZ	4, 222, 294
#*Aigialus grandis* Kohlm. & S. Schatz	Aigialaceae	I, S	M	W	AC, AM, BG, Cs, RA, RA*, RM, R, RU, SA, SG, XG	Atl: Bz, SC, Tr Ind: AI, AP, Bl, Md, MI, NI, Su, Sy, TN Pac: A, Br, i, J, M, P, Si, T	14, 17, 18, 33, 49, 53, 54, 87, 88, 91, 92, 96, 97, 105, 123, 124, 158, 162, 163, 171, 193, 196, 199, 203, 214, 230, 250, 243, 281, 283, 290, 291, 308
#*Aigialus mangrovis* Borse	Aigialaceae	I	M	W	AA, AA*, AL*, AM, AO, BC*, CT, KC, LR, RA*, RM, RU, SA	Atl: Bz, F Ind:AI, AP, Mr, MI, NI, Sy, TN Pac: Br, M, Si, T	18, 29, 33, 53, 54, 49, 97, 106, 169, 230, 272, 283, 308, 315, 316, 317, 324, 371
#*Aigialus parvus* S. Schatz & Kohlm.	Aigialaceae	I	M	D, W	AA, AA*, AL*, AM, AM*, BC*, BG*, KC, RA, RA*, RM, RU, SA, SG	Atl: F, SC Ind: AI, AP, E, Md, MI, NI, Su, TN Pac: A, Br, M, P, Si, T, Tw	4, 14, 16, 17, 18, 29, 33, 53, 54, 87, 88, 91, 92, 93, 96, 97, 105, 123, 162, 163, 169, 171, 193, 200, 203, 230, 260, 291, 308, 315, 316, 317
#*Aigialus rhizophorae* Borse	Aigialaceae	I	M	W	RU	Ind: MI	29, 33, 97, 158
Aigialus striatispora K.D. Hyde	Aigialaceae	I	M	W	RA	Pac: T	107, 124

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Akanthomyces lecanii (Zimm.) Spatafora, Kepler & B. Shrestha	Cordycipitaceae	D	M	S	–	Ind: WBI	82
#*Alternaria alternata* (Fr.) Keissl.	Pleosporaceae	D, I	E, M	R, S, T,	AI, PA, RM, RS, SA, So	Atl: Bz, SC, Tr Ind: AI, AP, Bl, Md, MI, NI, Su, Sy, TN Pac: Br, Ch, M, Si	41, 151, 257, 269, 270, 280, 353, 354
#*Alternaria atra* (Preuss) Woudenb. & Crous	Pleosporaceae	–	M	R	–	Ind: KA	19
#*Alternaria chartarum* Preuss	Pleosporaceae	D	M	W, S	AI, AO, BG, RM, SC	Ind: KA, KE, OD, WB	21, 22, 41, 48, 241, 268, 275
#*Alternaria chlamydospora* Mouch	Pleosporaceae	–	E	L, R	AI	Ind: KA	242
#*Alternaria humicola* Oudem.	Pleosporaceae	D	M	S	–	Ind: WBI	82
#*Alternaria maritima* G.K. Sutherl.	Pleosporaceae	I	M	V, W	AI, PM	Pac: Ch Ind: KE, Pa	80, 353, 360
#*Amarenographium solium* Abdel-Wahab, Hodhod, Bahkali & K.D. Hyde	Phaeosphaeriaceae	I	M	W	AM	Ind: SB	7
#*Amesia nigricolor* (L.M. Ames) X. Wei Wang & Samson	Chaetomiaceae	D	M	S	–	Ind: WBI	279
#*Amorphotheca resinae* Parbery	Amorphothecaceae	D	M	S	–	Pac: H	218
#*Amphisphaeria mangrovei* Devadatha & V.V. Sarma	Amphisphaeriaceae	I	M	W	SM	Ind: Mu	273
#*Aniptodera chesapeakensis* Shearer & M.A. Miller	Halosphaeriaceae	I	M	D, I, P, W	AA, AA*, AI, AM, AC, AO, AS, BC*, NF, PA, RA, RA*, RM, RU, SA, SG, XG*	Atl: Bz, Cu Ind: AI, AP, GJ, MI, Mr, SA, SL, Su, SY Pac: Br, Ch, J, M, NSW, P, SI, T, Tw, WM	14,16, 18,22, 30, 33, 49, 53, 64, 81, 86, 87, 88, 98 142, 162, 260, 272, 285, 287, 308, 353
Aniptodera haispora Vrijmoed, K.D. Hyde & E.B.G. Jones	Halosphaeriaceae	I	M	W	AO, Ax, RA, RM	Atl: Cu Ind: AP Pac: Ch	287, 291, 325, 326, 353
Aniptodera intermedia K.D. Hyde & Alias	Halosphaeriaceae	I	M	P	NF, RM	Atl: Cu Pac: M, P, Tw Ind: WBI	18, 49, 120, 127, 142, 260, 287, 296
#*Aniptodera juncicola* Volkm. -Kohlm.	Halosphaeriaceae	I	M	W	AM, AI, AO, BG, RA, RM, SC	Ind: GI, AP, KA, KE, LI, PM, SA	81, 238, 297
Aniptodera lignicola K.D. Hyde, W.H. Ho & K.M. Tsui	Halosphaeriaceae	I	M	W	UM	Ind: TN Pac: Ch	40, 326
Aniptodera limnetica Shearer	Halosphaeriaceae	I, S	M	W	AM, BG	Ind: E Pac: J	4, 243, 353
Aniptodera mangrovei K.D. Hyde	Halosphaeriaceae	I	M	I, P, W	AA, AO, AS, BP*, KC, NF, RA, RM, RU, SA, XG	Atl: Cu Ind: AI, AP, E, Mr, Su, Sy Pac: Br, Ch, M, NSW, P, Si, T	4, 14, 16, 18, 54, 87, 91-93, 96-98, 106, 123, 125, 142, 158, 162, 272, 291, 308, 315, 317, 318, 325, 353
Aniptodera megalospora K.D. Hyde, W.H. Ho & K.M. Tsui,	Halosphaeriaceae	I	M	W	UM	Pac: Ch	353
Aniptodera nypae K.D. Hyde	Halosphaeriaceae	I	M	P	NF	Pac: M, T	18, 115, 142, 287,
Aniptodera salsuginosa Nakagiri & Tad. Ito,	Halosphaeriaceae	I	M	W	BG, RM, RS	Atl: Cu Pac: J, M, T	245, 287, 308, 353, 370

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Aniptosporopsis lignatilis (K.D. Hyde) K.L. Pang, C.L. Lu, W.T. Ju & E.B.G. Jones	Halosphaeriaceae	I, S	M	W	AM, BP, RA, RS, RU	Atl: Cu, USA Ind: AI, Mr, Sy SA Pac: Ch, J, M, P, T, Tw	49, 81, 173, 243, 260, 287,308, 326, 327, 353
Anisostagma rotundatum K.R.L. Petersen & Jørg. Koch	Halosphaeriaceae	I	M	W	AM	Ind: SA	81
#*Annabella australiensis* Fryar, Haelew. & D.E.A. Catches	Cordieritidaceae	I	M	W	AM	Pac: A	81
#*Annulohypoxylon atroroseum* (J.D. Rogers) Y.M. Ju, J.D. Rogers & H.M. Hsieh	Hypoxylaceae	I	E	L	HO	Pac: T	311
#*Annulohypoxylon bovei* (Speg.) Y.M. Ju, J.D. Rogers & H.M. Hsieh	Hypoxylaceae	I	M	W	UM	Pac: Ch, M, Sw Tw	338
#*Antennospora quadricornuta* (Cribb & J.W. Cribb) T.W. Johnson	Halosphaeriaceae	I	M	W	AA*, AG, AL, AM, AM*, BC*, BP*, CE, HT, LR, Pc, Px, RA, RM, RR, RU, SD, SG, Wb	Atl: An, Ba, Bd, Brz, C, Cu, EM, F, Gh, Ha, Lb, Mq, Pn, PR, SC, Sj, Tg, Tr, Tx, Vz Ind: AI, E, GJ, Jv, K, KA, KE, Md, MI, Mr, Mz, SB, SL, Su, Sy, TN, Y Pac: A, Br, Ch, Fi, G, H, J, M, P, Si, So, T, TA, Tw, WM	4, 7, 14, 16, 17, 21, 26, 33, 49, 51–54, 57, 59, 64, 86–89, 91, 93, 94, 96–98, 100, 123, 124, 154, 162, 169, 177, 180, 182-185, 187, 192, 196, 197, 199, 213, 214, 233, 248, 255, 260, 268, 272, 306, 308, 309, 315, 317, 321–324, 325, 331, 340, 341, 353, 370, 371
Anthostomella eructans Ellis & Everh.	Xylariaceae	–	M	D, P	NF	Pac: Br	142
Anthostomella leptospora (Sacc.) S.M. Francis	Xylariaceae	–	M	W	AM, RA	Ind: AP	291
Anthostomella nypae K.D. Hyde, B. S Lu & Alias	Xylariaceae	I	M	P	NF	Pac: Br, M, T	18, 49, 120
Anthostomella nypensis K.D. Hyde, B. S Lu & Alias	Xylariaceae	I	M	P	NF	Pac: Br, M	18, 49, 120, 142, 251
Anthostomella nypicola K.D. Hyde, B. S Lu & Alias	Xylariaceae	I	M	P	NF	Pac: M	18, 120
Apioclypea nypicola K. D. Hyde, J. Forhl & E. Taylor	Xylariaceae	I	M	P	NF	Pac: M	18, 120
#*Arcopilus aureus* (Chivers) X. Wei Wang & Samson	Chaetomiaceae	D	M	S	–	Pac: J	150
Arecophila nypae K. D. Hyde	Cainiaceae	I	M	P	NF	Pac: M	118, 120
#*Arenariomyces majusculus* Kohlm. & Volkm. -Kohlm.	Halosphaeriaceae	I	M	W	AM	Atl: Ba, Bd, Brz, Bz, Cu, EM, F, Mq, Sr, Tg, Tr Ind: ESA, KE, MI, SL, Sy Pac: Br, Ch, M, NSW, P, Si	287, 51, 64, 200, 238, 275, 281, 40, 252
#*Arenariomyces parvulus* Jørg. Koch	Halosphaeriaceae	I	M	W	–	Atl: Cu, SC, EM Pac: A, H, Fi, Si, So, T, Tw, WM	22, 260, 287, 176, 199, 200, 201, 214, 228
#*Arenariomyces trifurcatus* Höhnk,	Halosphaeriaceae	D, I, S	M	S, W, X	CR, HT, RM	Atl: Ba, Bd, Bz, Cu, EM, F, Mq, Sr, Tg, Tr Ind: ESA, KE, MI, SL, Sy, TN Pac: A, Br, Ch, Fi, G, H, J, P, T, Tw, WM	16, 26, 33, 57, 64, 86, 87, 88, 93, 123, 124, 131, 176, 177, 180, 181, 183, 184, 191, 196, 197, 200, 213, 214, 248, 259, 260, 287, 303, 321, 322, 328,

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Arthrinium phaeospermum* (Corda) M.B. Ellis	Apiosporaceae	D	M	S	–	Pac: J	150, 151, 246
#*Arthrobotrys arthrobotryoides* (Berl.) Lindau	Orbiliaceae	I	M	D	–	Pac: Ch	353, 314
Arthrobotrys brochopagus (Drechsler) S. Schenck, W.B. Kendr. & Pramer	Orbiliaceae	I	M	D	–	Pac: Ch	353, 314
#*Arthrobotrys cladodes* Drechsler	Orbiliaceae	I	M	D, W	–	Pac: Ch	353, 314
Arthrobotrys dactyloides Dreschler	Orbiliaceae	I	M	D	RM	Atl: Brz	25, 353, 314
Arthrobotrys eudermatus (Drechsler) M. Scholler, Hagedorn & A. Rubner	Orbiliaceae	I	M	D, W	–	Pac: Ch	353, 314
Arthrobotrys irregularis (Matr.) Mekht.	Orbiliaceae	I	M	D, W	–	Pac: Ch	314, 353
#*Arthrobotrys javanicus* (Rifai & R.C. Cooke) Jarow	Orbiliaceae	I	M	D	–	Pac: Ch	314, 353
Arthrobotrys musiformis Drechsler	Orbiliaceae	I	M	D, W	–	Pac: Ch	314, 353
#*Arthrobotrys oligosporus* Fresen.	Orbiliaceae	I	M	D, W	–	Pac: Ch, M	14, 25, 353
#*Arthrobotrys polycephalus* (Drechsler) Rifai	Orbiliaceae	I	M	D	–	Pac: Ch	314, 353
#*Arthrobotrys pyriformis* (Juniper) Schenk, W.B. Kendr. & Pramer	Orbiliaceae	I	M	D, W	–	Pac: Ch	314, 353
Arthrobotrys thaumasius (Drechsler) S. Schenck, W.B. Kendr. & Pramer	Orbiliaceae	I	M	D, W	–	Pac: Ch	314, 353
#*Ascocratera manglicola* Kohlm.	Aigialaceae	I	M	W	AA, AG, AM, AO, BG, CE? Cs, LR, RA, RM, RR, RU, SA, XG	Atl: Bz, EM, Sc, Tg Ind: AI, AP, E, LI, Md, NI, TN Pac: A, Br, Ch, Fi, M, NSW, NZ, P, T	4, 18, 14, 17, 49, 51, 54, 97, 98, 105, 123, 124, 158, 196, 199, 203, 210, 214, 215, 222, 283, 291, 308, 353, 359
#*Ascocylindrica marina* Abdel-Wahab, Bahkali & E.B.G. Jones	Ascocylindricaceae	I	M	W	AM	Ind: E, SB	10, 43
#*Ascotricha chartarum* Berk	Xylariaceae	–	E	R, U	AI, AU	Ind: KA	242
#*Aspergillus aculeatus* lizuka	Aspergillaceae	–	M	R	AM	Pac: J	151
#*Aspergillus aeneus* Sappa	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus allahabadi* B.S Mehrotra & Agnihorti	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus amstelodami* Thom & Church	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus avenaceus* G. Sm.	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus aureolus Fennell & Raper*	Trichocomaceae	D	M	S	–	Ind: TN	280
#*Aspergillus brunneouniseriatus* Suj. Singh & B.K. Bakshi	Aspergillaceae	D	M	S	–	Ind: WBI	82

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Aspergillus candidus* Link	Aspergillaceae	D	M	L, S	–	Ind: AP, OD, TN, WBI Pac: H	23, 48, 218, 354
#*Aspergillus carbonarius* (Bainier) Thom	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus carneus* (Teigh.) Blochwitz	Aspergillaceae	D	M	S	–	Ind: WBI Pac: H	55, 218
#*Aspergillus chevalieri* Thom & Church	Aspergillaceae	D	M	S	–	Ind: KA, TN, WBI	55, 267, 300
#*Aspergillus clavatus* Desm.	Aspergillaceae	D	M	S	–	Ind: TN, WBI Pac: J	55, 150, 151
Aspergillus curviformis H.J Chowdhery & J.N. Rai	Aspergillaceae	D	M	S	–	Ind: TN, WBI Pac: M	55
#*Aspergillus fischeri* Wehmer	Aspergillaceae	D	M	S	–	Ind: WBI Pac: J	82, 150
Aspergillus flavescens Wreden	Aspergillaceae	D	M	S, W	AM	Ind: GI, TN, WBI Pac: M	23, 82
#*Aspergillus flavipes* (Bainier & Sartory) Thom & Church	Aspergillaceae	D	M	S	–	Ind: AP, TN, WBI Pac: H	55, 217, 218, 354
#*Aspergillus flavus* Link	Aspergillaceae	D	M	D, S L, V	–	Atl: TX, EM Ind: AP, Pa, TN, WBI Pac: M	23, 63, 354, 360
#*Aspergillus foetidus* Thom & Raper	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus fumigatus* Fresen	Aspergillaceae	D	M	L, S	–	Ind: AP, GI, WBI Pac: M	23, 82, 354
#*Aspergillus giganteus* Wehmer	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus glaucus* (L.) Link	Aspergillaceae	–	E	L	–	Ind: AP, TN	280, 354
#*Aspergillus janus* Raper & Thom	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus japonicus* Saito	Aspergillaceae	D	M	S	–	Ind: AP, WBI	55, 354
#*Aspergillus lucknowensis* J.N. Rai, J.P. Tewari & S.C. Agarwal	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus melleus* Yukawa	Aspergillaceae	D	M	S	–	Ind: WBI	82
Aspergillus montevidensis Talice & J.A. Mackinnon	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus multicolor* Sappa	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus nidulans* (Eidam) G. Winter	Aspergillaceae	D	M	S	–	Ind: AP, TN, WBI	23, 279, 151, 354
#*Aspergillus niger* Tiegh.	Aspergillaceae	D, I	E	D, S, R, T, V	AA, AG, AM, AO, RA, RU, SA, SG, XG	Atl: F, TX, EM Ind: AI, AP, GI, Pa, TN, WBI Pac: H, J, M, Si, WM	23, 55, 63, 150, 151, 178, 218, 257, 354, 359
#*Aspergillus ochraceus* G. Wilh.	Aspergillaceae	D	M	S	–	Ind: AP, WBI	55, 354
#*Aspergillus panamensis* Raper & Thom	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus paradoxus* Fennell & Raper	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus parasiticus* Speare	Aspergillaceae	D	E	S, R	RA, RM	Ind: AI, KA, WBI	55, 319

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Aspergillus penicilliformis* Kamyschko	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus penicillioides* Mukerji & V.R. Rao	Aspergillaceae	I	E	L	Ea	Pac: T	366
#*Aspergillus phoenicis* (Codra) Thom & Curie	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus puniceus* (Corda) Thorn & Curie	Aspergillaceae	D	M	S	–	Ind: WBI	55
Aspergillus repens (Corda) Sacc.	Aspergillaceae	–	M	T	RM	Atl: F	257
#*Aspergillus ruber* (Jos. König, Spieck. & W. Bremer) Thom & Church	Aspergillaceae	D	M	S	–	Ind: WBI Pac: J	55, 150, 279
#*Aspergillus rugulosus* Thom & Raper	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus sclerotiorum* G.A. Huber	Aspergillaceae	D	M	S	–	Ind: WBI Pac: H	218
#*Aspergillus stellatus* Cruzi	Aspergillaceae	D	M	S	–	Ind: WBI	279
#*Aspergillus striatus* J.N. Rai, J.P. Tewari & Mukerji	Aspergillaceae	D	M	S	–	Ind: WBI	279
#*Aspergillus sulphureus* (Fres.) Thorn & Church	Aspergillaceae	D	M	S, V	–	Ind: Pa, WBI	82
#*Aspergillus tamarii* Kita	Aspergillaceae	–	M	–	CC	Ind: KA	41
#*Aspergillus terreus* Thorn	Aspergillaceae	D, I, S	M	D, S, T	AG, AM, RM	Atl: EM, F, TX, Ind: GI, TN, WBI Pac: J, M, WM	23, 55, 63, 82, 150, 178, 253, 257, 279
#*Aspergillus tubingensis* Mosseray	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus unguis* (Emile-Weil & L. Gaudin) Thorn & Raper	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Aspergillus ustus* (Bainier) Thom & Church	Aspergillaceae	D	M	S	–	Ind: WBI Pac: H	55, 218
#*Aspergillus varians* Wehmer	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus versicolor* (Vull.) Tirab.	Aspergillaceae	D	M	S	–	Ind: AP, WBI	55, 279, 354
#*Aspergillus violaceus* Fennell & Raper	Aspergillaceae	D	M	S	–	Ind: WBI	82
#*Aspergillus wentii* Wehmer	Aspergillaceae	D	M	S	–	Ind: WBI	55
#*Asterodiscus mangrovei* Dayarathne, E.B.G. Jones & K.D. Hyde	Stigmatodiscaceae	–	M	–	UM	Pac: T	70
#*Asteromyces cruciatus* Moreau & R. Moreau	Ascomycota genera *incertae sedis*	I	M	W	AM	Atl: Cu Ind: ESA	44, 287, 303
Astrosphaeriella aquatica K.D. Hyde	Astrosphaeriellaceae	–	M	P	NF	Pac: Br	142
Astrosphaeriella asiana (K.D. Hyde) Aptroot & K.D. Hyde	Astrosphaeriellaceae	–	M	P	NF	Pac: T	120, 351

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Astrosphaeriella nypae* K.D. Hyde	Astrosphaeriellaceae	I	M	P	NF	Pac: Br, M, T	142
Astrosphaeriella striaspora (E. Müll.) D. Hawksw. & Boise	Astrosphaeriellaceae	I	M	D, P	NF, RA, RU	Ind: AI, NI, Su, Sy Pac: Br, M, T	52, 54, 88, 91, 93, 97, 109, 113, 126, 158
#*Aureobasidium pullulans* (de Bary) Arnaud	Saccotheciaceae	D, I	M	D, S, T, V	CT, RM, TT	Atl: EM, F, Vz Ind: GI, Pa, TN, WBI Pac: H, J, M, Si, WM	23, 63, 213, 254, 255, 256, 257, 359
Bactrodesmium linderi (J.L. Crane & Shearer) M.E. A & E.L. Stewart	Pleosporales genera *incertae sedis*	I	M	W	AM, BG, BP*, KC, RA, RU	Ind: AP, ESA, MI, Pac: Br, Ch, M, Si, T, Tw	3, 18, 26, 33, 86, 96, 131, 162, 259, 260, 291, 30, 308, 315, 317, 325, 326, 370
#*Bacusphaeria nypae* Norlail., Alias & Suetrong	Tirisporellaceae	I	M	P	NF	Pac: M	9
Bathyascus avicenniae Kohlm.	Halosphaeriaceae	I	M	W	AG, AM	Atl: SJ Ind: AP	54, 184, 282, 283, 291
Bathyascus grandisporus K.D. Hyde & E.B.G. Jones	Halosphaeriaceae	I	M	W	RA, RU, SA	Ind: AI, Sy Pac: Br, Ch, P, T	54, 49,87, 88, 96, 97, 123, 124, 130, 158, 283, 353
Bathyascus mangrovei Ravik. & Vittal	Halosphaeriaceae	I	M	W	Rx	Ind: TN	283
Bathyascus vermisporus Kohlm.	Halosphaeriaceae	I	M	W	–	Pac: Ch	353
Belizeana tuberculata Kohlm. & Volkm. -Kohlm.	Dothiditthiaceae	I	M	W	AM, LR, RA, RU, SA, XG	Atl: Bz, EM, Sc, Tg Ind: AI, E, NI, Sy, TN Pac: A, Br, Ch, M, NSW, T	4, 52, 54, 87, 88, 121, 123, 124, 162, 196, 203, 283, 308, 325, 326, 353
#*Biatriospora borsei* B. Devadatha & V.V. Sarma	Biatriosporaceae	I	M	W	AM	Ind: Mu	367
#*Biatriospora marina* K. D. Hyde & Borse.	Biatriosporaceae	I	M	W	AA, AM, AO, RA, RM, RU, SA, SG	Atl: Bz Ind: AI, LI, Md, MI, Mr, NI, Sy Pac: A, Br, M, NSW, T	14, 18, 33, 51, 54, 92, 121, 123, 158, 162, 163, 170, 196, 203, 268, 272, 316–318
Biconiosporella corniculata Schaumann	Lasiosphaeriaceae	–	M	W	–	Ind: KE Pac: T	170, 251, 308
Biflua physasca Jørg. Koch & E.B.G. Jones	Ascomycota genera *incertae sedis*		M	W	–	Ind: KA	22
Bisifusarium dimerum (Penz.) L. Lombard & Crous	Nectriaceae	D	M	S	–	Pac: H	218, 312
Botryophialophora marina Linder	Sclerotiniaceae	–	M	–	–	Atl: Cu	287,
#*Botrytis cinerea* Pers.	Sclerotiniaceae	D, I	M	S	–	Atl: F Ind: WBI	55, 236
#*Brachysporiella gayana* Bat.	Kirschsteiniotheliales genera *incertae sedis*	–	M	W	AO, RM, SC	Ind: KA	241
#*Camarops ustulinoides* (Henn.) Nannf., Svensk	Boliniaceae	I	M	W	Rx	Pac: T	70
Camarosporium palliatum Kohlm. & E Kohlm.	Camarosporiaceae	I, S	M	W	AA, AD, SD, SN	Ind: MI, TN	34, 36, 213
Camarosporium roumeguerei Sacc.	Camarosporiaceae	I, S	M	D, W	AA, AG, AM? AO, SB	Atl: Tx Ind: AP, ESA, K, MI Pac: Br, T, WM	33, 36, 64, 97, 178, 213, 268, 291, 303, 340
Capillataspora corticola K. D. Hyde	Dothideomycetes genera *incertae sedis*	I	M	W	RA, RA*	Pac: Br	95, 100

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Carbosphaerella leptosphaerioides I. Schmidt	Halosphaeriaceae	–	M	–	–	Pac: H, T	214,
#*Carinispora nypae* K. D. Hyde	Pseudoastrosphaeriellaceae	I	M	P	NF	Pac: Br, M, P, T	18, 49, 109, 113, 142, 143
Carinispora velatispora K. D. Hyde	Pseudoastrosphaeriellaceae	I	M	P	OT, NF	Pac: Br, T	115
#*Caryosporella rhizophorae* Kohlm.	Melanommataceae	I, S	M	W	AM, RA, RM, RR, RU	Atl: Ba, Bz, CU, SC Ind: AI, ESA, Mr, NI, Su, Sy Pac: A, Br, Fi, J, M, T, WM	64, 18, 49,87, 91, 93, 96, 97, 243, 162, 168, 188, 199, 203, 228, 233, 243, 272, 287, 303, 308, 371
#*Catabotrys deciduus* (Berk. & Broome) Seaver & Waterton	Catabotryaceae	I	M	W	RM	Ind: PO	353
#*Cephalotrichum stemonitis* (Pers.) Nees	Microascaceae	D	M	S	–	Ind: WBI	82
Ceriosporopsis cambrensis I.M. Wilson	Halosphaeriaceae	–	M	W	AM	Ind: SA Pac: Tw	81, 260
#*Ceriosporopsis capillacea* Kohlm.	Halosphaeriaceae	–	M	–	UM	Ind: KE, GA, MH	40, 249, 277
#*Ceriosporopsis halima* Linder	Halosphaeriaceae	I	M	W	Ax, Wb	Atl: Ba, Brz, EM, F, SC, Tg, Tx Ind: ESA, K, MI, SL, Sy, TN Pac: A, Ch, Br, H, M, NSW, T, Tw	26, 33, 34, 57, 64, 79, 86, 153,199, 200, 213, 214, 228, 260, 272, 303, 318, 322, 329, 330, 332, 340, 341
#*Chaetomium globosum* Kunze	Chaetomiaceae	I	M	W	–	Ind: TN Pac: Ch, M, WM	63, 269, 270
Chaetomium luteum (J.N. Rai & J.P. Tewari) P.F. Cannon	Chaetomiaceae	D	M	S	–	Ind: WBI	82
#*Chaetomium strumarium* (J.N. Rai, J.P. Tewari & Mukerji) P.F. Cannon	Chaetomiaceae	D	M	S	–	Ind: WBI	82
#*Chaetopsina aurantisalinicola* Dayarathne, E.B.G. Jones & K.D. Hyde	Nectriaceae	S	M	W	Rx	Pac: T	70
#*Chaetosphaeria mangrovei* Dayar., E.B.G. Jones & K.D. Hyde	Chaetosphaeriaceae	I	M	W	UM	Pac: T	144
Cirrenalia basiminuta Raghuk. & Zainal	Halosphaeriaceae	I	M	R, W	AA*, AI, BC*, RA, RU	Atl: Ba Ind: AI, K, LI, Mr, TN Pac: H, Ch, M, Si	14,18, 154, 158, 168, 177, 206, 214, 272, 278, 283, 285, 291, 317, 318, 353
#*Cirrenalia macrocephala* (Kohlm.) Meyers & R.T. Moore	Halosphaeriaceae	–	M	D, P, W	AM, KC, NF, RA, RM, RU, Wb	Atl: Cu, F, K, Sr, TX Ind: AP, ESA, Jv, MI, SA, SL, TN Pac: Ch, J, T	5, 12, 27, 33, 60, 81, 96, 154,177, 184,213, 283, 287, 291, 303, 309, 320, 322, 325–332, 340, 341, 353
Cirrenalia pseudomacrocephala Kohlm.	Halosphaeriaceae	I	M	D, I, T, W	AG, AM, AS, BG, BP*, RA, RA*, RM, RU, XG*	Atl: Bd, EM, F Ind: AI, Mr, Su, Sy Pac: Br, Ch, J, M, T	14, 17, 18, 54, 64, 86, 88, 91, 92, 94, 96, 97, 123, 124, 162, 180, 192, 213, 244, 257, 272, 331, 332, 353, 370
#*Cladosporium cladosporioides* (Fresen.) G.A de Vries	Cladosporiaceae	D, I	M	D, R, S, T, L	AG, HO, RM, RS	Atl: EM, F, Tx Pac: J, Ch, T, WM	63, 82, 150, 151, 178, 244, 257, 353
#*Cladosporium herbarum* (Pers.) Link	Cladosporiaceae	I	M	W	AM	Atl: EM Ind: MI Pac: WM	12, 63, 82

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Cladosporium indicum J.N. Rai, J.P. Tewari & Mukerji	Cladosporiaceae	D	M	S	–	Ind: WBI	279
#*Cladosporium macrocarpum* Preuss	Cladosporiaceae	–	M	–	UM	Ind: KA, KE, TN, PO	275
#*Cladosporium oxysporum* Berk. & M.A. Curtis	Cladosporiaceae	–	M	D, T	AG, CT	Atl: Tx Pac: M Ind: KA	20, 178, 359
#*Cladosporium psoraleae* M.B. Ellis	Cladosporiaceae	–	E	R	RM	Ind: KA	20
#*Cladosporium sphaerospermum* Penz., Michelia	Cladosporiaceae	I	E	L	Ea, HO	Pac: T	311, 366
Clavariopsis bulbosa (Anastasiou) Nakagiri & Tubaki	Dothideomycetes genera *incertae sedis*	I	M	W	AI, AM, RA*, RU, RR, XG, Pu, Tu,	Atl: Brz, Lb, Tr Ind: AI, ESA, Jv, K, Md, MI, SL, Sy, TN Pac: AS, Br, H, Ch, J, M, P, Si, T	16, 18, 26, 27, 33, 53, 54, 80, 86, 88, 92, 97, 131, 162, 176, 177, 180, 183, 184, 200, 285, 303, 317, 318, 320, 321, 323, 325, 328, 341
#*Cochliobolus geniculatus* R.R. Nelson	Pleosporaceae	–	M	W	BG	Ind: KA	241
Collemopsidium pneumatophorae (Kohlm.) Aptroot	Mycosphaerellaceae	I	M	W	AA, AM, AF, AG, AL, AO, RU	Atl: Cu Pac: Br Ind: E	4, 26, 64, 86, 97, 180, 182, 185, 187, 191,196, 197, 211, 213, 229, 277, 287, 291, 303, 309, 315–318,
Coniothyrium obiones Jaap	Coniothyriaceae	–	M	–	SG	Ind: OD	48
#*Cordyceps memorabilis* (Ces.) Ces.	Cordycipitaceae	I	E	L	Ea	Pac: T	310, 311
#*Corollospora angusta* Nakagiri & Tokura	Halosphaeriaceae	–	M	W	UM	Ind: GA, KA, TN, PO	249
#*Corollospora besarispora* Sundari	Halosphaeriaceae	I	M	W	–	Atl: Cu	287
#*Corollospora cinnamomea* Jørg. Koch	Halosphaeriaceae	–	M	W	UM	Ind: KA Pac: Tw	22, 260
#*Corollospora colossus* Nakagiri & Tokura	Halosphaeriaceae	I	M	W	–	Atl: Cu Pac: Tw	260, 287
#*Corollospora filiformis Nakagiri*	Halosphaeriaceae	–	M	–	–	Pac: Tw	260
#*Corollospora fusca* Nakagiri & Tokura	Halosphaeriaceae	D, I	M	S, W	–	Pac: H, J	200, 246
#*Corollospora gracilis* Nakagiri & Tokura	Halosphaeriaceae	I	M	W	UM	Atl: Cu	287
Corollospora indica Prasannarai, Ananda & K.R. Sridhar	Halosphaeriaceae	I	M	W	UM	Ind: GU, KA, OD, TN, PM	40, 175, 250, 252, 274
#*Corollospora intermedia* I. Schmidt	Halosphaeriaceae	–	M	C, D, W	UM	Atl: Sr Ind: GA, GU, KA, KE, TN	12, 19, 40, 252
#*Corollospora lacera* (Linder) Kohlm.	Halosphaeriaceae	–	M	D, W	UM	Atl: Sr Ind: KA	12
#*Corollospora luteola* Nakagiri & Tubaki	Halosphaeriaceae	–	M	W	UM	Ind: TN	249

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Corollospora maritima* Werderm.	Halosphaeriaceae	I	M	D, W	AM, Ca, HT, RM, Sr, TT, Wb	Atl: Ba, Bd, Brz, Bz, EM, F, Mq, SC, SJ, Sr, Tg, Tr, Tx Ind: ESA, E, K, MI, SB, SL, Sy, TN Pac: A, AS, Br, Ch, Fi, H, J, NZ, M, Si, So, Tw, WM	4, 7, 18, 26, 33, 44, 63, 64, 79, 86, 88, 92, 131, 176, 180, 199, 203, 205, 213, 214, 215, 222, 228, 260, 264, 277, 287, 303, 320, 331, 353
#*Corollospora pseudopulchella* Nakagiri & Tokura	Halosphaeriaceae	I	M	W	–	Atl: Cu	287
#*Corollospora pulchella* Kohlm., I. Schmidt & Nair	Halosphaeriaceae	I	M	P, W	PO, RA, RM, Sr	Atl: Brz, Bz, Cu, EM, F, Mq, SC, SJ, Sr, Tg, Tr, Tx Ind: ESA, K, MI, SL, Sy, TN Pac: A, AS, Br, Ch, Fi, H, J, NZ, M, Si, So, Tw, WM	12, 26, 35, 63, 64, 86, 92, 106, 108, 131, 176, 177, 180, 183, 184, 187, 191, 194, 197, 205, 213, 214, 260, 277, 287, 291, 331, 332, 353
#*Corollospora quinqueseptata Nakagiri*	Halosphaeriaceae	–	M	–	–	Pac: M	18
Corollospora ramulosa (Meyerss & Kohlm.) E.B.G. Jones & Abdel-Wahab	Halosphaeriaceae	I	M	D	RM, Sr, SD, TT	Atl: Bz, EM, F, Mq, Tg, TX Ind: Sy Pac: Br, Fi, H, J, T, WM	44, 96, 284
Coronopapilla avellina Kohlm. & Volkm.-Kohlm	Zopfiaceae	I	M	W	RM	Atl: Bz	201
#*Coronopapilla mangrovei* (K.D. Hyde) Kohlm. & Volkm.-Kohlm.	Zopfiaceae	I	M	W	AM, RU, XG	Ind: AI, Mr Pac: Br, M, T	18, 54, 93, 97, 272
#*Corynespora cassiicola* (Berk. & M.A. Curtis) C.T. Wei	Corynesporascaceae	I	M	D, L, H, W	AI, CT	Pac: Ch, M	285, 359
#*Corynascus sepedonium* (C.W. Emmons) Arx	Chaetomiaceae	D	M	S	–	Ind: WBI	279
Crinigera maritima I. Schmidt	Ascomycota genera *incertae sedis*	–	M	W	UM	Ind: GA, KA, KE, OD, PO, TN, WB	39, 275
#*Cryptosphaeria halophila* Dayarathne & K.D. Hyde	Diatrypaceae	I	M	W	Ax	Pac: T	70
Cryptovalsa halosarceiicola K.D. Hyde	Diatrypaceae	I	M	W	HH	Pac: A	374
Cryptovalsa mangrovei Abdel-Wahab & Inderb	Diatrypaceae	I	M	W	KC	Pac: Ch	373
#*Cucullosporella mangrovei* (K.D. Hyde & E.B.G. Jones) K.D. Hyde & E.B.G. Jones	Halosphaeriaceae	I, S	M	P, W	AM, BG, BP, NF, RA, RM, RR, XG	Atl: Tg Ind: Mr, Sy Pac: Br, M, J, P, T	14, 16, 18, 49, 88, 92, 96, 97, 109, 120, 123, 124, 126, 129, 158, 162, 163, 243, 272, 308, 370
#*Cumulospora marina* I. Schmidt	Lulworthiaceae	I	E, M	W	AI	Atl: Cu, F Ind: E Pac: Ch, T	5, 169, 287, 353
#*Curvularia eragrostidis* (Henn.) J.A. Mey.	Pleosporaceae	D	M	S	–	Ind: AP	354
#*Curvularia hawaiiensis* (Bugnic. ex M.B. Ellis) Manamgoda, L. Cai & K.D. Hyde	Pleosporaceae	D	M	S	–	Ind: AP	354
#*Curvularia lunata* (Wakker) Boedijn	Pleosporaceae	–	M	W	UM	Ind: AP, KA Pac: M, WM	21, 63, 354, 356, 359

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Curvularia penniseti* (Mitra) Boedijn	Pleosporaceae	D	M	S	–	Ind: WBI	82
#*Curvularia senegalensis* (Speg.) Subram.	Pleosporaceae	I	M	W	CT	Pac: M, WM	63, 359
# *Curvularia australiensis* (Bugnic. ex M.B. Ellis) Manamgoda, L. Cai & K.D. Hyde	Pleosporaceae	D	M	S	–	Ind: AP	354
# *Curvularia spicifera (Bainier) Boedijn*	Pleosporaceae	D	M	S	–	Ind: WBI	82
#*Curvularia tuberculata* B.L. Jain	Pleosporaceae	D	M	S	–	Ind: AP, WBI	82, 354
#*Curvularia verruculosa* Tandon & Bilgrami ex M.B. Ellis	Pleosporaceae	I	E	L	HO, TH	Pac: T	311
#*Cylindrocladiella parva* (P.J. Anderson) Boesew	Nectriaceae	D	M	R, S	RM	Pac: H	217, 218
Cytospora pinastri Fr.	Cytosporaceae	–	E	R	SC	Ind: KA	20
#*Cytospora rhizophorae* Kohlm. & E. Kohlm.	Cytosporaceae	D	M	R, S	AM, CD, RA, RM, RR, RU, SG, XG	Atl: Ba, Bd, Bz, EM, F, Lb, Mq, SC, SJ, Sr, Tg, Tr Ind: AI, AP, Md, Mr, Sy Pac: A, Br, Ch, H, HM, M, PG, WG, WM	53, 54, 64, 85, 86, 97, 162, 163, 185, 187, 191, 192, 196, 197, 199, 200, 213, 257, 272, 274, 291, 353
#*Dactylaria purpurella* (Sacc.) Sacc.	Calloriaceae	–	E	R	AC	Ind: KA	20
#*Decorospora gaudefroyi* (Pat.) Inderb., Kohlm. &Volkm. -Kohlm.	Pleosporaceae	–	M	W	UM	Atl: Ba	168
Delortia palmicola Pat. & Gaillard	Ascomycota genera *incertae sedis*	I	M	W	RU	Ind: KA	371
#*Deniquelata vittalii* Devadatha, V.V Sarma & E.B.G Jones	Didymosphaeriaceae	I	M	W	SM	Ind: Mu	73
#*Diaporthe marina* Dayarathne & K.D. Hyde	Diaporthaceae	S	M	W	Rx	Pac: T	70
# *Diaporthe salinicola* Speg.	Diaporthaceae	S	M	W	Xx	Pac: T	70
#*Diaporthe salsuginosa* Vrijmoed, K.D. Hyde & E.B.G. Jones	Diaporthaceae	I	M	W	KC	Pac: Ch Ind: TN	325, 326, 353, 376
#*Diatrypasimilis australiensis* J.J. Zhou & Kohlm.	Diatrypaceae	I	M	W	AM	Ind: E	7
#*Diatrype mangrovei* Dayarathne & K.D. Hyde	Diatrypaceae	S	M	W	BC	Pac: T	70
Dictyocheirospora heptaspora (Garov.) M.J. D'souza, Boonmee & K.D. Hyde	Dictyosporiaceae	I, S	M	P	NF	Pac: T	170
Dictyopolyschema pirozynskii M.B. Ellis	Ascomycota genera *incertae sedis*	–	M	C, W	UM	Ind: KA	19, 52, 239
#*Dictyosporium elegans* Corda	Dictyosporiaceae	I	M	P	NF, Rx	Pac: J, T	243

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Dictyosporium pelagicum (Linder) G.C. Hughes	Dictyosporiaceae	I	M	D, I, P, W	AA, AM*, AS, BC, BP*, NF, RA, RM, Wb	Atl: Cm, F, IC, Tx Ind: K, MI, Sy Pac: Br, Ch, M, NZ, Si, WM	14, 17, 18, 36, 60, 64, 85, 86, 87, 92, 94, 96, 97, 98, 108, 109, 120, 153, 213, 229, 315, 317, 318, 325–332, 341, 353, 370
Didymella avicenniae S.D. Patil & Borse	Didymellaceae	I	M	W	AA, SA, SG, XG	Ind: MI, Su, TN Pac: Br, M, T	18, 29, 87, 97
#*Didymella fucicola* (G.K. Sutherl.) Kohlm.	Didymellaceae	–	M	W	RM	Ind: WBI	281
Didymosphaeria lignomaris Strongman & J.D. Miller	Didymosphaeriaceae	I	M	W	–	Ind: E Pac: Ch	353
Diplocladiella scalaroides G. Arnaud ex M.B. Ellis	Ascomycota genera *incertae sedis*	–	M	W	UM	Ind: KA	298
Diplodia orae-maris Linder	Botryosphaeriaceae	I	M	W	–	Pac: Ch	353
Dryosphaera tropicalis Kohlm. & Volkm.-Kohlm	Ascomycota genera *incertae sedis*	–	M	W	RM	Ind: GU, KA, KE, MH, TN, PO, WBI	39, 241, 239, 250, 262, 263, 275, 281, 296
#*Dyfrolomyces mangrovei* (K.D. Hyde) K.D. Hyde, K.L. Pang, Alias, Suetrong & E.B.G. Jones,	Pleurotremataceae	I	M	W	Pc, RA, SG	Atl: Ba Pac: NSW, T	18, 112, 124, 168, 353
#*Dyfrolomyces marinosporus* (K.D. Hyde) K.D. Hyde, K.L. Pang, Alias, Suetrong & E.B.G. Jones	Pleurotremataceae	I	M	P, W	AO,Ax, KC, NF	Ind: AP, Md, Mr Pac: A, Br, Ch, T, Tw	53, 112, 260, 272, 274, 291, 308, 325, 326, 353
#*Dyfrolomyces neothailandicus* Dayarathne, Jones E.B.G. & K.D. Hyde	Pleurotremataceae	S	M	W	Rx	Pac: T	70
#*Dyfrolomyces phetchaburiensis* Dayar., E.B.G. Jones & K.D. Hyde	Pleurotremataceae	S	M	W	RA	Pac: T	70
#*Dyfrolomyces rhizophorae* K.D. Hyde	Pleurotremataceae	I	M	W	AM*, BG, BP*, RA, RM	Ind: MI, Su, TN Pac: Ch, Fi, H, M, T, Tw	17, 18, 112, 203, 260, 291, 308, 367
#*Dyfrolomyces thailandicus* Dayarathne, Jones E.B.G. & K.D. Hyde	Pleurotremataceae	S	M	W	AM, Rx	Pac: T	70
#*Dyfrolomyces tiomanensis* K.L. Pang, S.A. Alias, K.D. Hyde, Suetrong & E.B.G. Jones	Pleurotremataceae	I	M	W	–	Pac: M	258
Ebullia octonae (Kohlm.) K.L. Pang	Halosphaeriacee	I	M	W	–	Ind: MI Pac: Br, H	30, 33, 66, 88, 189, 197, 200, 214
Ellisembia crassispora (M.B. Ellis) Subram.	Sporidesmiaceae	I	M	D, P	NF	Pac: Br	142
#*Emericellopsis minima* Stolk	Hypocreales genera *incertae sedis*	D	M	S	–	Ind: Mz	307
#*Emericellopsis terricola* J.F.H. Beyma	Hypocreales genera *incertae sedis*	–	M	C, W	UM	Ind: KA	19, 52, 239
#*Epicoccum nigrum* link	Didymellaceae	I	M	C, D, W	AG, RA, RM	Atl: Brz, Tx Ind: AP, TN, WBI	19,25, 48, 53, 82, 293
Etheirophora bijubata Kohlm. & Volkm.-Kohlm.	Etheirophoraceae	–	M	W	UM	Pac: T	214, 308

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Etheirophora blepharospora* (Kohlm. & E. Kohlm.) Kohlm. & Volkm.-Kohlm.	Etheirophoraceae	I	M	W	Cs, RA, RM, RS, RU, SA	Atl: Ba, Bd, Bz, C, Cu, EM, F, SC, SJ, Tr Ind: AI, Md, Mr, Sy Pac: A, Br, H, C, Fi, So	53, 54, 64, 86, 96, 105, 184, 187, 190, 192, 196, 199, 200, 203, 213, 214, 260, 272, 287, 308, 337
#*Etheirophora unijubata* Kohlm. & Volkm Kohlm.	Etheirophoraceae	–	M	W	UM	Ind: KA	22
Eutypella naqsii K.D. Hyde	Diatrypaceae	I	M	W	Ax	Ind: AP Pac: Tw	18, 117, 260, 308
#*Exserohilum rostratum* (Drechsler) K.J. Leonard & Suggs	Pleosporaceae	I	M	D, P, W	AA, AM*, AS, BC, BP*, NF, RA, RM, Wb	Atl: Cm, F, IC, Tx Ind: K, MI, Sy Pac: Br, Ch, M, NZ, Si, WM	41
#*Falciformispora lignatilis* K.D. Hyde	Trematosphaeriaceae	I	M	W	AC	Ind: Mu Pac: J, Tw	13, 75, 108, 260
#*Farasanispora avicenniae* Abdel-Wahab, Bahkali & E.B.G. Jones	Pleosporales *incertae sedis*	I	M	W	AM, SM	Ind: Fa, Mu	73, 223
Fasciatispora lignicola Alias, E.B.G. Jones & Kuthub.	Xylarialesgenera *incertae sedis*	I	M	W	BG, RA	Ind: AP Pac: M, T	13, 18, 291
#*Fasciatispora nypae* K.D. Hyde	Xylarialesgenera *incertae sedis*	I	M	P	NF	Pac: Br, M, T	101, 109, 113, 120
#*Fasciatispora petrakii* (Mhaskar & V.G. Rao) K.D. Hyde	Xylarialesgenera *incertae sedis*	I	M	P	NF	Pac: M	18, 109, 120, 271
#*Flagellospora curvula* Ingold	Nectriaceae	–	M	D	–	Ind: Kn	80
Frondicola tunitricuspis K.D. Hyde	Hyponectriaceae	I	M	P	NF	Pac: Br, M	18, 120, 142,
#*Fulvocentrum aegyptiacum* (Abdel-Wahab, El-Shar. & E.B.G. Jones) E.B.G. Jones & Abdel-Wahab	Juncigenaceae	I	M	W	AM, BP*, KC, SA*	Ind: E, SA	2, 4, 10, 81, 375
#*Fulvocentrum clavatisporum* (Abdel-Wahab, El-Shar. & E.B.G. Jones) E.B.G. Jones & Abdel-Wahab	Juncigenaceae	I	M	W	AM, BP*, KC*	Pac: Ch Ind: E, SB	2, 4,7, 353, 375
#*Fulvocentrum rubrum* Abdel-Wahab & E.B.G. Jones	Juncigenaceae	I	M	W	AM	Ind: SB	10
#*Fusariella obstipa* (Pollack) S. Hughes	Bionectriaceae	–	E	R	RM	Ind: KA	20
Fusarium chlamydosporum Wollenw. & Reinking	Nectriaceae	D	E	R, S	RM	Ind: KA Pac: H	20, 218
#*Fusarium ciliatum* Link	Nectriaceae	–	E	R	BG	Ind: AI	319
#*Fusarium incarnatum* (Roberge) Sacc	Nectriaceae	D	M	S	–	Ind: OD	48
#*Fusarium lateritium* Nees	Nectriaceae	D	M	S	–	Pac: H	218
#*Fusarium oxysporum* Schltdl	Nectriaceae	D, I	M, E	R S L	AI, Aa, AO, Ea, HO, TH	Ind: AP Pac: P, T	20, 239, 242, 48, 354, 310, 311
#*Fusarium roseum Link*	Nectriaceae	D	M	R, S	RM	Pac: H	218

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Fusicoccum microspermum Har. & P. Karst	Botryosphaeriaceae	–	M	D	TC	Atl: DR	271, 319
***#Fusicolla bharatavarshae* Devadatha, V.V Sarma & E.B.G Jones**	Nectriaceae	I	M	W	AM	Ind: Mu	174
***#Fusicolla gigantispora* Dayarathne & K.D. Hyde**	Nectriaceae	I	M	B	AM, Bx	Pac: T	70
#Gesasha mangrovei Abdel-Wahab & Nagahama	Halosphaeriaceae	I	M	W	UM	Pac: J	6
#Gesasha peditatus Abdel-Wahab & Nagahama	Halosphaeriaceae	I	M	W	UM	Pac: J	6
#Gesasha unicellularis Abdel-Wahab & Nagahama	Halosphaeriaceae	I	M	W	UM	Pac: J	6
Gloniella clavatispora T.D. Steinke & K.D. Hyde	Hysteriaceae	I	M	W	AM	Ind: ESA	305
#Haiyanga salina (Meyerss) K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I, S	M	W	AM, AG, CE, CQ, CR, HT, RM?, SA, TT, Wb	Atl: Ba, Brz, Bz, C, Cu, EM, F, Lb, Mq, SC, Si, Sr, Tg, Tr Ind: AI, ESA, K, MI, SL, Sy Pac: A, Br, Ch, Fi, H, M, Ms, So, T, Tw, WM	10, 12, 14, 16, 17, 18, 30, 33, 54, 63, 64, 86, 88, 92, 97, 131, 176, 177, 180, 183, 187, 196, 197, 199, 200, 203, 206, 214, 260, 287, 239, 331, 239, 331, 353, 370
#Halazoon fuscus (I. Schmidt) Abdel-Wahab, K.L. Pang, Nagah., Abdel-Aziz & E.B.G. Jones	Lulworthiaceae	I	M	W	–	Pac: Ch	5, 353
#Halenospora varia (Anastasiou) E.B.G. Jones	Leotiaceae	I	M	D, P, T, W	AM, AO, BG, NF, RA, RM, RU, SA, Wb	Atl: Cu, Ba, Bz? F Ind: AI, AP, KI, LI, Md, MI, NI, SL, Sy, TN Pac: AS, Br, Ch, H, J, M, P, PI, Si, T, WG, WM	16, 18, 26, 30, 33, 61, 87, 96, 287, 353
#Halobyssothecium obiones (P. Crouan & H. Crouan) Dayarathne, E.B.G. Jones & K.D. Hyde	Lentitheciaceae	I, S	M	W	Ax, RA, SI, Jx, Sx, SP, Rx	Atl: F, Tx Ind: AP, MI, TN Pac: A, Ch, J	33, 38, 69, 213, 233, 261, 277, 291, 321, 322, 331, 332
***#Halocryptosphaeria avicenniae* Devadatha & V.V. Sarma**	Diatrypaceae	I	M	W	AM	Ind: Mu	70
#Halocryptosphaeria bathurstensis K.D. Hyde & Rappaz	Diatrypaceae	I	M	W	AM, AO	Ind: AP, E, SA, SB Pac: J, T, Tw	4, 7, 18, 81, 139, 168, 259, 260, 291, 308, 324, 368, 375
#Halocryptovalsa avicenniae (Abdel-Wahab, Bahkali & E.B.G. Jones) Dayarathne & K.D. Hyde	Diatrypaceae	I	M	W	AM	Ind: SB, TN Pac: T	9, 70
***#Halodiatrype avicenniae* Dayarathne & K.D. Hyde**	Diatrypaceae	I	M	W	Ax	Pac: T	67
#Halodiatrype mangrovei (K.D. Hyde) Dayarathne & K.D. Hyde	Diatrypaceae	I	M	R	RA	Pac: T, Tw Atl: Ba	67, 114, 168, 260, 308, 353
***#Halodiatrype salinicola* Dayarathne & K.D Hyde**	Diatrypaceae	S	M	W	Rx	Pac: T	70
Halographis runica Kohlm. & Volkm.Kohlm.	Roccellaceae	–	M	W	UM	Ind: KA	22

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Halojulella avicenniae* (Borse) Suetrong, K.D. Hyde & E.B.G. Jones	Halojulellaceae	I	M	W	AA, AM, AO, RA	Ind: AI, AP, E, Md, MI, SB Pac: A, Ch, M, T, Tw	4, 14, 17, 30,32, 33, 42, 53, 54, 105, 158, 203, 265, 291
#*Halokirschsteiniothelia maritima* (Linder) Boonmee & K.D. Hyde	Mytilinidiaceae	I	M	W	AM, AO, AP? RA?	Atl: Ba, Cu Ind: E Pac: Tw	50, 80, 208, 287, 168, 260, 291
#*Halomassarina thalassiae* Suetrong, Sakay., E.B.G. Jones, Kohlm., Volkm.-Kohlm. & C.L. Schoch	Trematosphaeriaceae	I	M	W, P	AL, CE, LR, KC, NF, RM, RU, SD	Atl: Ba, F Pac: Ch, M, P, T	3, 14, 17, 18, 49, 51, 52, 54, 64, 87, 88, 97, 123, 124, 158, 162-164, 168, 169, 162, 198, 206, 283, 291, 308, 325, 326, 353
Halonectria milfordensis E.B.G. Jones	Bionectriaceae	S, I	M	W	AC, KC, Wb	Atl: Cu Pac: Ch, Tw	260, 287, 328–331, 353
#*Halorosellinia krabiensis* Dayarathne, & K.D. Hyde	Xylariaceae	I	M	W	UM	Pac: T	70
#*Halorosellinia oceanica* (S. Schatz) Whalley, E.B.G. Jones, K.D. Hyde & Læssøe	Xylariaceae	I	M	C, W	AA, AC, AM, AM*, AO, BC*, BG, BP, EA, KC, LR, RA, RA*, RM, RU, SA, SG, SP, TG, XG*	Atl: Ba, Bd, Bz, F, Mq, SJ, Tr Ind: AI, AP, E, ESA, LI, Md, MI, Mr, NI, Su, Sy, TN Pac: A, Br, Ch, Fi, H, M, NSW, P, Si, So, T, WM	3,16, 17, 18,19, 21, 49, 52, 54, 91, 93, 96–98, 100, 106, 123, 124, 158, 214, 230, 243, 260, 272, 294, 295, 303, 308, 315, 317, 325, 338, 339, 348, 353, 370
#*Halorosellinia rhizophorae* Dayarathne, Jones E.B.G. & K.D. Hyde	Xylariaceae	I	M	W	UM	Pac: T	70
#*Halorosellinia xylocarpi* Dayarathne & K.D. Hyde	Xylariaceae	S	M	W	Rx, Xx	Pac: T	70
#*Halosarpheia fibrosa* Kohlm. & E. Kohlm.	Halosphaeriaceae	I, S	M	R, W	AG, AM, RS, Ru	Atl: Bd, Bz, Brz, F Ind: E, ESA?, K, MI, Mr, SA, Sy Pac: A, Br, Ch, J, M, NSW, NZ, T, Tw	4, 14, 17, 18, 26, 31, 33, 81, 87, 96, 98, 222, 243, 260, 272,303, 308, 326, 353
#*Halosarpheia marina* (Cribb & J.W. Cribb) Kohlm.	Halosphaeriaceae	I	M	I, P, R, W	AA, AA*, Al? AL*, AM, AM*, AO, AS, BC*, BP, BP*, CT, NF, RA, RA*, RM, RS, RU, SA, SG, XG	Atl: Bd, Bz Ind: AI, AP, BI, E, ESA, LI, MI, Mr, SA, Sy Pac: A, Br, Ch, H, J, M, NSW, P, T, Tw, WM	4, 16, 17, 18, 31, 49, 57, 64, 81, 87,, 96, 98, 214,260, 272, 285, 303, 308, 336, 353, 370
Halosarpheia minuta W.F. Leong	Halosphaeriaceae	I	M	W	AA, AA*, AC, AG, AM, AM*, AO, BC*, BP*, RA*, RU, SA, SG	Ind: AI, AP Pac: A, Br, Ch, H, J, M, NSW, T, WM	14,18, 97, 162, 308, 353
#*Halosarpheia trullifera* (Kohlm.) E.B.G. Jones, S.T. Moss & Cuomo	Halosphaeriaceae	I	M	W	AM?	Ind: ESA Pac: Ch, M, Tw, NZ	162, 260, 222, 303, 353
#*Halosarpheia unicellularis* Abdel-Wahab & E.B.G. Jones	Halosphaeriaceae	I	M	W	AM	Ind: E, SA	2, 4, 81
#*Halosphaeria appendiculata* Linder	Halosphaeriaceae	I	M	W	Px	Atl: Brz, IC, Lb Pac: A, Br, J, M Ind: KA	26, 57, 79, 80, 85, 87, 96

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Halosphaeriopsis mediosetigera* (Cribb & J.W. Cribb) T.W. Johnson	Halosphaeriaceae	I	M	I, P, T, W	AG, AI, AL, AM, AM*, AN, AO, AS, BG, BN, BP*, CD, CT, KC, NF, RA, RM, RR, RS, RU	Atl: Brz, Bz, C, EM, F, Lb, Mq, SC, Sr, Tg, Tr Ind: AI, AP, Jv, LI, ESA, K, KE, Md, MI, SL, Sy, TN Pac: A, Br, Ch, H, J, M, P, T	14, 17, 18, 16, 26, 57, 59, 87, 92, 96, 214, 222, 285, 353
#*Halotestudina muriformis* Dayarathne & K.D. Hyde	Testudinaceae	A	M	W	Rx, Bx	Pac: T	70
#*Hansfordia pulvinata* (Berk. & M.A. Curtis) S. Hughes	Ascomycota genera *incertae sedis*	–	M	W	UM	Ind: KA	52, 239,
Hapsidascus hadrus Kohlm. & Volkm.-Kohlm.	Sordariomycetes genera *incertae sedis*	I	M	W	RM	Ind: Bz, Tg	204
#*Heleococcum japonense* Tubaki	Bionectriaceae	I, S	M	W	Ax, RA	Ind: AP, J, Jv, TN Pac: Tw	213, 260, 283, 309,
#*Helicascus kanaloanus* Kohlm.	Morosphaeriaceae	I	M	W	AA, AC, KC, RM, RU, SA, SD, SP, XG?	Ind: AI, ESA, Md, MI, Su? Pac: Br, H, M, P, Si, T?	14,16, 18, 33, 53, 54, 87, 91–93, 98, 102, 106, 123, 162, 163, 164, 183, 184, 200, 213, 265, 315, 348
#*Helicascus mangrovei* Preedanon, Suetrong & Sakay	Morosphaeriaceae	I	M	W	UM	Pac: T	276, 308
#*Helicascus nypae* K.D. Hyde	Morosphaeriaceae	I	M	P	NF	Pac: Br, M, T	18, 102, 109, 113, 120, 142
#*Helicoma muelleri* Corda	Tubeufiaceae	–	M	W	RM	Ind: KA	241
#*Helicoma hongkongense* (C.K.M. Tsui, Goh, K.D. Hyde & Hodgkiss) Y.Z. Lu	Tubeufiaceae	–	M	P	NF	Pac: T	231
Helicoma hyalonemum G.Z. Zhao, Xing Z. Liu & W.P. Wu	Tubeufiaceae	–	M	P	NF	Pac: T	231
Helicoma pannosum (Berk. & M.A. Curtis) Y.Z. Lu & K.D. Hyde	Tubeufiaceae	–	M	P	NF	Pac: T	231
#*Helicomyces roseus* Link	Tubeufiaceae	–	M	W	AO, BG, RM	Ind: KA	242
Helicorhoidion nypicola K.D. Hyde & Goh	Ascomycota genera *incertae sedis*	I	M	P	NF	Atl: Cu Pac: Br, M, T	142, 287
Hemisartorya maritima J.N. Rai & H.J. Chowdhery	Trichocomaceae	D	M	S	–	Ind: WBI	55, 356
Herpotrichia nypicola K.D. Hyde & Alias	Melanommataceae	I	M	P	NF	Pac: M	18, 120
#*Hortaea werneckii* (Horta) Nishim. & Miyaji	Teratosphaeriaceae	I	M	W	AM	Ind: SB	7
#*Hydea pygmea* Kohlm.	Lulworthiaceae	I, S	M	D, P, R, W	AA, AA*, AL*, AM, AM*, BC*, BG*, KC, NF, RA, RA*, RM, RU, SA, SG, Wb, XG*	Atl: Brz, Cu, Lb, Sr F, Tr Ind: AI, AP, KA, Md, MI, NI, Su, TN Pac: A, Br, M, P, Si	5, 12, 20, 14, 17, 18, 22, 64, 87, 96, 272, 287, 293, 353
#*Hypomontagnella monticulosa* (Mont.) Sir, L. Wendt & C. Lambert	Hypoxylaceae	I	E	L	Ea	Pac: T	310, 311
Hypophloeda rhizospora K.D. Hyde & E.B.G. Jones	Melanconidaceae	I	M	W	RA, RA*, RU	Atl: Ba Ind: Sy Pac: Br, Ch, M, T	17, 18, 96, 97, 100, 168, 353

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Hypoxylon aurantium* Dayarathne, Jones E.B.G. & K.D. Hyde	Hypoxylaceae	S	M	W	RA	Pac: T	70
#*Hypoxylon fragiforme* (Pers.) J. Kickx f.	Hypoxylaceae	I	E	L	Ea	Pac: T	310, 311
#*Hypoxylon hypomiltum* Mont.	Hypoxylaceae	I	M	W	RA	Pac: T	124
#*Hypoxylon mangrovei* Dayarathne, Jones E.B.G. & K.D. Hyde	Hypoxylaceae	S	M	W	RA	Pac: T	70
#*Hypoxylon ochraceum* Henn.	Hypoxylaceae	–	M	W	–	Atl: Sr Ind: ESA Pac: A, Ch, M, PG	338
#*Hypoxylon rubiginosum* (Pers.) Fr.	Hypoxylaceae	I	M	W	–	Pac: Ch, M	338
#*Hypoxylon subgilvum* Berk. & Broome	Hypoxylaceae	I	M	W	–	Pac: Br, Ch, M, T	338
#*Hypoxylon teeravasati* Devadatha, V.V Sarma & E.B.G. Jones	Hypoxylaceae	I	M	W	AM, SM	Ind: Mu	273
#*Hysterium rhizophorae* Dayar. & K.D. Hyde	Hysteriaceae	I	M	W	AC, RA	Ind: Mu Pac: T	73, 143
#*Hysterium thailandica* Jayasiri & K.D. Hyde	Hysteriaceae	I	M	W	UM	Pac: T	70
#*Idriella lunata* P.E. Nelson & S. Wilh	Microdochiaceae	I	M	D	RM	Atl: F Pac: J	60, 243
Iwilsoniella rotunda E B G Jones	Halosphaeriaceae	I	M	W	–	Atl: Cu	287
Jalapriya toruloides (Corda) M.J. D'souza, Hong Y. Su, Z.L. Luo & K.D. Hyde	Dictyosporiaceae	I	M	W	KC	Pac: Ch	86
#*Jattaea bruguierae* Dayarathne, Jones E.B.G. & K.D. Hyde	Calosphaeriaceae	I	M	W	BC	Pac: T	68
#*Jattaea mucronata* Dayar. & K.D. Hyde	Calosphaeriaceae	I	M	W	RU	Pac: T	9
#*Juncigena adarca* Kohlm., Volkm. -Kohlm. & O.E. Erikss.	Juncigenaceae	I	M	–	–	Atl: Cu	287,
#*Kallichroma asperum* Abdel-Wahab, Bahkali & E.B.G. Jones	Bionectriaceae	S	M	W	AM	Ind: SB	8
#*Kallichroma ellipsoideum* Abdel-Wahab, Bahkali & E.B.G. Jones	Bionectriaceae	I	M	W	AM	Ind: SB	8
#*Kallichroma glabrum* (Kohlm.) Kohlm. & Volkm. -Kohlm.	Bionectriaceae	S	M	W	AM	Atl: Ba Pac: Ch, M, T, Tw Ind: E, SA, SB	14, 18, 81, 168, 4, 7, 260, 308, 353
#*Kallichroma tethys* (Kohlm. & E. Kohlm.) Kohlm. & Volkm. -Kohlm.	Bionectriaceae	I	M	C, R, W	AA, AC, AG, AM, AO, BG, BP*, CE, HT, LR, Ps, RA, RM, RS, RU, SA, SG, TG	Atl: Ba, Bd, Bz, EM, F, Sc, SJ, Tg Ind: AI, AP, E, ESA, Mr, NI, Sy Pac: A, Br, Ch, Fi, H, M, NSW, P, So, T, Tw, WM	4, 14, 17, 18, 19, 40, 64, 87, 49,53, 54, 64, 94, 96–98, 123, 124, 162, 163, 168, 182-184, 187, 192, 169, 169, 190–192, 196, 197, 199, 200, 207, 214, 218, 260, 272, 291, 297, 303, 308, 326, 353, 370
#*Kamalomyces mangrovei* Dayarathne & K.D. Hyde	Tubeufiaceae	I	M	W	Xx	Pac: T	145

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Kirschsteiniothelia phoenicis* S.N. Zhang & K.D. Hyde	Kirschsteiniotheliaceae	S	M	W	RO	Pac: T	144
#*Kochiella crispa* (Kohlm.) Sakay., K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I	M	W	–	Atl: Lb, Mq Ind: Sy Pac: Br, H, T	86, 88, 92, 131, 171, 184, 199, 214, 260
#*Kohlmeyeriopsis medullaris* (Kohlm., Volkm.-Kohlm. & O.E. Erikss.) Klaubauf, M.-H. Lebrun & Crous	Magnaporthaceae	I	M	W	–	Atl: Cu	287,
#*Lanceispora amphibia* Nakagiri, I. Okane, Tad. Ito & Katumoto	Xylariales genera *incertae sedis*	I	M	W	BG	Pac: Ch, J	353, 355
#*Lanspora coronata* K.D. Hyde & E.B.G. Jones	Phomatosporaceae	I	M	W	HT	Atl: F Pac: H Ind: Sy	86, 131, 158, 214, 162, 169, 200
#*Lanspora cylindrospora* Devadatha, V.V. Sarma & E.B.G. Jones	Phomatosporaceae	I	M	W	SM	Ind: Mu	146
#*Lasiodiplodia avicenniarum* Jayasiri, E.B.G. Jones & K.D. Hyde	Botryosphaeriaceae	I	M	H	AM	Pac: T	377
#*Lasiodiplodia krabiensis* Dayarathne & K.D. Hyde	Botryosphaeriaceae	S	M	W	Bx	Pac: T	70
Lautitia danica (Berl) Schatz	Dothideomycetes genera *incertae sedis*	–	M	W	AI	Ind: AI	241
Lautospora gigantea K.D. Hyde & E.B.G. Jones	Lautosporaceae	I	M	W	AO, Ax, Rx, SA, SG	Ind: AP, Mr Pac: Br, T	98, 123, 132, 272, 291
#*Lautospora simillima* Kohlm. Volkm. -Kohlm. & O.E. Erikss	Lautosporaceae	I	M	W	–	Pac: T	308
#*Leptographium lundbergii* Lagerb. & Melin	Ophiostomataceae	D	M	S	–	Pac: H	217
#*Leptosphaeria albopunctata* (Westend.) Sacc.	Leptosphaeriaceae	–	M	W	Bx, Jx, Px, Sx	Ind: Kn	80
#*Leptosphaeria australiensis* (Cribb & J.W. Cribb) G.C. Hughes	Leptosphaeriaceae	I	M	W	AA, AC, AG, AM, AM*, AO, AS, BG, BP*CE? Cs, LR, RA, RM, RU, SA, XG	Atl: Ba, Bd, Brz, C, Cu, EM, F, Lb, Mq, SC, Si, SJ, Sr, Tr Ind: AI, AP, E, ESA, LI, Md, MI, Mr, NI, SA, SB, Su, Sy, TN Pac: A, Br, Ch, Fi, SB, G, H, M, P, So, T, Tw, WM	4, 7, 12, 14, 17, 18, 25, 31, 33, 36, 52–54, 55, 57, 64, 81, 86–88, 91–94, 96–98, 100, 105, 168, 123, 124, 131, 162-164,182, 183, 192, 214, 260, 272, 287, 291, 308, 326, 353, 370
Leptosphaeria avicenniae Kohlm. & E. Kohlm.	Leptosphaeriaceae	I	M	W	AA, AF, AG, AN, RA?, RM, RU?, XG	Atl: Ba, Bd, Brz, Bz, EM, F, Lb, Mq, Si Pac: Br, Ch, NZ, Sr, T	12, 64, 87, 92, 93, 96, 97, 106, 168, 180, 182, 184, 190, 192, 196, 222, 325, 326, 337, 326, 353
Leptosphaeria nypicola K.D Hyde & Alias	Leptosphaeriaceae	I	M	P, W	NF	Ind: Sy? Pac: M, T	18,
#*Leptosphaeria orae-maris* Linder	Leptosphaeriaceae	I	M	W	AM, SI, RM	Atl: F Ind: GA, GI Pac: Ch, J	179, 233, 321, 322, 290, 353
#*Leptosphaeria pelagica* E.B.G. Jones	Leptosphaeriaceae	I	M	R	RU	Ind: Mr	272,

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Leptosphaeria peruviana Speg.	Leptosphaeriaceae	I	M	W	AO, Ax, RA	Ind: AP Pac: T, Tw	213, 260, 291, 308
Leptosphaerulina mangrovei Inderb. & E.B.G. Jones	Didymellaceae	I	M	W	KC	Pac: Ch	149, 353
#*Letendraea helminthicola* (Berk. & Broome) Weese ex Petch	Didymosphaeriaceae	I	E	L	TH	Pac: T	311
#*Lignincola laevis* Höhnk	Halosphaeriaceae	I	M	D, G, I, P, R, W	AA, AA*, AC, AI, AL, AM, AM*, AO, AS, BG, BN, BP, BP*, Cs, HT, KC, LR, NF, PA, Pc, PF, RA, RA*, RM, RS, RU, SA, SD, SG, Wb	Atl: Bd, Brz, Bz, Cu, Cy, F, Mq, SC, Si, Tr Ind: AI, AP, ESA, LI, Md, MI, Mr, NI, SA, Su, Sy, TN Pac: A, Br, Ch, Fi, H, J, M, NZ, P, Si, So, T, Tw, WG, WM	12, 13, 14, 16, 17, 25, 26, 33, 51, 53, 54, 64, 8186-88, 91–94, 96-98, 105, 106, 108, 109, 123, 124,162–164, 169, 182–187, 191, 196, 199, 200, 214, 230, 222, 260, 264, 269, 272, 277, 285, 287, 303, 308, 315–318, 321, 322,324–332
Lignincola nypae K.D Hyde & Alias	Halosphaeriaceae	I	M	P	NF	Pac: M, P, T	18, 49
#*Lignincola tropica* Kohlm.	Halosphaeriaceae	I	M	W	AA, AM, BP, RA, RA*, RM, RS, RU, SA, SD, SG, Wb	Atl: Bz, Cu, EM Ind: AP, Mr Pac: Br, Ch, M, P, Si, T, Tw, WM	14, 49,64, 87, 92, 96, 97, 123, 158, 162, 184, 196, 260, 272, 287, 291, 353, 370
Limacospora sundica (Jørg. Koch & E.B.G. Jones) Jørg. Koch & E.B.G. Jones	Halosphaeriaceae	I	M	W	BG, RM	Ind: KA	241, 371
Lindra hawaiiensis Kohlm. & Volkm. -Kohlm.	Lulworthiaceae	I	M	W	UM	Pac: H	214, 281
#*Lindra obtusa* Nakagiri & Tubaki	Lulworthiaceae	–	M	W	AI, BG, RM	Ind: KA	241, 247, 268, 371
#*Lindra thalassiae* Orpurt, Meyers, Boral & Simms	Lulworthiaceae	I	M	W	Sr	Atl: Cu, F Ind: KA	52, 234, 239 287, 169,
#*Lineolata rhizophorae* (Kohlm. & E. Kohlm.) Kohlm. & Volkm.-Kohlm.	Dothideomycetes *incertae sedis*	I, S	M	W, R	AM, AM*, AS, BG, BN, BP, BP*, Cs, HT, KC, LR, NF, PA, Pc, PF, RA, RA*, RM, RS, RU, SA, SD, SG, Wb	Atl: Ba, Bd, Brz, Bz, Cy, F, Mq, SC, Tr Ind: AI, AP, E, ESA, Kn, LI, Md, MI, Mr, NI, Su, Sy, TN Pac: A, Br, Fi, H, Ch, J, M, P, Si, So, T, WG, WM	4, 7, 49, 14, 52–54, 64, 80, 97, 105, 123, 124, 164, 168, 182, 187, 196, 197, 199, 203, 213, 243, 272, 291, 308, 315, 317, 337,
#*Linocarpon angustatum* K.D. Hyde & Alias	Linocarpaceae	I	M	P	NF	Pac: Br, M, T, P	18, 49, 119, 120, 142,308
#*Linocarpon appendiculatum* K.D Hyde	Linocarpaceae	I	M	P, W	NF	Ind: Su Pac: Br, M, P, PG, T	18, 49, 89, 91, 109, 110, 120, 142
#*Linocarpon bipolare* K.D. Hyde	Linocarpaceae	I	M	P	NF	Pac: Br, T	18, 109, 110, 120, 142,308
#*Linocarpon livistonae* (Henn.) K.D. Hyde	Linocarpaceae	I	M	P	NF, Ls	Atl: Brz, FG, G Pac: A, Br, M, P, Sw, Tw	110, 120, 142
Linocarpon longisporum K.D. Hyde	Linocarpaceae	I		P	NF	Pac: Br, M	18, 109, 110, 120, 142
Linocarpon nypae (Henn.) K.D Hyde	Linocarpaceae	I	M	P	NF	Pac: Br, M, P, T	14,18, 89, 109, 110, 120, 142
#*Linocarpon pandani* Syd. & P. Syd.	Linocarpaceae	I	M	P, W	NF, PL	Pac: Br, P, Tw	87, 89, 92, 110
#***Longicorpus striataspora* (K.D. Hyde) S.N. Zhang, K.D. Hyde & J.K. Liu**	Striatiguttulaceae	I	M	D, P, W	NF, RA, RU	Ind: AI, NI, Su, Sy Pac: A, Br, Fi, M, NSW, P, T	18, 49, 87, 142, 308

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Lophiostoma acrostichi (K.D. Hyde) Aptroot & K.D. Hyde	Lophiostomataceae	I	M	W	AS	Atl: Ba Pac: Br	92, 134, 168
Lophiostoma appendiculatum Fuckel	Lophiostomataceae	I	M	T	RM	Atl: F	171
#*Lulwoana uniseptata* (Nakagiri) Kohlm., Volkm-Kohlm., J. Campb., Spatafora & Grafenham	Lulworthiaceae	I	E	W	AC, RM	Atl: F, Cu, PR, Si WSA, TX Ind: K, KA, LI, MI, TN, WB Pac: Ch, J, M, NSW, NZ, P, T	12, 16, 18, 287, 306
Lulworthia floridana Meyers	Lulworthiaceae	I	M	D, W	RM, Wb	Atl: F Ind: MI, Y Pac: Br, Si, NZ	60, 87, 158, 213
#*Lulworthia fucicola G.K. Sutherl.*	Lulworthiaceae	–	M	W	–	Pac: M	18
Lulworthia lindroidea Kohlm.	Lulworthiaceae	–	M	W	–	Pac: Tw	260
Lulworthia longispora Cribb & J.W Cribb	Lulworthiaceae	I	M	W	AM	Pac: A	56, 213
#*Lulworthia medusa* (Ellis & Everh.) Cribb & J.W Cribb	Lulworthiaceae	I	M	D, H, P, T, W	AA, AC, AG, AM, AM*, AO, BG, BP, BP*, Ca, HT, KC, LR, NF, RA, RA*, RM, RU, SA, SD, SG, Wb	Atl: Bd, Brz, Bz, Cy, F, Mq, SC, Tr Ind: AI, AP, ESA, LI, Md, MI, Mr, NI, Su, Sy, TN Pac: A, Br, Ch, Fi, H, J, M, P, Si, So, T, WG, WM	14, 26, 30, 34, 56, 60, 85, 87, 153, 162, 169, 228, 233, 257, 277, 315–317
Lulworthia purpurea (I.M. Wilson) T.W. Johnson	Lulworthiaceae		M	W	UM	Ind: MI	53,281, 250, 291
Luttrellia estuarina Shearer	Halosphaeriaceae	–	M	W	–	Pac: M	18
#*Manglicola guatemalensis* Kohlm. & E. Kohlm.	Manglicolaceae	I	M	W	RA, RA*, RM	Atl: Bz, SC Ind: AI, AP, ESA, LI, Md, MI, Mr, NI, TN Pac: A, Br, Ch, Fi, H, J, M, P, Si, So, T, WG, WM	87, 88, 96, 100, 191, 213
#*Mangrovispora pemphii* K.D. Hyde & Nakagiri	Sordariomycetes genera *incertae sedis*	I	M	W	Pc	Atl: F Pac: A, T	103, 169, 308
#*Marinophialophora garethjonesii* J.F. Li, Phookamsak, Dayarathne & K.D. Hyde	Herpotrichiellaceae	I	M	W	UM	Pac: T	221
#*Marinosphaera mangrovei* K.D. Hyde	Phyllachorales genera *incertae sedis*	I	M	W	AA, AC, AI, AM, AO, BG, BP*, CT, Hs, HT, Ps, RA, R, RU, SG, SP, ST, XG	Ind: AP, BI, E, ESA, Md, Mr, SA, SB, Su Pac: A, Br, H, Ch, LI, M, P, Si, So, T, Tw	4, 7, 10, 14, 16, 17, 18, 30, 51, 53, 54, 81, 87, 96, 97, 105, 123, 124, 142, 156, 158, 162, 214, 260, 272, 285, 291, 303, 308, 315–317, 327, 352
Massarina lacertensis Kohlm. & Volkm.- Kohlm.	Massarinaceae	–	M	R	AM	Ind: E, Mr	4, 18,168, 201, 272
#*Matsusporium tropicale* (Kohlm.) K.L. Pang and E.B.G. Jones	Lulworthiaceae	D, I, S	M	D, P, R, S, W	AA, AM*, AO, BG*, BP, BP*, NF, RA, RA*, RR, RU, SA, XG*	Atl: Ba, Brz, Cu, Lb, Sr Ind: AI, AP, Md, MI, NI, Su, Sy Pac: Br, J, M, P, Si, T, WM	5, 12, 14, 63, 64, 86-88, 91-93, 96, 100, 106, 120, 123, 124, 168, 180, 182, 213, 243, 272, 291, 308, 315, 317
Melaspilea mangrovei Vrijmoed, K.D. Hyde & E.B.G. Jones	Melaspileaceae	I	M	W	RU	Atl: Ba Pac: Ch, M, T	3, 4, 17, 14, 18,168, 327
#*Memnoniella oenanthes* (M.B. Ellis) L. Lombard & Crous	Stachybotryaceae	–	M	W	AI, SC	Ind: KA	241
#*Menispora ciliata* Corda	Chaetosphaeriaceae	–	M	W	BG, RM	Ind: KA	241, 371

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Metarhizium anisopliae* (Metschn.) Sorokin	Clavicipitaceae	D	M	S	–	Pac: H, J	150
#*Microascus manginii* (Loubière) Curzi	Microascaceae	D	M	S	–	Ind: WBI	82
#*Moana turbinulata* Kohlm. & Volkm. -Kohlm.	Halosphaeriaceae	–	M	W	–	Pac: H, Tw	214, 260
#*Moleospora maritima* Abdel-Wahab, Abdel-Aziz & Nagah.	Lulworthiales	I	M	W	AM	Ind: E, SB Pac: T	5, 7, 308
#*Monodictys putredinis* (Wallr.) S. Hughes	Dothideomycetes genera *incertae sedis*	–	M	W	AI, AO, RM	Ind: KA	241
#*Moromyces varius* (Chatmala & Somrith.) Abdel-Wahab, K.L. Pang, Nagah., Abdel-Aziz & E.B.G. Jones	Lulworthiaceae	–	M	W	–	Pac: Br, J, T, Tw Ind: E, SA	5, 81, 260, 308
#*Morosphaeria muthupetensis* B. Devadatha, V. V. Sarma. & E.B.G Jones	Morosphaeriaceae	I	M	W	RM	Ind: Mu	74
#*Morosphaeria ramunculicola* (K.D. Hyde) Suetrong, Sakay., E.B.G. Jones & C.L. Schoch	Morosphaeriaceae	I, S	M	W	RM, RU, RR	Ind: Mu, Mr Pac: Ch, J, M, T	14, 17, 18, 104, 123, 243, 272, 353, 365, 370
#*Morosphaeria velatispora* (K.D. Hyde & Borse) Suetrong, Sakay., E.B.G. Jones & C.L. Schoch	Morosphaeriaceae	I	M	R, W	AO, KC, RM, RU	Atl: Bz, F, SC Ind: AI, AP, LI, Md, Mr, Mu, NI, Sy, TN Pac: Br, Ch, J, M, T, Tw, WM	14, 18, 33, 87, 122, 123, 124, 162-164, 169, 199, 203, 260, 272, 291, 308, 326, 353, 365, 367
Mycoenterolobium platysporum Goos	Ascomycota	I	M	W	RS	Pac: J, M	243
Mycosphaerella salicorniae (Auersw.) Lindau	Mycosphaerellaceae	I	M	Y	AL, RU, SV	Pac: Br	64, 97, 123, 124, 187, 192, 213
Mycosphaerella staticicola (Pat.) Dias	Mycosphaerellaceae	–	M	W	UM	Ind: KA	22, 275
#*Myxotrichum chartarum* Kunze	Amorphothecaceae	–	M	W	UM	Ind: KA	19
#*Naïs inornata* Kohlm.	Halosphaeriaceae	I	M	W	AA, AL	Atl: Cu Pac: Ch, M, T, NZ	18, 97 222, 229, 287, 309, 315, 353
#*Nakataea oryzae* (Catt.) J. Luo & N. Zhang	Magnaporthaceae	–	M	W	RM, UM	Ind: KA	52, 239, 241, 371
#*Natantispora lotica* (Shearer) J. Campb., J.L. AndeRon & Shearer	Halosphaeriaceae	I	M	W	AA*, AM, BC*	Pac: Ch, M, Si, Tw	14, 18, 97, 213, 328-330, 340, 353
#*Natantispora retorquens* Shearer & J.L. Crane) J. Camp., J.L. Anderson & Shearer	Halosphaeriaceae	I	M	D, I, P, W	AA, AA*, Al, AM*, AS, BP*, HT, NF, RA*, RU	Ind: ESA, KA, MI, SA, SL Pac: A, Br, Ch, H, M, P, Si, T, Tw	14, 18, 22, 31, 33, 81, 92, 96, 214, 260, 285,303, 308, 326, 353
#*Nectria marina* Dayarathne & K.D. Hyde	Nectriaceae	S	M	W	UM	Pac: T	70
Nereiospora cristata (Kohlm.) E.B.G. Jones, R.G. Johnson & S.T. Moss	Halosphaeriaceae	I	M	P, W	NF, SA, Wb	Atl: Si Pac: M, T, Tw	12, 18, 87, 260, 308

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Nemania mangrovei* E.B.G. Jones & Vrijmoed	Xylariaceae	I	M	W	KC	Pac: Ch	3, 167
Nemania maritima Y.M. Ju & J.D. Rogers	Xylariaceae	I, S	M	W	Rx	Pac: Ch, M, Tw	18, 260, 353, 308
#***Nemania phetchaburiensis* Dayarathne, Jones E.B.G. & K.D. Hyde**	Xylariaceae	S	M	W	Rx	Pac: T	70
#***Nemania viridis* Dayarathne & K.D. Hyde**	Xylariaceae	I	M	W	Rx	Pac: T	70
#***Neocamarosporium salicorniicola* Dayar., E.B.G. Jones & K.D. Hyde**	Neocamarosporiaceae	I	M	W	Sx	Pac: T	335
#*Neocosmospora bostrycoides* (Wollenweber & Reinking) M. Sandoval-Denis, L. Lombard & P.W. Crous	Nectriaceae	D	M	S	–	Pac: H	218
#***Neocosmospora rhizophorae* Dayarathne & K.D. Hyde**	Nectriaceae	I	M	W	Rx	Pac: T	70
#*Neocosmospora solani* (Mart.) L. Lombard & Crous	Nectriaceae	D	M	R, S	RM	Atl: EM Pac: H, WM Ind: AP, OD	48, 218, 354
#***Neodevriesia manglicola* Devadatha, V.V. Sarma & E.B.G. Jones**	Neodevriesiaceae	I	M	W	RM	Ind: Mu	369
#*Neolinocarpon globosicarpum* K.D. Hyde	Linocarpaceae	–	M	P	NF	Atl: Brz, Ba Pac: M, T	18, 109, 113, 120, 142
#*Neomassariosphaeria typhicola* (P. Karst.) Y. Zhang ter, J. Fourn. & K.D. Hyde	Lindgomycetaceae	I	M	W	AM, RA	Ind: AP, ESA	213, 291, 303
#*Neptunella longirostris* (Cribb & J.W. Cribb) K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I	M	D, W	AO	Atl: Bd, Cu, EM Ind: AP, ESA, KI, MI, TN Pac: A, Br, Ch, H, J, M, NSW, P, Si, So, T, Tw	14, 18, 33, 34, 57, 96, 98, 109, 113, 120, 123, 124, 130, 182, 184, 187, 192, 198, 200, 213, 260, 283, 287, 291, 303, 308, 316–318, 320, 321, 324, 325, 326, 353
#***Nigrograna rhizophorae* Dayarathne, E.B.G. Jones & K.D. Hyde**	Nigrogranaceae	S	M	W	R*	Pac: T	70
#***Nigrograna samueliana* Devadatha, V.V. Sarma & E.B.G. Jones**	Nigrogranaceae	I	M	W	AM	Ind: Mu	70
#*Nigrospora oryzae* (Berk. & Broome) Petch	Apiosporaceae	DI I	M, E	D, L, H, W,	AA, AG, AR, RA, TH	Atl: Cm, F, IC, Tx Ind: K, MI, Sy Pac: Br, Ch, M, NZ, Si, T, WM	311, 358
#*Nimbospora bipolaris* K.D. Hyde & E.B.G. Jones	Halosphaeriaceae	–	M	–	–	Ind: Sy Pac: H	128, 214
#*Nimbospora effusa* Jørg. Koch	Halosphaeriaceae	I	M	D, W	–	Ind: Sy Pac: H	128, 214
Nipicola carbospora K.D. Hyde	Xylariaceae	–	M	–	–	Pac: M	18, 109, 111, 120
Nipicola selangorensis K.D. Hyde	Xylariaceae	–	M	–	–	Pac: M	18, 115, 120

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Nypaella frondicola K.D. Hyde & B. Sutton	Ascomycota genera *incertae sedis*	I	M	P	NF	Atl: Cu Pac: Br, M, T	18, 120, 140, 287,
#*Oceanitis cincinnatula* (Shearer et J.L. Crane) J. Dupont et E.B.G. Jones	Halosphaeriaceae	I	M	I, W	AI	Ind: Sy Pac: Br, M, Si, Tw	14, 17. 18, 86, 88, 92, 94, 97, 229, 260, 308, 317, 318, 370
#*Oceanitis viscidula* (Kohlm. & E. Kohlm.) J. Dupont & E.B.G. Jones	Halosphaeriaceae	I	M	W	AI	Atl: Brz, Lb, Si Pac: A, Ch	12, 26, 180, 182, 190, 203, 272, 331, 332, 353, 370
#*Ochroconis constricta* (E.V. Abbott) de Hoog & Arx	Sympoventuriaceae	–	E	R	SC	Ind: KA	20
#*Ochroconis humicola* (G.L. Barron & L.V. Busch) de Hoog & Arx	Sympoventuriaceae	D, I	M	D, R, S, T	AM, RM	Atl: F Pac: J	151, 244, 257
#*Ocostaspora apilongissima* E.B.G. Jones, R.G. Johnson & S.T. Moss	Halosphaeriaceae	I	M	W	–	Atl: Cu Ind: Sy Pac: A, H, WM	64, 86, 108, 131, 132, 161, 200, 203, 214, 287
#*Okeanomyces cucullatus* (Kohlm.) K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I, S	M	I, T, W	AG, AI, AL, AM, AM*, AO, AS, BG, BP*, CE, HT, LR, Pc, PF, RA, RM, RU, SA, SG, Wb, XG*	Atl: Ba, Bd, Brz, Cu, EM, F, Gh, Mq, Sr, Tg Ind: AI, AP, E, ESA, Jv, K, LI, Md, MI, Mr, NI, SB, Su, Sy, TN Pac: A, Br, H, Ch, M, NS, P, Si, So, T, Tw, WG, WM	4, 7, 12, 14, 16, 17, 18, 26, 30, 33, 64, 87, 88, 92, 96, 97, 123, 172, 180, 192, 196,169, 209, 213, 214, 260, 272, 283, 285, 287, 303, 308
Ophiobolus australiensis Johnson & Sparrow	Phaeosphaeriaceae	I	M	W	AM	Pac: A	57, 96, 98, 183, 213, 220
Ophiobolus littoralis (P. Crouan & H. Crouan) Sacc.	Phaeosphaeriaceae	–	M	D	–	Ind: TN	280
#*Ophiodeira monosemeia* Kohlm. & Volkm.-Kohlm.	Halosphaeriaceae	I	M	W	RM	Atl: Bz, SC, Tg Ind: AP Pac: Br, T	96, 97, 123, 124, 199, 291, 324
#*Orbilia blumenaviensis (*Henn.) Baral & E. Weber	Orbiliaceae	I	M	D, W	–	Pac: Ch	314, 353
Oxydothis nypae K.D. Hyde & Nakagiri	Oxydothidaceae	I	M	P	NF	Pac: Br, M, T	18, 109, 113, 116, 120, 137, 142, 171
Oxydothis nypicola K.D. Hyde	Oxydothidaceae	I	M	P	NF	Pac: Br, M	18, 116, 120, 271
#*Oxydothis phoenicis* S.N. Zhang, K.D. Hyde & J.K. Liu	Oxydothidaceae	I	M	P	PO	Pac: T	376
Paecilomyces indicus J.N. Rai, J.P. Tewari & Mukerji	Trichocomaceae	D	M	S	–	Ind: WBI	279
Paecilomyces variotii Bainier	Trichocomaceae	–	E	R	RM	Ind: AP, KA	20, 354
#*Panorbis viscosus* (I. Schmidt) J. Campb., J.L. AndeRon & Shearer	Halosphaeriaceae	I	M	P, R, W	AA, AC, AM, NF, RA*, RU, SA, SG, XG	Pac: A, Br, Ch, H, M, NZ, P, Si, T, WM Ind: AP, ESA, KA, KE, MH, Mr, Su, Sy, TN	18, 22, 81, 86, 88, 91–93, 96, 97, 104, 120, 123,124, 158, 164, 171, 203, 214, 260, 262, 263, 291, 299, 303, 325, 353
#*Papulaspora halima* Anastasiou	Sordariomycetes	I, S	M	T, W	RM, Wb	Atl: F, SJ, Tx Ind: K, MI, Sy Pac: Br, Ch, M, NZ, Si, T, WM	96, 171

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Paraaniptodera longispora* (K.D. Hyde) K.L. Pang, C.L. Lu, W.T. Ju, E.B.G. Jones & K.D. Hyde	Halosphaeriaceae	I	M	P, R, W	AM, BP, NF, OO, RA, RM, RU, SG, TG	Atl: Bd, Bz, F Ind: E, Mr Pac: A, Br, J, M, NSW, P, T, Si	4, 18, 97, 99, 123, 124, 202, 272, 173, 308, 353
#*Paradendryphiella arenariae* (Nicot) Woudenb. & Crous	Pleosporaceae	–	M	–	AG, RM, TT, Wb	Atl: Brz, F, Tx Ind: Jv Pac: Br, M, P, WM	18,63, 64, 97
#*Paradendryphiella salina* (G.K. Sutherl.) Woudenb. & Crous	Pleosporaceae	D, S	M	S, T	RA, RM, RU, SA	Atl: F Ind: GI, KE, TN Pac: H, P	16, 23, 97
#*Paradictyoarthrinium diffractum* Matsush.	Paradictyoarthriniaceae	D, I	M	S, W	AM,	Ind: Mu Pac: T	152
#*Paraliomyces lentifer* Kohlm.	Pleosporales genera *incertae sedis*	I	M	W	Ax, AG, AN, Rx, RM	Atl: EM, F, GM, Ind: TN Pac: Br, Tw	64, 96, 179, 180, 184, 213, 260, 337
#*Parengyodontium album* (Limber) C.C. Tsang, J.F.W. Chan, W.M. Pong, J.H.K. Chen, A.H.Y. Ngan, M. Cheung, C.K.C. Lai, D.N.C. Tsang, S.K.P. Lau & P.C.Y. Woo	Cordycipitaceae	–	M	R	AM	Pac: J	150
Passeriniella mangrovei G.L. Maria & K.R. Sridhar	Dothideomycetes genera *incertae sedis*	I	M	W	AO, BG, RM	Ind: KA	240
#*Passeriniella savoryellopsis* K.D. Hyde & Mouzouras	Dothideomycetes genera *incertae sedis*	I	M	W	AA, AM, BG, RA, RM, RU, SA, SG, XG	Atl: Bz, SC, Tg Ind: AP Pac: Br, M, T	14, 18, 52, 54, 64, 87, 88, 96, 97, 123, 124, 136, 158, 199, 272, 308, 315–317, 324
#*Patellaria apiculatae* Dayarathne & K.D. Hyde	Patellariaceae	I	M	W	RA	Pac: T	70
#*Patellaria atrata* (Hedw.) Fr.	Patellariaceae	I	M	W	Ax, RA, HT	Pac:H, T, Tw Ind: AP	260, 308
Payosphaeria minuta W.F. Leong	Nectriaceae	I, S	M	W	AA*, AG, AM, AL, BC*, BG, CT, RA, RM, RU, SA, SG, XG	Atl: Bz, Cu, SC, Tg Ind: AP Pac: Br, M, Si, T, Su	18, 182, 214, 271, 287, 344, 370
#*Pedumispora rhizophorae* K.D. Hyde & E.B.G. Jones	Diaporthales genera *incertae sedis*	I	M	W	RA, RU	Ind: AP, Sy Pac: T	135, 291
#*Penicilliopsis clavariiformis* Solms	Aspergillaceae	D	M	S	–	Pac: J	150
#*Penicillium chrysogenum* Thom	Aspergillaceae	D	M	S	–	Ind: OD	48, 354
#*Penicillium citrinum*Thom	Aspergillaceae	D, S, I	M E	R, S, T, L	RM, Wb, TH	Atl: F, SJ, Txg Ind: K, MI, OD, Sy Pac: Br, Ch, M, T, NZ, Si, WM	48, 354, 311, 313
#*Penicillium corylophilum* Dierckx	Aspergillaceae	D	M	S	–	Pac: H, J	217
#*Penicillium crustosum* Thom	Aspergillaceae	D	M	S	–	Pac: H, J	150
#*Penicillium decumbens* Thom	Aspergillaceae	D	M	S	–	Pac: H, J	217
#*Penicillium erubescens D.B. Scott*	Aspergillaceae	I	E	L	Ea	Pac: T	310; 311
#*Penicillium expansum* Link	Aspergillaceae	D	M	S	–	Ind: AP	354
#*Penicillium glabrum* (Wehmer) Westling	Aspergillaceae	D	M	S	–	Pac: H, J Ind: AP	218, 354
#*Penicillium janczewskii* Zalewski	Aspergillaceae	D	M	S	–	Pac: H, J	217

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Penicillium melinii* Thom	Aspergillaceae	D	M	S	–	Pac: H, J	217
#*Penicillium nalgiovense* Laxa	Aspergillaceae	D	M	S	–	Pac: H, J	217
#*Penicillium ochrochloron* Biourge	Aspergillaceae	D	M	S	–	Pac: H, J	217
#*Penicillium oxalicum* Currie & Thom	Aspergillaceae	D	M	S	–	Pac: H, J Ind: AP	217, 354
#*Penicillium parvum* Raper & Fennell	Aspergillaceae	D	M	S	–	Pac: J	150
#*Penicillium resticulosum* Birkinshow, Raistrick & G. Sm.	Aspergillaceae	D, I	M	S, R	BG	Ind: A&N	319
#*Penicillium roseopurpureum* Dierckx	Aspergillaceae	D	M	T, S	RM	Atl: F Ind: WBI	257
#*Penicillium simplicissimum* (Oudem.) Thom	Aspergillaceae	D	M	S		Pac: H, J	150
#*Peroneutypa indica* Devadatha V.V. Sarma & E.B.G Jones	Diatrypaceae	I	M	W	SM	Ind: Mu	70
#*Peroneutypa mangrovei* Devadatha & V.V. Sarma	Diatrypaceae	S	M	W	AM	Ind: Mu	273
#*Peroneutypa polysporae* Devadatha V.V. Sarma & E.B.G Jones	Diatrypaceae	I	M	W	SM	Ind: Mu	70
#*Peroneutypa scoparia* (Schwein.) Carmarán & A.I. Romero	Diatrypaceae	S	M	W	AM	Ind: PO	70, 145
#*Pestalotia heterocornis* Guba	Amphisphaeriaceae	D	M	S	–	Pac: H	217
#*Pseudopestalotiopsis theae* (Sawada) Maharachch., K.D. Hyde & Crous	Sporocadaceae	I	E	L	Ea	Pac: T	310, 311
#*Pestalotiopsis versicolor* (Speg.) Steyaert	Sporocadaceae	D	M	S	–	Ind: WBI	82
#*Petriella setifera* (Alf.Schmidt) Curzi	Microascaceae	I	M	W	–	Pac: Ch	329–332
#*Petriella sordida* (Zukal) G.L. Barron & J.C. Gilman	Microascaceae	–	E	R	AO	Ind: KA	20
#*Phaeoacremonium aureum* C.F.J. Spies, Moyo, Halleen & L. Mostert	Togniniaceae	I	M	W	RA	Pac: T	70
Phaeodactylium alpiniae (Sawada) M.B. Ellis	Ascomycota genera *incertae sedis*	D	M	S	–	Ind: WBI	82
#*Phaeoisaria clematidis* (Fuckel) S. Hughes	Pleurotheciaceae	–	M	W	AO, BG, RM, SC	Ind: KA	241
#*Phaeoseptum carolshearerianum* Devadatha, V.V. Sarma & E.B.G. Jones	Phaeoseptaceae	I	M	W	AM, SM	Ind: Mu	70
#*Phaeoseptum manglicola* Devadatha, V.V. Sarma & E.B.G. Jones	Phaeoseptaceae	I	M	W	AM, SM	Ind: Mu	70
Phaeosphaeria capensis Steinke & K.D. Hyde	Phaeosphaeriaceae	I	M	W	AM	Ind: E	4

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Phaeosphaeria halima* (T.W. Johnson) Shoemaker & C.E. Babc.	Phaeosphaeriaceae	I	M	D, W	AA, BG	Atl: F, TX Ind: ESA	97,213, 233, 303
Phaeosphaeria neomaritima (R.V. Gessner & Kohlm.) Shoemaker & C.E. Babc	Phaeosphaeriaceae	I	M	D, T	RA	Pac: Br	97, 233
#*Phaeosphaeria spartinae* (Ellis & Everh.) Shoemaker & C.E. Babc.	Phaeosphaeriaceae	I	M	W	RM	Ind: KI	281
#*Phaeosphaeria spartinicola* Leuchtm.	Phaeosphaeriaceae	I	M	W	UM	Ind: TN	275
Pharcidia rhachiana Kohlm	Mycosphaerellaceae	I	M	W	RM	Ind: KI, MH	281
#*Phialophorophoma litoralis* Linder	Pleosporales genera *incertae sedis*	I	M	P, W	AA? AC? AI, AM, NF? RA? SA? SG? XG*?	Atl: Cu Pac: A, Br, Ch, H, NSW, T?	87, 96, 287
#*Phoma herbarum* Westend	Didymellaceae	D	E	S, R	RM	Pac: J Ind: KA	20, 82
Phoma multispora V.H. Pawar, P.N. Mathur & Thirum.	Didymellaceae	D	M	S	–	Ind: WBI	266
Phoma ostiolata V.H. Pawar, P.N. Mathur & Thirum	Didymellaceae	D	M	S	–	Ind: WBI	266
Phoma suaedae Jaap	Didymellaceae	I	M	W	AM, RA	Pac: M Ind: E	17, 18,
Phomatospora acrostichi K.D. Hyde	Phomatosporaceae	I	M	I	AS	Pac: Br	92, 97
Phomatospora kandeliae K.D. Hyde	Phomatosporaceae	I	M	W	KC	Pac: Br, Tw	106, 260, 353
Phomatospora nypae K.D. Hyde	Phomatosporaceae	I	M	P	NF	Pac: M	18, 113, 120
Phomatospora nypicola K.D. Hyde & Alias	Phomatosporaceae	I	M	P	NF	Pac: M	18,120, 127
Phomopsis mangrovei K.D. Hyde	Diaporthaceae	I	M	W	RA, RU	Ind: AI, AP, GI Pac: T	54, 350
Phomopsis obscurans (Ellis & Everh.) B. Sutton	Diaporthaceae	I	M	D	RM	Atl: Brz	25
Phomopsis pittospori (Cooke & Harkn.) Grove	Diaporthaceae	–	E	R	AO	Ind: KA	20
Phomopsis terminaliae (Henn.) B. Sutton	Diaporthaceae	I	M	D	TC	Atl: Brz Pac: Tw	271
Phragmospathula phoenicis Subram. & N.G. Nair	Ascomycota genera *incertae sedis*	I	M	W	RS	Pac: J	243,
Piricauda elliptica (Cooke) R.T. Moore	Sordariomycetes genera *incertae sedis*	I	M	W	–	Ind: Sy Pac: Br	87,
Plectophomella nypae K.D. Hyde & B. Sutton	Pleosporales	I	M	P	NF	Pac: Br, M, T	18,
Pleospora pelagica T.W. Johnson	Pleosporaceae	–	M	D	AG, Sx, SI, TC	Atl: F, TX	97, 213, 272
Pleospora spartinae (J. Webster & M.T. Lucas) Apinis & Chesters	Pleosporaceae	I	M	Z	AI	Pac: Ch	353

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Pleotrichocladium opacum* (Corda) Hern.-Restr., R.F. Castañeda & Gené	Melanommataceae	I, S	M	I, W	AM, AS, RA	Ind: Su, TN Pac: Br, M	14, 18, 92
Pleurophomopsis nypae K.D. Hyde & B. Sutton	Ascomycota genera *incertae sedis*	I	M	P	–	Atl: Cu Pac: Br, M	18, 287
***Pontoporeia mangrovei* Devadatha & V.V Sarma**	Halotthiaceae	I	M	W	AM, SM	Ind: Mu	75
#*Praelongicaulis kandeliae* (Abdel-Wahab & E.B.G. Jones) E.B.G. Jones, Abdel-Wahab & K.L. Pang	Halosphaeriaceae	I	M	W	KC	Pac: Ch, T	1, 3, 353
#*Pseudallescheria ellipsoidea* (von Arx & Fassat.) McGinnis, A.A. Padhye & Ajello	Microascaceae	S	M	W	Wb	Pac: Ch	329–332
#*Pseudoastrosphaeriellopsis kaveriana* Devadatha, Wanas., Jeewon & V.V. Sarma	Pseudoastrosphaeriellaceae	S	M	W	AM, SM	Ind: Mu	273
#*Pseudohalonectria falcata* Shearer	Pseudohalonectriaceae	I	M	W	KC	Pac: Ch	353
Pseudolignincola siamensis Chatmala & E.B.G. Jones	Halosphaeriaceae	I	M	P	NF	Pac: T	170
#*Pseudothielavia terricola* (J.C. Gilman & E.V. Abbott) X. WeiWang & Houbraken	Chaetomiaceae	D	M	S	–	Ind: WBI Pac: J, WM	63, 279, 150
#*Purpureocillium lilacinum* (Thom) Luangsa-ard, Houbraken, Hywel-Jones & Samson	Ophiocordycipitaceae	D	M	S	–	Pac: H, J	150
Pyrenographa xylographoides Aptroot	Pyrenulaceae	I	M	W	CT, RA, RU, SA	Atl: Ba, F Pac: A, M, T	15, 17, 18,168, 308
#*Pyrenophora biseptata* (Sacc. & Roum.) Crous	Pleosporaceae	–	M	S	–	Pac: M	63
#*Quintaria lignatilis* (Kohlm.) Kohlm. & Volkm.-Kohlm.	Lophiostomataceae	I, S	M	W	AA, AM, AO, BG, BP*, CT, Pc, RA, RM, RR, RU, SA, SG, Xs	Atl: Ba, Bz, F, SC Ind: AI, AP, LI, Md, MI, Mr, NI, Su, Sy, TN Pac: A, Br, Ch, J, M, P, So, T, Tw, WM	14, 16, 17, 18, 52, 53, 54, 35, 64, 68, 86–88, 91, 96, 123, 124, 105, 150, 162, 169, 196, 199, 203, 214, 243, 272, 283, 291, 308, 353, 370
#*Raghukumaria keshaphalae* Devadatha, V.V Sarma & E.B.G Jones	Trematosphaeriaceae	I	M	W	AC	Ind: Mu	174
#*Remispora hamata* (Höhnk) Kohlm	Halosphaeriaceae	I	M	W	AM, Wb	Atl: Brz Ind: SA Pac: Ch NZ	26, 81, 222, 329–332
#*Remispora maritima* Linder	Halosphaeriaceae	I, S	M	W	RM, Wb	Atl: Brz Ind: K Pac: H, J	26, 180, 321, 322
#*Remispora quadri-remis* (Höhnk) Kohlm.	Halosphaeriaceae	I, S	M	W	RA, RU, Wb	Pac: Ch, J, M NZ	156, 162, 213, 222, 321, 322, 329–332, 353
#*Remispora stellata* Kohlm.	Halosphaeriaceae	–	M	W	–	Pac: Tw, NZ	222, 260

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Rhabdospora avicenniae Kohlm. & E. Kohlm.	Mycosphaerellaceae	I	M	B, R	AG, AF, AM, BG, HT, RA	Atl: Ba, Bd, Bz, C, F, Lb Ind: ESA Pac: M, Tw, WM	14, 17, 18, 64, 96, 168, 192, 260, 303
#*Rhizophila marina* K.D. Hyde & E.B.G. Jones	Diatrypaceae	I	M	R, W	AM, BG, RA, RS, RU	Ind: AI, AP, BI, ESA, Ka, Md, Mr, NI, Su, Sy Pac: A, Br, M	14, 18, 17, 52, 53, 54, 64, 86– 88, 91–93, 112, 120, 123, 124, 157, 159, 203, 131–133, 272, 303, 308
#*Rhytidhysteron bruguierae* Dayarathne & K.D. Hyde	Hysteriaceae	I	M	W	Bx	Pac: T	70
#*Rhytidhysteron mangrovei* Vin. Kumar & K.D. Hyde	Hysteriaceae	I	M	W	UM	Pac: T	216
#*Rimaconus multiguttulatus* Dayarathne & K.D. Hyde	Chaetosphaeriales genera *incertae sedis*	–	M	W	Bx	Pac: T	70
#*Rimora mangrovei* (Kohlm. & Vittal) Kohlm., Volkm.-Kohlm., Suetrong, Sakay. & E.B.G. Jones	Aigialaceae	I	M	P, W	AM, AO, BG, CD, NF, RA, RM, RU, SA, SG,	Atl: Ba, Bz, Cu, SC Ind: AI, AP, ESA, LI, Md, MI, Mr, NI, TN Pac: A, Br, Ch, Fi, H, J, M, P, Si, So, T, WG, WM	4, 14, 18, 33, 49, 51, 53–54, 64, 97, 123, 124, 168, 162, 195, 196, 272, 283, 303, 272, 287, 291, 308
Robillarda rhizophorae Kohlm.	Sporocadaceae	I	M	W	RM	Atl: F Pac: Br, H	87, 96
#*Roussoella mangrovei* C. Phukhamsakda & K.D. Hyde	Roussoellaceae	–	M	W	Rx	Pac: T	144
#*Saagaromyces abonnis* (Kohlm.) K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I, S	M	P, R, W	AA, AC, AG, AM, CE, HT, KC, LR, NF, RA, RM, RS, RU, SA, SG, XG	Atl: Ba, Bd, Bz Ind: AI, AP, BI, E, ESA, LI, MI, Mr, SA, Sy Pac: A, Br, Ch, H, J, M, NSW, Sh, T, Tw, WM	2, 3, 4, 14, 17, 18, 33, 35, 51, 81, 87, 96, 105, 106, 120, 123, 162, 168, 196, 214, 243, 260, 272, 291, 303, 324, 325, 326,
#*Saagaromyces glitra* (J.L. Crane & Shearer) K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I	M	W	AL, AM, AO, BC*, BP*, Cs, RA, RM, RU, SA, SG, SL, Wb	Atl: Ba, Bz, C, EM, F, I, SJ, Tg Pac: A, Br, M, SI, T, Tw Ind: AI, AP, ESA, KE, Su, TN	14, 18, 54, 96, 101, 102, 105, 123, 124, 158, 162, 200, 230, 260, 303, 308, 315, 318, 325, 326
#*Saagaromyces mangrovei* Abdel-Wahab, Bahkali & E.B.G. Jones	Halosphaeriaceae	I	M	W	AM	Ind: SA	81, 223
#*Saagaromyces ratnagirensis* (S.D. Patil & Borse) K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I	M	W	AA, AC, AM, AM*, AO, BP*, RA*, RU, SA, SG	Atl: Ba Ind: AI, AP, BI, E, ESA, KA, LI, MI, Mr, Md, Sy Pac: A, Br, Ch, H, M, NSW, J, P, T, WM	14, 17, 18,22, 49, 168, 272, 308, 371
#*Salsuginea phoenicis* S.N. Zhang, E.B.G. Jones, K.D. Hyde & J.K. Liu	Salsugineaceae	I	M	P	PO	Pac: T	343
#*Salsuginea ramicola* K.D. Hyde	Salsugineaceae	I	M	P, W	AA, AC, AM, KC, NF, SA, XG	Ind: AI Pac: Br, M, P, T	18, 54, 102, 106, 308, 353
#*Salsuginea rhizophorae* Dayarathne, E.B.G. Jones & K.D. Hyde	Salsugineaceae	I	M	W	RA	Pac: T	70

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Sammeyersia grandispora* (Meyers) S.Y. Guo, E.B.G. Jones & K.L. Pang	Lulworthiaceae	I	M	D, H, P, R, T, W	AA, AC, AG, AM, AM*, AO, BG, BP, BP*, Ca, HT, KC, LR, NF, RA, RA*, RM, RR, RU, SA, SD, SG, SP, XG, XG*, Wb	Atl: Ba, Bd, Brz, Bz, F, Gh, Lb, SC, Tg, Tr, Ind: AI, AP, E, ESA, K, KA, LI, Md, MI, Mr, NI, SA, SB, Su, Sy, TN Pac: A, Br, Ch, Fi, H, J, M, NSW, P, Si, T, WG, WM	4, 7, 9, 14, 16, 17, 18, 20, 22, 29, 30, 33, 34, 51, 53, 54, 60, 64, 81, 86–88, 91–93, 96–98, 102, 108, 120, 123, 124, 162–164, 168, 184, 187, 191, 192, 196, 199, 200, 214, 228, 233, 243, 257, 278, 291, 303, 315–317, 308, 370
#*Sarocladium strictum* (W. Gams) Summerb.	Sarocladiaceae	I	M	D	RM	Atl: Brz	25
#*Sarocladium terricola* (J.H. Mill., Giddens & A.A. Foster) A. Giraldo, Gené & Guarro	Sarocladiaceae	I	M	W	–	Pac: J	150
#*Savoryella appendiculata* K.D. Hyde & E.B.G. Jones	Savoryellaceae	–	M	W	–	Pac: M, T	18, 308
#*Savoryella aquatica* K.D. Hyde	Savoryellaceae	I	M	D, P	NF	Pac: Br, T	142
#*Savoryella lignicola* E.B.G. Jones & R.A. Eaton	Savoryellaceae	I	M	I, P, W	AA, AC, AG, AM, AM*, AO, AS, BC*, BP*, HT, KC, NF, RA, RU, SA, SG, ST, XG	Atl: Cu Ind: AI, AP, E, ESA, K, KA, LI, Md, MI, Mr, SL, Su, Sy, TN Pac: Br, Ch, H, J, M, P, Si, T, WM, Tw	14, 16, 17, 18, 22, 33, 34, 52, 53, 54, 64, 86– 88, 96, 97, 106, 108, 120, 123, 157, 159, 131–133, 213, 260, 272,287, 291, 299, 303, 308, 315, 317, 325, 326, 353, 371
#*Savoryella longispora* E.B.G. Jones & K.D. Hyde	Savoryellaceae	I	M	W	AM, AM*, BG, BP*, Cs, RA	Pac: A, Br, M, Si, T, Tw	14, 18, 115, 123, 308, 370, 371
Savoryella melanospora Abdel-Wahab & E.B.G. Jones	Savoryellaceae	I	M	W	–	Pac: T	308
#*Savoryella nypae* (K.D. Hyde & Goh) S.N. Zhang, K.D. Hyde & J.K. Liu	Savoryellaceae	I	M	P	NF	Atl: Cu Pac: Br, M, T, Tw	18, 87, 142, 260, 287, 308
#*Savoryella paucispora* Cribb & J.W Cribb) J. Koch	Savoryellaceae	I, S	M	P, W	AM, AM*, AO, BC*, BG, BP*, HT, NF, RA*, RR, RU, SA, XG	Atl: Cu Ind: AI, KA, ESA, LI, Mr, SL, Su, Sy Pac: A, Br, Ch, H, J, M, P, Si, T, Tw	14, 16, 18, 22, 51, 54, 58, 86–88, 91, 162–164, 176, 177, 187, 200, 213, 243, 260, 272, 287,303, 308, 315, 317, 318, 325, 326, 329, 332, 353, 370, 371
#*Savoryella verrucosa* Minoura & T. Muroi	Savoryellaceae	I	M	W	–	Pac: M	18
*Schizothyrium laguncularia*e (G. Winter) von Arx	Schizothyriaceae	–	M	D	LR	Atl: Brz	182
#*Sclerococcum haliotrephum* (Kohlm. & E. Kohlm.) Ertz & Diederich	Dactylosporaceae	I, S	M	P, W	AA*, AA, AG, AL*, AM, AO, BC*, BG, BP*, CT, LR, NF, OO, Ps, RA, RM, RR, RU, SA, SG, Wb, XG	Atl: Ba, Bd, Bz, Cu, F, Mq, SJ, Tr Ind: AI, AP, E, ESA, KA, LI, Md, MI, Mr, NI, SA, SB, Su, Sy, TN Pac: A, Br, Ch, Fi, H, J, M, NSW, P, Si, So, T, Tw, WM	4, 7, 14, 16, 17, 18, 22, 29, 49, 51, 53, 54, 64, 81, 86–88, 91–93, 96–98, 105, 108, 123, 124, 131, 191, 214, 243, 169, 213, 214, 260, 272, 303, 287,308, 317, 324, 326, 345, 353, 370
#*Sclerococcum mangrovei* (E.B.G. Jones, Alias, Abdel-Wahab & S.Y. Hsieh) Ertz & Diederich	Dactylosporaceae	I	M	W	AM, AM*, BP*, KC	Pac: Ch, M, T, Tw	3, 155, 260, 308, 353, 370
#*Sclerocleista ornata* (Raper, Fennell & Tresner) Subram.	Aspergillaceae	D	M	S	RM	Atl: F	257
#*Scopulariopsis brumptii* Salv.-Duval	Microascaceae	D	M	S	–	Pac: J	151

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Scytalidium terminale* G.V. Rao & de Hoog	Hyaloscyphaceae	_	M	D	RM	Atl: Brz	25
#*Sedecimiella taiwanensis* K.L. Pang, Alias & E.B.G. Jones	Niessliaceae	–	M	W	–	Pac: T, Tw	260, 308
Spathulospora lanata Kohlm.	Spathulosporaceae	I	M	D	–	Ind: TN	280
#*Simplicillium lanosoniveum* (J.F.H. Beyma) Zare & W. Gams	Cordycipitaceae	I	E	L	Ea	Pac: T	310, 311
#*Simplicillium sympodiophorum* Nonaka, Kaifuchi & Masuma,	Cordycipitaceae	I	E	L	Ea	Pac: T	310, 311
#*Sphaerulina orae-maris* Linder	Mycosphaerellaceae	I	M	W	RA*, RM, RU	Atl: F Pac: Br	97
Splanchnonema britzelmayrianum (Rehm) Boise	Pleomassariaceae	–	M	W	RA	Ind: AP	291
Sporidesmium fragilissimum (Berk. & M.A. Curtis) M.B. Ellis	Sporidesmiaceae	–	M	D	–	Ind: TN	283
Sporidesmium vagum Nees & T. Nees	Sporidesmiaceae	I	M	W	AO, RA	Ind: AP	292
Sporormiella grandispora S.I. Ahmed & Cain ex J.C. Krug	Sporormiaceae	I	M	W	Rx	Ind: TN	28
#*Stachybotrys chartarum* (Ehrenb.) S. Hughes	Stachybotryaceae	D, I	M	S, W	AI	Atl: EM Pac: Ch	82, 353
#*Stachybotrys mangiferae* P.C. Misra & S.K Srivast	Stachybotryaceae	I	M	W	RS	Pac: J	243,
#*Stachylidium bicolor* Link	Plectosphaerellaceae	I	M	W	AI	Pac: Ch, KA	241, 353, 371
Stagonosporopsis salicorniae (Magnus) Died	Didymellaceae	I	M	Z	SB	Ind: MI	27, 35, 64, 239
#*Stephanonectria keithii* (Berk. & Broome) Schroers & Samuels	Bionectriaceae	I	E	L	TH	Pac:T	311
#*Stigmidium apophlaeae* (Kohlm.) Aptroot	Mycosphaerellaceae	–	M	W	UM	Ind: KA	22
#*Striatiguttula nypae* S.N. Zhang, K.D. Hyde & J.K. Liu	Striatiguttulaceae	S	M	P	NF	Pac: T	343
#*Striatiguttula phoenicis* S.N. Zhang, K.D. Hyde & J.K. Liu	Striatiguttulaceae	S	M	P	PO	Pac: T	343
#*Swampomyces armeniacus* Kohlm. & Volkm.-Kohlm.	Juncigenaceae	–	M	W	AG, AM, RA? RM, RU, SG? XG?	Atl: Bz, SC Ind: AI, E, Mr, NI, SA, SB, Sy, TN Pac: A, Br, J, M, P, NG, T	2, 4, 7, 18, 54, 81, 97, 123, 124, 138, 158, 162, 168, 196, 272, 283, 324, 352
#*Swampomyces triseptatus* K.D. Hyde & Nakagiri	Juncigenaceae	I, S	M	R, W	AC, AM, Ax, BP*, RA, RS, RU, XG	Atl: Ba Ind: Mr, SB, Su Pac: A, Br, J, M, P, T	7, 14, 18, 123, 168, 243, 272,
#*Sympodiella alternata* Tubaki & Saito ex Crous & Hern. -Restr.	Ascomycota genera *incertae sedis*		M	W	RU	Ind: KA	371
Taeniolella stricta (Corda) S. Hughes	Kirschsteiniotheliaceae	I	M	W	BG, RM	Ind: KA	241, 371
#*Talaromyces aerugineus* (Samson) N. Yilmaz, Frisvad & Samson	Trichocomaceae	D	M	S	–	Pac: H	218

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Talaromyces diversus* (Raper & Fennell) Samson, N. Yilmaz & Frisvad	Trichocomaceae	D	M	S	–	Pac: H, J	217
#*Talaromyces flavus* (Klocker) Stolk & Samson	Trichocomaceae	D, I	E, M	L, S	Ea	Pac: H, J, T	150, 217, 310, 311
#*Talaromyces funiculosus* (Thom) Samson, N. Yilmaz, Frisvad & Seifert	Trichocomaceae	D	M	S	–	Ind: AP, GI Pac: H, J	150, 354
#*Talaromyces helicus* (Raper & Fennell) C.R. Benj.	Trichocomaceae	D	M	S	–	Pac: J	150
#*Talaromyces piceae* (Raper & Fennell) Samson, N. Yilmaz, Houbraken, Spierenb., Seifert, Peterson, Varga & Frisvad	Trichocomaceae	D	M	S	–	Ind: AP	354
#*Talaromyces purpureogenus* Samson, N. Yilmaz, Houbraken, Spierenb., Seifert, PeteRon, Varga & Frisvad	Trichocomaceae	D	M	S	–	Pac: H, J	150
#*Talaromyces rugulosus* (Thom) Samson, N. Yilmaz, Frisvad & Seifert	Trichocomaceae	D	M	S	–	Pac: H, J	150
#*Talaromyces stipitatus* (Thom) C.R. Benj.	Trichocomaceae	D	M	S	–	Pac: J	150
#*Talaromyces ucrainicus* (Panas.) Udagawa	Trichocomaceae	D	M	S	–	Pac: J	150
#*Talaromyces variabilis* (Sopp) Samson, Yilmaz, Frisvad & Seifert	Trichocomaceae	D	M	S		Pac: H, J	217
#*Talaromyces wortmannii* (Klocker) C.R. Benj.	Trichocomaceae	D	M	S	–	Pac: J	150
#*Tetraploa scheueri* Kaz. Tanaka & K. Hiray.	Tetraplosphaeriaceae		M	W	UM	Ind: KA, KE	52, 239
Thalassogena sphaerica Kohlm. & Volkm.Kohlm.	Halosphaeriaceae	I, S	M	R, W	AM, RA, RU	Atl: Bz, Cu Ind: ESA, Mr Pac: Br, T, Tw	123, 124, 158, 198, 260, 272, 287,303, 304, 308
#*Thalespora appendiculata* Chatmala & E.B.G. Jones	Halosphaeriaceae	I	M	W	–	Pac: T	170
#*Thozetella nivea* (Berk.) Kuntze	Chaetosphaeriaceae	I	M	P	NF	Pac: T	231
#*Thyridariella mahakoshae* B. Devadatha, V.V Sarma, Wanas., K.D. Hyde & E.B.G Jones	Thyridariaceae	I	M	W	AM	Ind: Mu	72
#*Thyridariella mangrovei* B. Devadatha, V.V Sarma, K.D. Hyde, Wanas. & E.B.G Jones	Thyridariaceae	I	M	W	AM	Ind: Mu	72
Tirispora mandoviana V.V. Sarma & K.D. Hyde	Halosphaeriaceae	I	M	W	RM	Pac: Tw Ind: GI	260, 288
#*Tirispora unicaudata* E.B.G. Jones & Vrijmoed	Halosphaeriaceae	I	M	P, W	AI, AM*, BP*, NF	Pac: Ch, M, T, Tw	18, 165, 260

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Tirisporella beccariana* (Ces.) E.B.G. Jones, K.D. Hyde & Alias	Tirisporellaceae	I	M	P	NF	Pac: M, P, T	18, 308
#*Torpedospora mangrovei* (Abdel-Wahab & Nagah.) E.B.G. Jones & Abdel-Wahab	Torpedosporaceae	I	M	W	–	Pac: T, J	5, 120, 160, 308
#*Torpedospora radiata* Meyers	Torpedosporaceae	I	M	D, W	AG, AN, CE, CR, HT, Pc, RA, RM, RU, Wb	Atl: Ba, Brz, Bz, EM, F, IC, Lb, Mq, SC, Si, SJ, Sr, Tg Ind: Jv, K, KE, MI, SA, SL, Sy, TN Pac: A, AS, Br, Ch, G, H, J, M, NZ, P, So, T, WM	12, 14, 16, 17, 18, 26, 33, 34, 51, 63, 64, 81, 87, 168, 176, 177, 179, 182–187, 191, 193, 196, 197, 203, 206, 213, 324, 331, 332, 340, 341
#*Toxicocladosporium irritans* Crous & U. Braun	Cladosporiaceae	I	E	L	HO	Pac: T	311
Trematosphaeria lineolatispora K.D. Hyde	Trematosphaeriaceae	I, S	M	W	–	Pac: Ch, T, WM	64, 108, 325, 326, 353
Trematosphaeria mangrovis Kohlm.	Trematosphaeriaceae	I, S	M	P, W	RR, NF	Atl: Ba, Cu, Lb Ind: Mr Pac: M, P, T	18, 162, 168, 181, 182, 213, 272, 287, 308
#*Trichocladium alopallonellum* (Meyers & R.T. Moore) Kohlm. & Volkm.-Kohlm	Chaetomiaceae	I, S	E	P, R, W	AA*, AG, AL*, AM*, AO, BP*, CE, CQ, CT, LR, NF, PF, Px, RA, RM, RU, SA, Wb	Atl: Ba, Bd, Brz, Bz, Cm, Cu, EM, Gh, IC, Lb, SC, Tx Ind: AI, AP, ESA, Jv, K, KA, LI, Md, MI, NI, SJ, SL, Su, Sy, TN, Y Pac: A, Br, Ch, H, J, M, Ms, P, Si, So, T, Tw, WM	16, 17, 18, 19, 20, 33, 64, 87, 96 192, 214, 326
Trichocladium constrictum I. Schmidt	Chaetomiaceae	I	M	W	–	Atl: Cu Ind: ESA, SL Pac: Ch, T	287, 353
#*Trichocladium griseum* (Traaen) X. Wei Wang & Houbraken	Chaetomiaceae	D	M	S	–	Ind: AP	354
Trichocladium lignicola I. Schmidt	Chaetomiaceae	I	M	W	–	Atl: Cu Ind: E, ESA, SL Pac: Ch, T	287, 308, 353
Trichocladium melhae E.B.G. Jones, Abdel-Wahab & Vrijmoed	Chaetomiaceae	I	M	W	–	Pac: T	166, 353
#*Trichoderma aureoviride* Rifai	Hypocreaceae	D	M	R, S	BG	Pac: J	150
#*Trichoderma deliquescens* (Sopp) Jaklitsch	Hypocreaceae	D	M	S	–	Pac: H	218
#*Trichoderma harzianum* Rifai	Hypocreaceae	D	M	S	AM*, BG, KC, Lu, RS, RU, SA	Pac: J	150
#*Trichoderma kaningii* Oudem	Hypocreaceae	D, I	M	D, S	Ax	Ind: BI, GI Pac: J	23, 150
#*Trichoderma lixii* (Pat.) P. Chaverri	Hypocreaceae	I	E	L	Ea	Pac: T	310, 311
#*Trichoderma longibrachiatum* Rifai	Hypocreaceae	I	M	D	RM	Atl: Brz	25
#*Trichoderma polysporum* (Link) Rifai	Hypocreaceae	D	M	S	–	Ind: WBI	82
#*Trichoderma pseudokoningii* Rifai	Hypocreaceae	D	M	S	–	Pac: J	150
#*Trichoderma reesei* E.G. Simmons	Hypocreaceae	I	M	D	AM, BG	Ind: ESA	150, 304

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Trichoderma virens (J.H. Mill., Giddens & A.A. Foster) Arx	Hypocreaceae	D	M	R, S	Lu	Pac: J	150
#*Trichoderma viride* Pers.	Hypocreaceae	D	M	D, R, S, T	AG, RM, SA	Atl: EM, F, Tx Ind: AP, WBI Pac: H, M, WM	218, 354
#*Tubakiella galerita* (Tubaki) Sakayaroj, K.L. Pang & E.B.G. Jones	Halosphaeriaceae	I	M	W	–	Atl: Brz, EM, TX Ind: Sy Pac: H, Tw	26, 183, 184, 187, 191, 200, 233, 214, 260
Tunicatispora australiensis K.D. Hyde	Halosphaeriaceae	I, S	M	W	AM	Ind: SA Pac: A, NSW	81, 98
#*Typhicola typharum* (Desm.) Crous	Pleosporaceae	–	M	W	RM	Ind: KI	281
#*Vaginatispora armatispora* (K.D. Hyde, Vrijmoed, Chinnaraj & E.B.G. Jones) Wanas., E.B.G. Jones & K.D. Hyde	Lophiostomataceae	I	M	W	–	Atl: Ba Pac: Ch	53, 141, 168, 325, 326, 334, 353, 370
#***Vaginatispora microarmatispora* B. Devadatha, V.V Sarma & E.B.G Jones**	Lophiostomataceae	I	M	W	AC	Ind: Mu	71, 368
#***Vaginatispora nypae* Jayasiri, E.B.G. Jones & K.D. Hyde**	Lophiostomataceae	I, S	M	P	NF	Pac: T	371
#***Vaginatispora palmae* S.N. Zhang, J.K. Liu & K.D. Hyde**	Lophiostomataceae	I, S	M	P	NF	Pac: T	145
#***Verruconis mangrovei* Devadatha V.V. Sarma & E.B.G. Jones**	Sympoventuriaceae	I	M	W	AC, EA	Ind: Mu	146
#*Verruculina enalia* (Kohlm.) Kohlm. & Volkm. -Kohlm.	Testudinaceae	I, S	M	D, G, P, W	AA, AA*, AF, AG, AL*, AM, AM*, AN, AO, BC*, BG, BM, BP*, CD, CE, CQ, Cs, KC, LR, NF, PA, Pc, RA, RA*, RM, RR, RS, RU, SA, SP, SG, ST, XG	Atl: Ba, Bd, Brz, Bz, Cu, EM, F, GM, LB, Mq, SC, Sr, Tg, Tr, Tx Ind: AI, AP, ESA, Kn, LI, Md, MI, Mr, NI, SB, Sy, TN Pac: A, Br, Ch, Fi, G, H, J, M, Ms, P, Si, So, Su, T, Tw, WG, WM	12, 13, 16, 17, 26, 33, 51, 53, 54, 64, 80, 86–88, 91–93, 96–98, 106, 108, 109, 182, 184, 185, 187, 191, 192, 199, 200, 203, 211, 272, 283, 291, 304, 315-319, 323, 324, 325, 326, 345, 347, 365, 367, 368, 370
Verticillium cellulosae Dasz.	Plectosphaerellaceae	D	M	S	–	Pac: H	218
Verticillium sulfurellum Sacc.	Plectosphaerellaceae	D	M	S	–	Pac: H	218
Verticillium terrestre (Pers.) Sacc	Plectosphaerellaceae	D	M	S	–	Ind: WBI	279
Vibrissea nypicola K.D. Hyde & Alias	Vibrisseaceae	I	M	P	NF	Pac: M, P, T	18, 120, 127
#*Virgaria nigra* (Link) Nees	Xylariaceae	–	M	R	–	Pac: J	150
#***Vittaliana mangrovei* Devadatha, Nikita, A. Baghela & V.V. Sarma**	Phaeosphaeriaceae	I	M	W	AM	Ind: Po	76
Volutina concentrica Penz. & Sacc.	Nectriaceae	–	M	R	–	Pac: J	151
#*Wardomyces pulvinatus* (Marchal) C.H. Dickinson	Microascaceae	–	M	W	UM	Ind: TN	283
#*Westerdykella aurantiaca* (J.N. Rai & J.P. Tewari) Kruys	Sporormiaceae	D	M	S	–	Ind: WBI	279

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Westerdykella capitulum* (Panwar, P.N. Mathur & Thirum.) Gruyter, Aveskamp & Verkley	Sporormiaceae	D	M	S	–	Ind: WBI	266
#*Westerdykella dispersa* (Clum) Cejp & Milko	Sporormiaceae	D	M	R, S	RS	Ind: WBI Pac: H, J	151, 218, 279
#*Westerdykella multispora* (Saito & Minoura) Cejp & Milko	Sporormiaceae	D	M	S	–	Ind: WBI Pac: H, J	150, 217, 218, 279
#*Westerdykella ornata* Stolk	Sporormiaceae	D	M	S	–	Pac: Mz	307
#*Xenoacremonium brunneosporum* Dayarathne, E.B.G. Jones & K.D. Hyde	Nectriaceae	–	M	B	RM	Pac: T	70
Xylomyces rhizophorae Kohlm. & Volkm. -Kohlm.	Aliquandostipitaceae	I	M	W	RM	Atl: Ba, Bz, Cu, Mq, SJ, Tg Pac: H	207
#*Zopfiella indica* Devadatha, Jeewon & V.V. Sarma	Lasiosphaeriaceae	I	M	W	UM	Ind: Mu	273
#*Zopfiella latipes* (N. Lundq.) Malloch & Cain	Lasiosphaeriaceae	I	M	G, W	AA, PA	Ind: AP, KI, MI Pac: Ch, J, T	35, 40, 213, 241, 250, 261, 275, 281, 291
#*Zopfiella marina* Furuya & Udawaga	Lasiosphaeriaceae	I	M	W	AO, Ax	Ind: AP Pac: M	18, 213, 291
#*Zygosporium gibbum* (Sacc., M. Rousseau & E. Bommer) S. Hughes	Zygosporiaceae	–	M	W	AO, CD	Ind: AP	291
#*Zygosporium masonii* S. Hughes	Zygosporiaceae	I	E	W	AC, AO, RM, SC, UM	Ind: KA, KE	52, 20, 239
Yeasts Ascomycota							
#*Ambrosiozyma monospora* (Saito) Van der Walt	Saccharomycopsidaceae	–	M	V	–	Pac: T	147
#*Candida albicans* (C.P. Robin) Berkhout	Debaryomycetaceae	–	M	C	–	Atl: Brz	24
#*Candida amphicis* S.O. Suh, N.H. Nguyen & M. Blackw.	Debaryomycetaceae	–	M	V	–	Pac: T	147
#*Candida andamanensis* Am-In, Limtong, Yongman. & Jindam.	Debaryomycetaceae	–	M	V, W	–	Pac: T	46, 147
#*Candida berthetii* Boidin, Pignal, Mermiér & Arpin	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Candida boidinii* C. Ramírez	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Candida californica* (Mrak & McClung ex K.W. Anderson & C.E. Skinner) F.Y. Bai, Z.W. Wu & V. Rober	Debaryomycetaceae	–	M	V	–	Pac: T	147
#*Candida conglobata* (Redaelli) Cif.	Debaryomycetaceae	–	M	V	–	Atl: Brz Pac: T	24, 225
#*Candida cylindracea* Koichi Yamada & Machida ex S.A. Mey. & Yarrow	Debaryomycetaceae	–	M	V	–	Atl: F	78
#*Candida diddensiae* (Phaff, Mrak & O.B. Williams) Fell & S.A. Mey.	Debaryomycetaceae	–	M	C	–	Atl: Brz	24
#*Candida ecuadorensis* S.A. James	Debaryomycetaceae	–	M	V	–	Pac: T	147

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Candida freyschussii* H.R. Buckley & Uden	Debaryomycetaceae	–	M	C	–	Atl: Brz	24
#*Candida glabrata* (H.W. Anderson) S.A. Mey. & Yarrow	Debaryomycetaceae	–	M	D, V	–	Pac: T Atl: F	225, 78
#*Candida germanica* Kurtzman, Robnett & Yarrow	Debaryomycetaceae	–	M	V	–	Atl: F	78
#*Candida insectorum* D.B. Scott, Van der Walt & Klift	Debaryomycetaceae	–	M	V	–	Pac: T	147
#*Candida intermedia* (Cif. & Ashford) Langeron & Guerra	Debaryomycetaceae	D	M	C, D, R, S	–	Atl: F, Brz Pac: Ch Ind: GI	23, 24, 78, 65
#*Candida laemsonensis* Am-In, Limtong, Yongman. & Jindam	Debaryomycetaceae	–	M	–	–	Pac: T	46
#*Candida maltosa* Komag., Nakase & Katsuya	Debaryomycetaceae	D	M	S	–	Pac: Ch	65
#*Candida maris* (Uden & Zobell) S.A. Mey. & Yarrow, in Yarrow & Meyer	Debaryomycetaceae	–	M	–	–	Atl: F	78
#*Candida maritima* (Siepmann) Uden & H.R. Buckley	Debaryomycetaceae	–	M	V	–	Atl: F	78
#*Candida melibiosica* H.R. Buckley & Uden	Debaryomycetaceae	–	M	C, R	–	Atl: Brz, F	24, 78
#*Candida membranifaciens* (Lodder & Kreger-van Rij) Wick. & Burton	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Candida michaelii* S.O. Suh, N.H. Nguyen & M. Blackw.	Debaryomycetaceae	–	M	V	–	Atl: F	78
#*Candida natalensis* Van der Walt & Tscheuschner	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Candida nonsorbophila* Nakase, Jindam., Am-in, Ninomiya, H. Kawas. & Limtong	Debaryomycetaceae	–	M	V	–	Pac: T	147
#*Candida orthopsilosis* Tavanti, A. Davidson, Gow, M. Maiden & Odds	Debaryomycetaceae	–	M	V	–	Pac: T	147
#*Candida palmioleophila* Nakase & Itoh	Debaryomycetaceae	–	M	D	–	Pac: T	225
#*Candida parapsilosis* (Ashford) Langeron & Talice	Debaryomycetaceae	D	M	C, D, R, S	–	Atl: F, Brz Ind: Pa Pac: Ch, T	24, 78, 45
#*Candida picinguabensis* Ruivo, Pagnocca, Lachance & C.A. Rosa	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Candida pseudointermedia* Nakase, Komag. & Fukaz.	Debaryomycetaceae	–	M	D	–	Pac: T	225
#*Candida pseudolambica* M.T. Sm. & Poot	Debaryomycetaceae	–	M	–	–	Atl: F	78
#*Candida rhizophoriensis* Fell, M.H. Gut., Statzell & Scorzetti	Debaryomycetaceae	–	M	V	–	Atl: F	78

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Candida sake* (Saito & M. Ota) Uden & H.R. Buckley ex S.A. Mey. & Ahearn	Debaryomycetaceae	–	M	C	–	Atl: Brz	24
#*Candida sharkensis* Fell, M.H. Gut., Statzell & Scorzetti	Debaryomycetaceae	–	M	V	–	Atl: F	78
#*Candida silvanorum* Van der Walt, Klift & D.B. Scott	Debaryomycetaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Candida sorboxylosa* Nakase	Debaryomycetaceae	–	M	V	–	Pac: T	147
#*Candida taylorii* Statzell-Tallman, Scorzetti & Fell,	Debaryomycetaceae	–	M	–	–	Atl: F	302
# *Candida thaimueangensis* Limtong, Yongman., H. Kawas. & T. Seki	Debaryomycetaceae	–	M	R, V	–	Atl: F Pac: Ch, T	78, 65, 147, 224
#*Candida tropicalis* (Castell.) Berkhout	Debaryomycetaceae	D	M	C, R, S	–	Atl: Brz Pac: Ch, T Ind: GI	23, 24, 65, 225
#*Candida viswanathii* Sandu & H.S. Randhawa	Debaryomycetaceae	–	M	V	–	Pac: T	147
#*Clavispora lusitaniae* Rodr. Mir.	Metschnikowiaceae	D	M	C, S	–	Atl: Brz Pac: Ch	24, 65
#*Cyberlindnera saturnus* (Klöcker) Minter	Phaffomycetaceae	D	M	R, S	–	Pac: Ch, T	65, 225
#*Cyberlindnera fabianii* (Wick.) Minter	Phaffomycetaceae	–	M	V	–	Pac: T	225
#*Debaryomyces hansenii* (Zopf) Lodder & Kreger-van Rij	Debaryomycetaceae	D	M	C, S, V	–	Atl: F, Brz Pac: Ch Ind: GI, Pa	23, 24, 65, 45
#*Debaryomyces nepalensis* Goto & Sugiy.	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Dekkera bruxellensis* Van der Walt	Pichiaceae	–	M	C, R	–	Atl: Brz Pac: Ch, T	65, 24, 147
#*Diutina catenulata* (Diddens & Lodder) Khunnamw., Lertwatt., Jindam., Limtong & Lachance	Saccharomycetales *incertae sedis*	D	M	C, S	–	Pac: Ch	65, 24
#*Diutina ranongensis* Khunnamw, Lertwatt, Jindam, Limtong & Lachance	Saccharomycetales *incertae sedis*	–	M	V	–	Pac: T	46
#*Diutina rugosa* (H.W. Anderson) Khunnamw., Jindam., Limtong & Lachance	Saccharomycetales *incertae sedis*	–	M	C	–	Atl: Brz	24
#*Galactomyces geotrichum* (E.E. Butler & L.J. Petersen) Redhead & Malloch	Dipodascaceae	D	M	S	–	Ind: OD	48
#*Hanseniaspora guilliermondii* Pijper	Saccharomycodaceae	–	M	C	–	Atl: Brz	24
#*Hanseniaspora uvarum* (Niehaus) Shehata, Mrak & Phaff ex M.T. Sm	Saccharomycodaceae	–	M	C	–	Atl: Brz	24

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Hanseniaspora vineae* Van der Walt & Tscheuschner	Saccharomycodaceae	–	M	C	–	Atl: Brz	24
#*Hyphopichia homilentoma* (Van der Walt & Nakase) L.R. Ribeiro, M. Groenew., M.T. Sm., C.A. Lara, Lachance & C.A. Rosa	Saccharomycetales genera *incertae sedis*	–	M	C	–	Atl: Brz	24
#*Issatchenkia orientalis* Kudryavtsev	Pichiaceae	D	M	S	–	Ind: GI	23
#*Kazachstania exigua* Kurtzman	Saccharomycetaceae	D	M	C, S	–	Atl: Brz Pac: Ch	24, 65
#*Kazachstania humilis* (E.E. Nel & Van der Walt) N. Jacques, Sarilar & Casarég	Saccharomycetaceae	–	M	C	–	Atl: Brz	24
#*Kluyveromyces aestuarii* (Fell) Van der Walt	Saccharomycetaceae	D	M	C, S	–	Atl: Brz, F Pac: Ch	47, 65, 147
#*Kluyveromyces siamensis* Am-in, Yongman. & Limtong,	Saccharomycetaceae	D	M	D, S	–	Pac: T	65, 147
#*Kodamaea ohmeri* (Etchells & T.A. Bell) Y. Yamada, Tom. Suzuki, M. Matsuda & Mikata	Metschnikowiaceae	–	M	C, V	–	Atl: Brz, F Pac: Ch, T	24, 65, 147, 225
#*Lachancea fermentati* Kurtzman	Saccharomycetaceae	–	M	V	–	Atl: F	78
#*Lachancea meyersii* Fell, Statzell & Kurtzman	Saccharomycetaceae	–	M	V	–	Atl: F	77, 78
#*Lodderomyces elongisporus* (Recca & Mrak) Van der Walt	Debaryomycetaceae	–	M	V	–	Pac: T	225
***Martiniozyma asiatica* Kurtzman**	Pichiaceae	–	M	W	–	Pac: T	147, 226
#***Metahyphopichia laotica* Sipiczki, Pfliegler, Safar, P.B. Morais & C.A. Rosa**	Saccharomycetales genera *incertae sedis*	–	M	V	–	Pac: T	147
#*Meyerozyma caribbica* (Vaughan-Mart., Kurtzman, S.A. Mey. & E.B. O'Neill) Kurtzman & M. Suzuki	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Meyerozyma carpophila* (Phaff & M.W. Mill.) Yurkov & G. Péter	Debaryomycetaceae	–	M	V	–	Atl: F	78
#*Meyerozyma guilliermondii* (Wick.) Kurtzman & M. Suzuki	Debaryomycetaceae	–	M	C, D, V	–	Atl: Brz Pac: Ch, T	24, 65, 225, 147
#*Nakazawaea anatomiae* (Zwillenb.) Kurtzman & Robnett	Saccharomycetales genera *incertae sedis*	–	M	V	–	Atl: F	78
#*Nakazawaea ishiwadae* (Sugiy. & Goto) Kurtzman & Robnett	Saccharomycetales genera *incertae sedis*	–	M	C	–	Atl: Brz	24
#*Ogataea angusta* (Teun., H.H. Hall & Wick.) S.O. Suh & J.J. Zhou	Pichiaceae	–	M	C	–	Atl: Brz	24
#*Pichia kudriavzevii* Boidin, Pignal & Besson	Pichiaceae	D	M	S, V	–	Atl: F Pac: Ch, T	24, 78, 65, 147
#*Pichia membranifaciens* (E.C. Hansen) E.C. Hansen	Pichiaceae	–	M	C	–	Atl: Brz	24

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Pichia occidentalis* (Kurtzman, M.J. Smiley & C.J. Johnson) Kurtzman, Robnett & Bas.-Powers	Pichiaceae	–	M	V	–	Pac: T	225, 147
#*Pichia sporocuriosa* G. Péter, Tornai-Leh., Dlauchy & Vitányi	Pichiaceae	–	M	V	–	Pac: T	147
#*Saccharomyces bayanus* Sacc.	Saccharomycetaceae	D	M	S, R	–	Ind: Pa	45
#*Saccharomyces cerevisiae* (Desm.) Meyen	Saccharomycetaceae	D	M	C, R, S	–	Atl: Brz Ind: GI, Pa	23, 24, 45
#*Saccharomycopsis crataegensis* Kurtzman & Wick.	Saccharomycopsidaceae	–	M	C	–	Atl: Brz	24
#***Saturnispora mangrovi* El-Samawaty, Boekhout & Abdel-Wahab**	Pichiaceae	–	M	D	–	Ind: SB	364
#*Saturnispora mendoncae* Kurtzman	Pichiaceae	–	M	V	–	Pac: Ch	65
#***Saturnispora sanitii* Kurtzman**	Pichiaceae	–	M	–	–	Pac: T	357
#*Saturnispora sekii* (Limtong, Kaewwichian, Jindamorakot, Am-In, Boonmak, Yongmanitchai, Srisuk, Kawasaki & Nakase) Kurtzman	Pichiaceae	–	M	–	–	Atl: USA	357
#*Saturnispora silvae* (Vidal-Leir. & Uden) Kurtzman	Pichiaceae	–	M	C, V	–	Atl: F, Brz Pac: T	24
#*Saturnispora suwanaritii* Limtong, Boonmak, Kaewwich., Am-In, Jindam., Yongman., Srisuk, H. Kawas. & Nakase ex Kurtzman	Pichiaceae	–	M	–	–	Atl: F Pac: T	78, 357
#*Scheffersomyces spartinae* (Ahearn, Yarrow & Meyers) Kurtzman & M. Suzuki	Debaryomycetaceae	D	M	S	–	Pac: Ch	65
#*Schizosaccharomyces pombe* Lindner	Schizosaccharomycetaceae	D	M	R, S	–	Ind: Pa	45
#*Schwanniomyces polymorphus var. africanus* (Van der Walt, Nakase & M. Suzuki) M. Suzuki & Kurtzman	Debaryomycetaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Schwanniomyces pseudopolymorphus* (C. Ramírez & Boidin) M. Suzuki & Kurtzman	Debaryomycetaceae	–	M	V	–	Pac: T	225
#*Schwanniomyces vanrijiae* (Van der Walt & Tscheuschner) M. Suzuki & Kurtzman	Debaryomycetaceae	–	M	C	–	Atl: Brz Pac: T	24, 147
#*Starmera caribaea* (Phaff, Starmer, Lachance, V. Aberdeen & Tredick) Y. Yamada, H. Kawas., Nagats., Mikata & T. Seki	Phaffomycetaceae	–	M	V	–	Atl: F Pac: T	78, 225
#*Suhomyces atakaporum* (S.O. Suh & M. Blackw.) M. Blackw. & Kurtzman	Debaryomycetaceae	–	M	V	–	Pac: T	147

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Suhomyces choctaworum* (S.O. Suh & M. Blackw.) M. Blackw. & Kurtzman	Debaryomycetaceae	–	M	V	–	Atl: F	78
#*Torulaspora delbrueckii* (Lindner) E.K. Novák & Zsolt	Saccharomycetaceae	–	M	C	–	Atl: Brz	24
#*Wickerhamiella galacta* (Golubev & Babeva) C. Vega & Lachance	Trichomonascaceae	–	M	C	–	Atl: Brz	24
#*Wickerhamomyces anomalus* (E.C. Hansen) Kurtzman, Robnett & Bas.-Powers	Phaffomycetaceae	–	M	C, V	–	Atl: Brz Pac: Ch, T	24, 65, 147
#*Wickerhamomyces hampshirensis* (Kurtzman) Kurtzman, Robnett & Bas.-Powers	Phaffomycetaceae	–	M	V	–	Atl: F	78
#*Wickerhamomyces pijperi* (Van der Walt & Tscheuschner) Kurtzman, Robnett & Bas.-Powers	Phaffomycetaceae	–	M	C	–	Atl: Brz	24
#*Wickerhamomyces rabaulensis* (Soneda & S. Uchida) Kurtzman, Robnett & Bas.-Powers	Phaffomycetaceae	–	M	C	–	Atl: Brz	24
#*Wickerhamomyces sydowiorum* (D.B. Scott & Van der Walt) Kurtzman, Robnett & Bas.-Powers	Phaffomycetaceae	–	M	D	–	Atl: F Pac: T	78
#*Yamadazyma mexicana* (M. Miranda, Holzschu, Phaff & Starmer) Billon-Grand	Debaryomycetaceae	–	M	C, V	–	Pac: Ch	24, 65, 147
#*Yarrowia hollandica* (Knutsen, V. Robert & M.T. Sm.) Gouliam., R.A. Dimitrov, M.T. Sm. & M. Groenew	Saccharomycetales genera *incertae sedis*	–	M	V	–	Pac: Ch	65
#*Yarrowia lipolytica* (Wick., Kurtzman & Herman) Van der Walt & Arx	Saccharomycetales genera *incertae sedis*	–	M	C, V	–	Atl: F, Brz Pac: Ch	24, 78, 65
#*Yarrowia phangngaensis* Gouliam., R.A. Dimitrov, M.T. Sm. & M. Groenew	Debaryomycetaceae	–	M	W	–	Pac: Ch, T	65
Basidiomycota							
Bovistella utriformis (Bull.) Demoulin & Rebriev	Agaricaceae	–	M	W	UM	Ind: KA	83
#*Calathella mangrovei* E.B.G. Jones & Agerer	Marasmiaceae	I	M	W	AM*, BP, KC	Ind: KA, Md Pac: Br, M, T	14,18, 156, 287
#*Fulvifomes halophilus* T. Hatt., Sakay. & E.B.G. Jones	Hymenochaetaceae	–	P	W	XG	Pac: T	84
#*Fulvifomes mangrovicus* (Imazeki) T. Hatt.	Hymenochaetaceae	–	P	W	XG	Pac: J	84
#*Fulvifomes siamensis* T. Hatt., Sakay. & E.B.G. Jones	Hymenochaetaceae	–	P	W	XG	Pac: T	84
#*Fulvifomes xylocarpicola* T. Hatt., Sakay. & E.B.G. Jones	Hymenochaetaceae	–	P	W	XG	Pac: T	84

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Grammothele fuligo* (Berk. & Broome) Ryvarden	Polyporaceae	–	M	P	NF	Pac: M, T	231
#*Haloaleurodiscus mangrovei* N. Maek., Suhara & K. Kinjo	Russulales genera *incertae sedis*	–	M	W	UM	Pac: J	232
#*Halocyphina villosa* Kohlm. & E. Kohlm.	Niaceae	I	M	P, W, R	AA, AA*, AC, AG, AL*, AM, AO, BC*, BG, BP, BP*, CE, KC, LR, NF, RA, RA*, RM, RR, RU, SA, SG, TG, XG	Atl: Bd, Bz, C, Cu, F, Gh, Lb, SC, Sj, Tg, Tr Ind: AI, AP, ESA, LI, Md, MI, Mr, NI, SL, Su, Sy, TN Pac: A, Br, Ch, Fi, H, M, P, Si T, Tw	14, 16, 17, 18, 29, 33, 62, 87,, 96, 156, 192, 260, 272, 287, 303, 308
Haplotrichum croceum (Mont.) Partr. & Morgan-Jones	Botryobasidiaceae	E	M	R	AO	Ind: KA	20
Nia globispora Barata & Basilio	Niaceae	I	M	w	AM	Ind: E	4
#*Nia lenicarpa* Abdel-Wahab and E.B.G. Jones	Niaceae	I	M	W	AM	Ind: E, SB	11
#*Nia vibrissa* R.T. Moore & Meyers	Niaceae	I	M	W	AG, AM, LR, RM, SI	Pac: H, P, T Ind: KE	16, 28, 33, 97, 214, 237, 238, 281
#*Phanerochaete sordida* (P. Karst.) J. Erikss. & Ryvarden	Phanerochaetaceae	I	M	L	Ea	Pac: T	310, 311
Phanerodontia chrysosporium (Burds.) Hjortstam & Ryvarden	Phanerochaetaceae	D	M	S	–	Pac: H	218
#*Physalacria maipoensis* Inderb. & Desjardin	Physalacriaceae	I	M	W	AM	Atl: Cu Pac: Ch, T, Tw	148, 260, 287, 308
#*Rhizoctonia solani* J.G. Kühn	Ceratobasidiaceae	D	M	S	–	Ind: WBI	82, 346
#*Schizophyllum commune* Fr.,	Schizophyllaceae	–	A, E, M	P	Ea, NF	Pac: T	231, 310, 311
#*Xylodon sambuci* (Pers.) Ţura, Zmitr., Wasser & Spirin	Schizoporaceae	–	M	P	NF	Pac: T	231
Basidiomycota Yeasts							
#*Cystobasidium slooffiae* (Novák & Vörös-Felkai) Yurkov et al.	Cystobasidiaceae	–	M	V	–	Atl: F	78
#*Cystofilobasidium bisporidii* (Fell, I.L. Hunter & Tallman) Oberw. & Bandoni	Cystofilobasidiaceae	–	M	V	–	Atl: F	78
#*Cystofilobasidium capitatu* (Fell, I.L. Hunter & Tallman) Oberw	Cystofilobasidiaceae	–	M	V	–	Atl: F	78
#*Erythrobasidium hasegawianum* Hamam., Sugiy. & Komag	Erythrobasidiaceae	I	M	V	–	Atl: F	78
#*Filobasidium magnum* (Lodder & Kreger-van Rij) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Filobasidiaceae	–	M	V	–	Atl: F	78
#*Hannaella phetchabunensis* Kaewwich., Jindam., Am-In & Limtong	Bulleribasidiaceae	–	M	V	–	Pac: T	147
#*Heterocephalacria arrabidensis* (Á. Fonseca, Scorzetti & Fell) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Filobasidiaceae	–	M	V	–	Pac: T	147

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Kwoniella dejecticola* (Thanh, Hai & Lachance) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Cryptococcaceae	–	M	V	–	Pac: T	147
#*Kwoniella mangrovensis* Statzell, Belloch & Fell	Cryptococcaceae	–	M	V	–	Atl: F, Ba	78, 301
#*Moesziomyces aphidis* (Henninger & Windisch) Q.M. Wang, Bege-row, F.Y. Bai & Boekhout	Ustilaginaceae	–	M	V	–	Atl: F	78, 333
#*Moesziomyces bullatus* (J. Schröt.) Vánky, Botaniska Notiser	Ustilaginaceae	–	M	C	–	Atl: F	78, 333
#*Naganishia albida* (Saito) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Filobasidiaceae	–	M	V	–	Pac: T	147
#*Naganishia liquefaciens* (Saito & M. Ota) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout	Filobasidiaceae	I	M	V	–	Atl: F Pac: T	78
#*Occultifur externus* J.P. Samp., R. Bauer & Oberw	Cystobasidiaceae	–	M	V	–	Atl: F	78, 286
#*Papiliotrema flavescens* (Saito) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Rhynchogastremaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Papiliotrema fuscus* (J.P. Samp., J. Inácio, Fonseca & Fell) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhouta	Rhynchogastremaceae	–	M	V	–	Atl: F	78
#*Papiliotrema laurentii* (Kuff.) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout	Rhynchogastremaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Papiliotrema pseudoalba* (Nakase & M. Suzuki) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout	Rhynchogastremaceae	–	M	V	–	Atl: F	78
#*Papiliotrema mangalensis* (Fell, Statzell & Scorzetti) A.M. Yurkov	Rhynchogastremaceae	–	M	V	–	Atl: F	78
#*Pseudozyma hubeiensis* F.Y. Bai & Q.M. Wang, in Wang, Jia & Bai	Ustilaginaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Rhodotorula evergladensis* Fell, Statzell & Scorzetti	Sporidiobolaceae	–	M	V	–	Atl: F	78
#*Rhodotorula mucilaginosa* (A. Jörg.) F.C. Harrison, Proc. & Trans. Roy. Soc	Sporidiobolaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Rhodotorula paludigena* (Fell & Tallman) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout,	Sporidiobolaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Rhodotorula sphaerocarpa* (S.Y. Newell & Fell) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout	Sporidiobolaceae	–	M	V	–	Atl: F Pac: T	78, 147
#*Rhodotorula toruloides* (I. Banno) Q.M. Wang, F.Y. Bai, M. Groe-new. & Boekhout	Sporidiobolaceae	–	M	V	–	Pac: T	147

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
#*Saitozyma podzolica* (Babeva & Reshetova) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Trimorphomycetaceae	–	M	V	–	Pac: T	147
#*Sakaguchia cladiensis* (Fell, Statzell & Scorzetti) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout	Sakaguchiaceae	–	M	V	–	Atl: F	78
#*Sakaguchia dacryoidea* (Fell, I.L. Hunter & Tallman) Y. Yamada, K. Maeda & Mikata	Sakaguchiaceae	–	M	V	–	Atl: F	78
#*Sakaguchia lamellibrachiae* (Nagah., Hamam., Nakase & Horikoshi) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout	Sakaguchiaceae	–	M	V	–	Pac: T	147
#*Solicoccozyma keelungensis* (C.F. Chang & S.M. Liu) A.M. Yurkov	Piskurozymaceae	–	M	V	–	Atl: F	78
#*Sporidiobolus pararoseus* Fell & Tallman	Sporidiobolaceae	–	M	V	–	Atl: F	78
#*Sporobolomyces blumeae* M. Takash. & Nakase	Sporidiobolaceae	–	M	V	–	Atl: F	78
#*Sporobolomyces carnicolor* Yamasaki & H. Fujii	Sporidiobolaceae	–	M	V	–	Atl: F	78
#*Sporobolomyces japonicus* Iizuka & Goto	Sporidiobolaceae	–	M	V	–	Atl: F	78
#*Sporobolomyces shibatanus* (Okun.) Verona & Cif.	Sporidiobolaceae	–	M	V	–	Atl: F	78
#*Trichosporon asahii* Akagi ex Sugita, A. Nishikawa & Shinoda	Trichosporonaceae	D	M	S, V	–	Pac: Ch, T	65
#*Trichosporon coremiiforme* (M. Moore) E. Guého & M.T. Sm.	Trichosporonaceae	–	M	V	–	Pac: T	225
#*Vishniacozyma victoriae* (M.J. Montes, Belloch, Galiana, M.D. García, C. Andrés, S. Ferrer, Torr.-Rodr. & J. Guinea) Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Bulleribasidiaceae	–	M	V	–	Atl: F	78
#*Vishniacozyma tephrensis* Xin Zhan Liu, F.Y. Bai, M. Groenew. & Boekhout	Bulleribasidiaceae	–	M	V	–	Atl: F	78
Chytridiomycota							
Blyttiomyces verrucosus Dogma	Chytridiaceae	–	M	X	–	Pac: NZ	361
#*Catenaria anguillulae* Sorokin	Catenariaceae	D	M	S	–	Atl: EM	362
Chytridium proliferum Karling	Chytridiaceae	D	M	S	–	Atl: EM	362
Chytriomyces multioperculatus Sparrow & Dogma	Chytriomycetaceae	D	M	S	–	Atl: EM	362
#*Paludomyces mangrovei* (Ulken) Letcher & M.J. Powell	Halomycetaceae	–	M	X	–	Pac: H Atl: Brz, EM	363
#*Ulkenomyces aestuarii* (Ulken) Letcher & M.J. Powell	Halomycetaceae	–	M	X	–	Pac: NZ Ind: ESA	363

Table 1 (continued)

Name of the fungi	Family	Habitat	Fungi nature	Substrate	Host	Distribution	References
Mucormycota							
#*Absidia glauca* Hagem	Cunninghamellaceae	–	M	D	–	Pac: M	359
#*Absidia spinosa* Lendn.	Cunninghamellaceae	D	M	S	–	Pac: H	218
#*Circinella simplex* Tiegh.	Lichtheimiaceae	D	M	S	–	Pac: H	217
#*Cunninghamella elegans* Lendn.	Cunninghamellaceae	–	M	–	–	Pac: H	218
#*Lichtheimia corymbifera* (Cohn) Vuill.	Lichtheimiaceae	D	M	S	–	Ind: AP	354
#*Lichtheimia ramosa* (Zopf) Vuill.	Lichtheimiaceae	D	M	S	–	Ind: WBI	279
#*Mucor circinelloides* Tiegh.	Mucoraceae	D	M	S	–	Ind: WBI	279
#*Mucor hiemalis* Wehmer	Mucoraceae	D	M	S	–	Pac: J	150
#*Mucor racemosus* Bull.	Mucoraceae	D	M	S	–	Ind: AP	354
#*Rhizomucor pusillus* (Lindt) Schipper	Lichtheimiaceae	D	M	S	–	Pac: J	150
#*Rhizopus stolonifer* (Ehrenb.) Vuill.	Rhizopodaceae	D	M	S	–	Atl: F Ind: WBI Pac: M	372
#*Syncephalastrum racemosum* Cohn ex J. Schröt.	Syncephalastraceae	D	M	S	BG	Pac: M Ind: AI, AP, WBI	267, 319, 354, 359
#*Syzygites megalocarpus* Ehrenb.	Rhizopodaceae	D	M	S	–	Ind: WBI	55

Taxa in bold face described since 2015, # Taxa with molecular data

Habitat: *D* in sediment, *I* intertidal, *S* submerged, – not mentioned

Nature of fungi: *M* saprobic mangrove fungi, *E* endophytic mangrove fungi (from submerged parts of mangrove plants)

Host or substrata

Codes for the Host are as follows

B—Bark; C—Animal (M = Mollusk, Wood Borers, Shells, Chicken bone, Endoskeleton of sebia, Feathers); D—dead leaves, G—dead marsh grass; H—fruit; I—fern rachis; L—living leaves; P—palm; R—prop roots or roots; S—sediment or soil; T—Seedlings; U—rhizome, V—water; W—dead or decaying wood, X—foam, Y—dead inflorescence; Z—culms

Host species

? uncertainity expressed by author, *Pole or block of wood

AA, *Avicennia alba*; AC, *Aegiceras corniculatum*; AD, *Arthrocnemum indicus*; Af, *Avicennia africana*; AI, *Acanthius ilicifolius*; AG, *Avicennia germinans*; AL, *Avicennia lanata*; AM, *Avicennia marina*; AN, *Avicennia nitida*; AO, *Avicennia officinalis*; AR, *Avicennia rumphiana*; Ax, *Avicennia* sp; AS, *Acrostichum speciosum*; AU, *Acrostichum aureum*; BC, *Bruguiera cylindrica*; BG, *Bruguiera gymnorrhiza*; BN, Bruguiera conjugate; BM, *Batis maritima*; BP, *Bruguiera parviflora*; Bx, *Bruguiera* sp; Ca, *Casuarina* sp; CC, *Caesalpinia crista*; CD, CE, *Ceriops decandra; Conocarpus erectus*; CQ, *Casuarina equisetifolia*; CR, *Canvalia rosea*; Cs, *Ceriops* sp; CT, *Ceriops tagal*; EA, *Excoecaria agallocha*; Ea, *Enhalus acoroides*; HH, *Halosarceia halocnemoides*; HO, *Halophila ovalis*; HT, *Hibiscus tiliaceus*; Hs, *Halosarcia* sp; KC, *Kandelia candel*; LR, *Languncularia racemosa*; Ls, *Livistona* sp; Lu, *Lumnitzera racemosa*; NF, *Nypa fruticans*; OO, *Osbornia ocodonta*; OT, *Oncosperma tigillarium*; PA, *Phragmites australis*; Pc, *Pemphis acidula*; PM, *Polycladia myrica*; PF, *Pulchea xfosbergii*; PO, *Phoenix paludosa*; Ps, *Pulchea* sp; Px, *Pithecellobium* sp; RA, *Rhizopora apiculata*; RM, *Rhizopora mangle*; RR, *Rhizopora racemosa*; RS, *Rhizopora stylosa*; RU, *Rhizopora mucronata*; Rx, *Rhizopora* sp; SA, *Sonneratia alba*; SB, *Salicornia brachiata*; SC, *Sonneratia caseolaris*; SD, *Sonneratia acida*; SG, *Sonneratia griffithii*; SI, *Spartina alterniflora*; SL, *Schoenoplectus littoralis*; SN, *Suaeda maritima;* SM, *Suaeda monoica*; So, *Sesuvium portulacastrum*; SP, *Sonneratia apelata*; Sr, *Sargassum* sp; Ss, *Sonneratia* sp; ST, *Scaveola taccada*; SV, *Salicornia virginica*; TC, *Terminalia catappa*; TH, *Thalassia hemprichii*; TG, *Tamarix gallica*; XG, *Xylocarpus granatum*; XM, *Xylocarpus moluccensis*; Xs, *Xylocarpus* sp; UM, Unidentified mangrove trees or mangrove wood or mangrove litter; Wb, non-mangrove wood bait

Sites

Atl, Atlantic; Ind, Indian Ocean; Mid, Middle East; Pac, Pacific

Table 1 (continued)

A, Australia; AI, Andaman Islands; An, Antigua; AP, Andhra Pradesh; India; AS, American Samoa; Ba, Bahamas; Bd, Bermuda; BI, Mumbai; India; Bl, Bali; Bm, Burma; Bn, Borneo; Indonesia; Bo, Bonaire; Br, Brunei; Brz, Brazil; Bz, Belize; C, Columbia; Ch, China; Cm, Cameroon; CR, Costa Rica; Cu, Cuba; Cy, Cayman Islands; DR, Dominican Republic; E, Egypt; EM, East Mexico; ESA, East South Africa; F, Florida; Fa, Farasan island; FG, French Guiana; Fi, Fiji; G, Galapagos; Gh, Ghana; GI, Goa; India; Gu, Guyana; H, Hawaii; IC, Ivory Coast; J, Japan; Jm, Jamaica; Jv, Java; K, Kuwait; KA, Karnatka; India; KE, Kerala; India; Kn, Kenya; LA, Louisiana; Lb, Liberia; LI, Lakshadweep Islands; M, Malaysia; Mc, Macau; Md, Maldivies; Mg, Madagascar; MI, Maharashtra, India; Mq, Martinique; Mr, Mauritius; Ms, Marshall Islands; Mz, Mozambique; NI, Nicobar Islands; India; NZ, Newzealand; OD, Odisha; P, Philippines; Pa, Pakistan; PG, Papua Guinea; PI, Palau Islands; Pn, Panama; PR, Puerto Rico; PO, Pondicherry; PU, Peru; Q, Queensland; SA, South Australia; SB, Saudi Arabia; SC, Saint Croix; Sh, Shenzen China; Si, Singapore; SJ, St.John; US Virgin Islands; SL, Sri Lanka; Sm, Somalia; Sn, Surinam; So, Society Islands; Sr, Sierra Leone; ST, Saint Thomas; Su, Sumatra; Sw, Sulawesi; Sy, Sychelles; T, Thailand; Ta, Tahiti; TN, Tamil Nadu, India; Tg, Tobago; Tr, Trinidad; Tw, Taiwan; WM, West Mexico; WSA, West South Africa; Vz, Venezuela; Y, Yemen; Z, Zanzibar

References

1. Abdel-Wahab et al. (1999) *Halosarpheia kandeliae* sp. nov. on intertidal bark of the mangrove tree *Kandelia candel* in Hong Kong. Mycol Res 103:1500–1504

2. Abdel-Wahab et al. (2001) Two new intertidal lignicolous *Swampomyces* species from Red Sea Mangroves in Egypt. Fungal Divers 8:35–40

3. Abdel-Wahab and El-Sharouny (2002) Ecology of subtropical mangrove fungi with emphasis on *Kandelia candel* mycota. Fungi in marine environments. Fungal Divers research series 7:247–65

4. Abdel-Wahab (2005) Diversity of marine fungi from Egyptian Red Sea mangroves. Bot Mar 48:348–355

5. Abdel-Wahab et al. (2010) Phylogenetic evaluation of anamorphic species of *Cirrenalia* and *Cumulospora* with the description of eight new genera and four new species. Mycol Prog 9:537–558

6. Abdel-Wahab and Nagahama (2011) *Gesasha* (Halosphaeriales, Ascomycota), a new genus with three new species from the Gesashi mangroves in Japan. Nova Hedwigia 92(3–4), 497–512

7. Abdel-Wahab et al. (2014) Marine fungi of Saudi Arabia. Bot Mar 57:323–335

8. Abdel-Wahab et al. 2016) Two new species of *Kallichroma* (Bionectriaceae, Hypocreales) from Saudi Arabian mangroves. Phytotaxa 260: 66–74

9. Abdel-Wahab (2017) New saprobic marine fungi and a new combination. Bot Mar 60:469–488

10. Abdel-Wahabet al. (2019) Marine fungi from Red Sea mangroves in Saudi Arabia with *Fulvocentrum rubrum* sp. nov.(Torpedosporales, Ascomycota). Nova Hedwigia 108:365–377

11. Abdel-Wahab et al. (2019) *Nia lenicarpa* sp. nov.(Niaceae, Agaricales) from Red Sea mangroves in Saudi Arabia with comments on *Nia vibrissa*. Phytotaxa 406:157–168

12. Aleem (1980) Distribution and ecology of marine fungi in Sierra Leone (Tropical West Africa). Bot Mar 23:679–688

13. Alias et al. (1994) *Fasciatispora lignicola* sp. nov.(Amphisphaeriaceae, Ascomycotina) from drift mangrove wood. Mycotaxon 52: 77–82

14. Alias et al. (1995) Frequency of occurrence of fungi on wood in Malaysian mangroves. Hydrobiologia 295: 97–106

15. Alias et al. (1996) *Pyrenographa xylographoides* from Malaysian and Australianmangroves. Mycol Res 100:580–582

16. Alias et al. (1999) Intertidal fungi from the Philippines, with a description of *Acrocordiopsis sphaerica* sp. nov.(Ascomycota). Fungal Divers 2:35–41

17. Alias and Jones (2000) Vertical distribution of marine fungi on *Rhizophora apiculata* at Morib mangrove, Selangor, Malaysia. Mycoscience 41:431

18. Alias et al. (2010) Biodiversity of marine fungi in Malaysian mangroves. Bot Mar 53:545–554

19. Ananda and Sridhar (2001) Mycoflora on dead animal substrates of mangrove. Sri Lanka J. Aquat. Sci 6: 85–93

20. Ananda and Sridhar (2002) Diversity of endophytic fungi in the roots of mangrove species on the west coast of India. Canadian Journal of Microbiology 48: 871–878

21. Ananda and Sridhar (2003) Filamentous fungal assemblage of two island mangroves of India. Prospects and Problems of Environment across the Millennium 35–44

22. Ananda and Sridhar (2004) Diversity of filamentous fungi on decomposing leaf and woody litter of mangrove forests in the southwest coast of India. Curr Sci 1431–1437

23. Araujo et al. (1981) Studies on fungi and yeasts from the west coast of India. Ind J Mar Sci 10: 341–345

24. Araujo et al. (1995) Ascomycetous yeast communities of marine invertebrates in a Southeast Brazilian mangrove ecosystem. Antonie van Leeuwenhoek 68:91–99

25. Booth (1979) Strategies for study of fungi in marine and marine influenced ecosystems. Rev Microb (S Aaulo) 10:123–137

26. Booth (1983) Lignicolous marine fungi from Sao Paulo, Brazil. Can J Bot 61:488–506

27. Borse (1984) Marine fungi from India-I. Indian Bot Reptr 3:156–157

28. Borse (1985) Marine fungi from India-II. Curr Sci 54:881–882

29. Borse (1987a) New species of *Aigialus* from India. Trans Br Mycol Soc 88:424–426

Table 1 (continued)

30. Borse (1987b) Marine fungi from India-IV. Trans Mycol Soc Japan.28:55–61
31. Borse (1987c) Marine fungi from India-VI. Indian Bot Reptr 6:108–110
32. Borse (1987d) Marine fungi from India–V. Curr Sci 56:1109–1111
33. Borse (1988a) Frequency of occurrence of marine fungi from Maharashtra coast, India. Ind J Mar Sci 17:165–167
34. Borse (1988b) Marine Fungi from India VII. Indian Bot Reptr 6: 62–64
35. Borse and Shrivastava (1988) Marine fungi from India-VIII. Indian Bot Reptr 7:26–30
36. Borse et al. (1988). Marine fungi from Maharashtra (India). Indian Bot Reptr 7:18–25
37. Borse and Hyde (1989) Marine fungi from India. III. *Acrocordiopsis patilii* gen. et. sp. nov. from mangorve wood. Mycotaxon. 34:535–540
38. Borse et al. (2000) Frequency of occurrence of marine fungi from Pirotan Isl (Gujarat), India. Geobios 27:145–148
39. Borse et al. (2005) Marine fungi from Maharashtra, diversity taxonomy. Fungi: Diversity and Biotechnology, Scientific Publishers, Jodhpur, 63–92
40. Borse et al. (2013) Marine fungi from India-XII. A revised check list. Ind J Mar Sci 42: 110–119
41. Anita and Sridhar (2009) Assemblage and diversity of fungi associated with mangrove wild legume *Canavalia cathartica*. Tropical and subtropical agroecosystems 10:225–235
42. Ariyawansa et al. (2013) Halojulellaceae a new family of the order Pleosporales. Phytotaxa, 130: 14–24
43. Ariyawansa et al. (2015) Fungal diversity notes 111–252-taxonomic and phylogenetic contributions to fungal taxa. Fungal Divers 75: 27–274
44. Boyd et al. (1982) The influence of temperature on the seasonal and geographic distribution of three marine fungi. Mycologia 74:894–902
45. Ahmed et al. (2019) Occurrence and biodiversity of marine yeast in mangrove ecosystem of Shabi Creek, Gwadar-Pakistan. Pure and Applied Biology (PAB) 8:680–687
46. Am–In et al. (2011) *Candida andamanensis* sp. nov., *Candida laemsonensis* sp. nov. and *Candida ranongensis* sp. nov., anamorphic yeast species isolated from estuarine waters in a Thai mangrove forest. Int J Syst Evol Microbiol 61:454–46
47. Araujo and Hagler (2011) *Kluyveromyces aestuarii*, a potential environmental quality indicator yeast for mangroves in the State of Rio de Janeiro, Brazil. Braz J Microbiol 42:954–958
48. Behera et al. (2012) Diversity of soil fungi from mangroves of Mahanadi delta, Orissa, India. J. Microbiol. Biotechnol. Res 2, 375–378. 49. Besitulo et al. (2010) Occurrence and distribution of fungi in a mangrove forest on Siargao Island, Philippines. Bot Mar 53:535–543
50. Boonmee et al. (2012) Two new *Kirschsteiniothelia* species with *Dendryphiopsis* anamorphs cluster in Kirschsteiniotheliaceae fam. nov. Mycologia 104: 698–714
51. Chinnaraj (1992) Higher marine fungi of Lakshadweep Islands and a note *on Quintaria lignatilis*. Crypt. Mycol. 13:312–319
52. Chinnaraj and Untawale (1992) Manglicolous fungi from India. Ind J Mar Sci 25:25–29
53. Chinnaraj (1993a) Manglicolous fungi from atolls of Maldives, Indian Ocean. Ind J Mar Sci 22:14–142
54. Chinnaraj (1993b) Higher marine fungi from mangroves of Andaman and Nicobar Islands. Sydowia 45:109–115
55. Chowdhery and Rai (1980) Microfungi from mangrove swamps of West Bengal India. 1. Two new species of the genus *Aspergillus*. Nova Hedwigia 32:229–236
56. Cribb and Cribb (1955) Marine fungi from Queensland. Papers of the University of Queensland Department of Botany 3:78–81
57. Cribb et al. (1956) Marine fungi from Queensland-II. Papers of the University of Queensland Department of Botany 3:97–107
58. Cribb et al. (1960) Marine fungi from Queensland-III. Papers of the University of Queensland Department of Botany 4:40–44
59. Cribb (1969) Some marine fungi from the Great Barrier Reef area. Queensland Naturalist 19:118–120
60. Fell and Masters (1973) Fungi associated with the degradation of mangrove (*Rhizophora mangle* L.) leaves in South Florida In Estuarine Microbial Ecology (L.H. Stevenson & R.R. Colwell, eds), pp. 455–66. USA University of South Carolina Press
61. Fell et al. (1975) Microbial activities in the mangrove (Rhizophora mangle) leaf detrital system. In: Proceedings of the international symposium on the biology and management of mangroves 2:661–679
62. Ginns (1977) *Halocyphina*, a marine basidiomycete (Aphyllophorales). Mycologia 69:53–58
63. González et al. (1998) Abundance and diversity of microfungi in three coastal beaches of Mexico. Mycoscience 39:115
64. Gonzalez. (2001) A checklist of higher marine fungi of Mexico. Mycotaxon 80:241–253
65. Chi et al. (2012) Occurrence and diversity of yeasts in the mangrove ecosystems in Fujian, Guangdong and Hainan provinces of China. Indian J Microbiol 52: 346–353

Table 1 (continued)

66. Chu et al. (2015) A molecular reappraisal of *Nimbospora* (Halosphaeriaceae, Microascales) and a new genus *Ebullia* for *N. octonae*. Mycoscience 56:34–41
67. Dayarathne et al. (2016) *Halodiatrype*, a novel diatrypaceous genus from mangroves with *H. salinicola* and *H. avicenniae* spp. nov. Mycosphere 7:612–627
68. Dayarathne et al. (2017) Multi-gene phylogeny of *Jattaea bruguierae*, a novel asexual morph from *Bruguiera cylindrica*. Stud Fungi 2:235–245
69. Dayarathne et al. (2018) A novel marine genus, *Halobyssothecium* (Lentitheciaceae) and epitypification of *Halobyssothecium obiones* comb. nov. Mycol Prog 17:1161–1171
70. Dayarathne et al. (2020) Morpho-molecular characterization of microfungi associated with marine based habitats. Mycosphere. 11:1–188
71. Devadatha et al. (2017) Introducing the new Indian mangrove species, *Vaginatispora microarmatispora* (Lophiostomataceae) based on morphology and multigene phylogenetic analysis. Phytotaxa 329:139–149
72. Devadatha et al. (2018a) *Thyridariella*, a novel marine fungal genus from India: morphological characterization and phylogeny inferred from multigene DNA sequence analyses. Mycol Prog 17:791–804
73. Devadatha et al. (2018b) *Deniquelata vittalii* sp. nov., a novel Indian saprobic marine fungus on *Suaeda monoica* and two new records of marine fungi from Muthupet mangroves, East coast of India. Mycosphere 9:565–582
74. Devadatha et al.(2018c) *Morosphaeria muthupetensis* sp. nov.(Morosphaeriaceae) from India: morphological characterization and multigene phylogenetic inference. Bot Mar 61:395–405
75. Devadatha and Sarma (2018) *Pontoporeia mangrovei* sp. nov, a new marine fungus from an Indian mangrove along with a new geographical and host record of *Falciformispora lignatilis*. Curr. Res. Environ. Appl. Mycol. 8:238–246
76. Devadatha et al. (2019) *Vittaliana mangrovei* Devadatha, Nikita, A. Baghela & VV Sarma, gen. nov, sp. nov.(Phaeosphaeriaceae), from mangroves near Pondicherry (India), based on morphology and multigene phylogeny. Cryptog Mycol 40:117–132
77. Fell et al. (2004) *Lachancea meyersii* sp. nov., an ascosporogenous yeast from mangrove regions in the Bahama Islands. Stud Mycol, 50:359–363
78. Fell et al. (2011) Five new species of yeasts from fresh water and marine habitats in the Florida Everglades. Antonie van Leeuwenhoek 99:533–549
79. Gorter (1978) Lignicolous marine fungi on submerged wood from the Atlantic coast of South Africa. Nova Hedwigia 29:895–903
80. Erneholm (1972) Marina svampar. Studier i den tempererade och tropiska marina svampfloran. Thesis. Department of Marine Botany, Göteborgs universitet
81. Fryar et al. (2019) *Annabella australiensis* gen. & sp. nov.(Helotiales, Cordieritidaceae) from South Australian mangroves. Mycol Prog 18:973–981
82. Garg (1983) Vertical distribution of fungi in Sunderban Mangrove mud. Ind J Mar Sci 12:48–55
83. Ghate and Sridhar (2016) Contribution to the knowledge on macrofungi in mangroves of the Southwest India. Plant Biosystems, 150:977–986
84. Hattori et al. (2014) Three species of *Fulvifomes* (Basidiomycota, Hymenochaetales) associated with rots on mangrove tree *Xylocarpus granatum* in Thailand. Mycoscience 55:344–354
85. Hughes and Chamut (1971) Lignicolous marine fungi from southern Chile, including a review of distributions in the southern hemisphere. Can J Bot 49: 1–11
86. Hyde (1986) Frequency of occurence of lignicolous marine fungi in the tropics. The biology of marine fung. S. T. Moss. Cambridge, Cambridge University Press 311–322
87. Hyde (1988a) Observations on the vertical distribution of marine fungi on *Rhizophora* spp., at Kampong Danau mangrove, Brunei. Asian Mar Biol 5:77–81
88. Hyde (1988b) Studies on the tropical marine fungi of Brunei. Bot J Linn Soc 98:135–151
89. Hyde (1988c) The genus *Linocarpon* from the mangrove palm *Nypa fruticans*. Trans Mycol Soc Japan 32: 265–271
90. Hyde (1988d) *Phomatospora acrostichi* sp. nov., a marine fungus on pinnae of *Acrostichum speciosum*. Trans Br Mycol Soc 90:135–138
91. Hyde (1989a) Intertidal mangrove fungi from north Sumatra.Can J Bot 67: 3078–3082
92. Hyde (1989b) Ecology of tropical marine fungi. Hydrobiologia 178: 199–208
93. Hyde (1989c) *Caryospora mangrovei* sp. nov. and notes on marine fungi from Thailand. Trans Mycol Soc Japan 30:333–341
94. Hyde (1989d) Intertidal fungi from the mangrove fern, *Acrostichum speciosum*, including *Massarina acrostichi* sp. nov. Mycol Res 93: 435–438
95 Hyde (1989e) *Capillataspora corticola* gen. et sp. nov., a new bitunicate ascomycete from intertidal prop roots of *Rhizophora apiculata*. Can J Bot 67:2522–2524
96. Hyde (1990a) A study of the vertical zonation of intertidal fungi on *Rhiziphora apiculata* at Kampong Kapok mangrove, Brunei. Aquatic botany, 36: 255–262
97. Hyde (1990b) A comparison of the intertidal mycota of five mangrove tree species. Asian Mar Biol 7:93–107
98. Hyde (1990c) Intertidal fungi from warm temperate mangroves of Australia, including *Tunicatispors australiensis*, gen. et. sp. nov. Australian Systematic Botany, 3:711–718

Table 1 (continued)

99. Hyde (1990d) A new marine ascomycete from Brunei. *Aniptodera longispora* sp. nov. from intertidal mangrove wood. Bot Mar 33:335–338
100. Hyde (1991a) Fungal colonization of *Rhizophora apiculata* and *Xylocarpus granatum* poles in Kampong Kapok mangrove, Brunei. Sydowia, 43:31–38
101. Hyde (1991b) A new amphisphaeriaceous fungus from intertidal fronds of *Nypa fruticans*. Trans Mycol Soc Japan 32:265–271
102. Hyde (1991c) *Helicascus kanaloanus*, *Helicascus nypae* sp. nov. and *Salsuginea ramicola* gen. et sp. nov. from intertidal mangrove wood. Bot Mar 34:311–318
103. Hyde (1991d) *Mangrovispora pemphii* get. et sp. nov., a new maringe fungus from *Pemphis acidula*. Systema Ascomycetum 10: 19–25
104. Hyde (1991e) *Massarina velatospora* and a new mangrove-inhabiting species, *M. ramunculicola* sp. nov. Mycologia 83:839–845
105. Hyde (1992a) *Julella avicenniae* (Borse) comb. nov.(Thelenellaceae) from intertidal mangrove wood and miscellaneous fungi from the NE coast of Queensland. Mycol Res 96:939–942
106. Hyde (1992b) Intertidal fungi from *Kandelia candel* including *Phomatospora kandelae* sp. nov. Trans Mycol Soc Japan 33:313–316
107. Hyde (1992c) *Aigialus striatispora* sp. nov. from intertidal mangrove wood. Mycol Res 96:1044–1046
108. Hyde (1992d) Intertidal mangrove fungi from the west coast of Mexico, including one new genus and two new species. Mycol Res 96: 25–30
109. Hyde (1992e) Fungi from decaying intertidal fronds of *Nypa fruticans*, including three new genera and four new species. Bot. J. Linn. Soc. 110:95–110
110. Hyde (1992f) Fungi from palms. I. The genus *Linocarpon*, a revision. Sydowia 44:32–54
111. Hyde (1992 g) Fungi from *Nypa fruticans*: *Nipicola carbospora* gen. et sp. nov. Ascomycotina). Cryptogam Bot 21:330–332
112. Hyde (1992 h) The genus *Saccardoella* from intertidal mangrove wood. Mycologia 84:803–810
113. Hyde (1993a) Fungi from palms. V. *Phomatospora nypae* sp. nov. and notes on marine fungi from *Nypa fruticans* in Malaysia. Sydowia 45:199–203
114. Hyde (1993b) *Cryptosphaeria mangrovei* sp. nov.(Diatrypaceae [Sphaeriales]) from intertidal mangrove wood. Trans Mycol Soc Japan
115. Hyde (1994a) Fungi from palms. XII. Three new intertidal ascomycetes from submerged palm fronds. Sydowia, 46:257–264
116. Hyde (1994b) Fungi from palms. XIII. The genus *Oxydothis*, a revision. Sydowia 46:265–314
117. Hyde (1995) *Eutypella naqsii* sp. nov. from intertidal *Avicennia*. Mycol Res 99:1462–1464
118. Hyde (1996) Fungi from palms. XXVI. The genus *Anthostomella*, with ten new species. Nova Hedwigia 62 273–340
119. Hyde and Alias (1999) *Linocarpon angustatum* sp. nov., and *Neolinocarpon nypicola* sp. nov. from petioles of *Nypa fruticans*, and a list of fungi fromaerial parts of this host. Mycoscience 40:145–149
120. Hyde and Alias (2000) Biodiversity and distribution of fungi associated with decomposing *Nypa fruticans*. Biodivers Conserv 9: 393–402
121. Hyde and Borse (1986a) Marine fungi from Seychelles V. *Biatriospora marina* gen. et sp. nov. from mangrove wood. Mycotaxon 26:263–270
122. Hyde and Borse (1986b) Marine fungi from Seychelles. VI: *Massarina velataspora* a new marine Ascomycotina from mangrove wood. Mycotaxon 27:161–167
123. Hyde et al. (1990) Ecology of intertidal fungi at Ranong mangrove, Thailand. Trans Mycol Soc Japan 31:17–27
124. Hyde et al. (1993) The distribution of intertidal fungi on *Rhizophora apiculata*. B Morton (Ed.), The Marine Biology of the South China Sea, Proceedings of the First International Conference on the Marine Biology of Hong Kong and South China Sea, University of Hong Kong Press, Hong Kong. 643–652
125. Hyde et al. (1986) Marine fungi from Seychelles. III. *Aniptodera mangrovii* sp. nov. from mangrove wood. Can J Bot 64: 2989–2992
126. Hyde and Fröhlich (1998) Fungi from palms XXXVII. The genus *Astrosphaeriella*, including ten new species. Sydowia 50: 81–132
127. Hyde et al. (1999) Eleven new intertidal fungi from *Nypa fruticans*. Mycol Res 103:1409–1422
128. Hyde and Jones (1985) Marine fungi from Seychelles. I. *Nimbospora effusa* and *Nimbospora bipolaris* sp. no v. from driftwood. Can J Bot 63:611–615
129. Hyde and Jones (1986) Marine fungi from Seychelles IV. *Cucullospora mangrovei* gen. et sp. nov. from dead mangrove. Bot Mar 29:491–496
130. Hyde and Jones (1987) Marine fungi from the Seychelles. VII. *Bathyascus grandisporus* sp. nov. from mangrove wood. Bot Mar 30:413–416
131. Hyde and Jones (1989a) Ecological observations on marine fungi from the Seychelles. Bot. J. Linn. Soc. 100: 237–254
132. Hyde and Jones (1989b) Intertidal Mangrove Fungi from Brunei. *Lautospora gigantea* gen. et sp. nov., a New Loculoascomycete from Prop Roots of *Rhizophora* spp. Bot Mar 32:479–482
133. Hyde and Jones (1989c) Marine fungi from Seychelles. VIII. *Rhizophila marina*, a new ascomycete from mangrove prop roots. Mycotaxon (USA) 34:527–533
134. Hyde and Jones (1989d) *Hypophloeda rhizospora* Hyde et Jones, gen. et sp. nov., a new ascomycete from intertidal prop roots of *Rhizophora* spp. Trans Mycol Soc Japan 30:51–68

Table 1 (continued)

135. Hyde and Jones (1992) Intertidal mangrove fungi: *Pedumispora* gen. nov.(Diaporthales). Mycol Res 96:78–80

136. Hyde and Mouzouras (1988) *Passeriniella savoryellopsis* sp. nov., a new ascomycete from intertidal mangrove wood. Trans Br Mycol Soc 91: 179–185

137. Hyde and Nakagiri (1989) A new species of *Oxydothis* from the mangrove palm, *Nypa fruticans*. Trans Mycol Soc Japan 30:69–76

138. Hyde and Nakagiri (1992) Intertidal fungi from Australia. The genus *Swampomyces* including *S. triseptatus* sp. nov. Sydowia 44:122–130

139. Hyde and Rappaz (1993) *Eutypa bathurstensis* sp. nov. from intertidal *Avicennia*. Mycol Res 97:861–864

140. Hyde and Sutton (1992) *Nypaella frondicola* gen. et sp. nov., *Plectophomella nypae* sp. nov. and *Pleurophomopsis nypae* sp. nov.(Coelomycetes) from intertidal fronds of *Nypa fruticans*. Mycol Res 96:210–214

141. Hyde et al. (1992) *Massarina armatispora* sp. nov., a new intertidal ascomycete from mangroves. Bot Mar 35:325–328

142. Hyde and Sarma (2006) Biodiversity and ecological observations on filamentous fungi of mangrove palm *Nypa fruticans* Wurumb (Liliopsida–Arecales) along the Tutong River, Brunei. Ind J Mar Sci 35:297–307

143. Hyde et al. (2017) Fungal diversity notes 603–708: taxonomic and phylogenetic notes on genera and species. Fungal Divers 87:1–235

144. Hyde et al. (2018) Mycosphere notes 169–224. Mycosphere 9:271–430

145. Hyde et al. (2019) Fungal diversity notes 1036–1150: taxonomic and phylogenetic contributions on genera and species of fungal taxa. Fungal Divers 96: 1–242

146. Hyde et al. (2020) Fungal diversity notes 1151–1273: taxonomic and phylogenetic contributions on genera and species of fungal taxa. Fungal Divers 100:5–277

147. Hoondee et al. (2019) Occurrence of oleaginous yeast from mangrove forest in Thailand. World J Microbiol Biotechnol 35:108

148. Inderbitzin and Desjardin. (1999) A new halotolerant species of *Physalacria* from Hong Kong. Mycologia 91:666–668

149. Inderbitzin et al. (2000) A new species of *Leptosphaerulina* from decaying mangrove wood from Hong Kong. Mycoscience 41: 233–237

150. Ito and Nakagiri. (1997a) A mycofloral study on mangrove mud in Okinawa, Japan. Research communications 18:32–39

151. Ito and Nakagiri. (1997b) Mycoflora of the rhizospheres of mangrove trees. Research communications 18:40–44

152. Isaka et al. (2015) Cytotoxic hydroanthraquinones from the mangrove-derived fungus *Paradictyoarthrinium diffractum* BCC 8704. Antibiotics 68:334–338

153. Jones. (1963) Marine fungi: II. Ascomycetes and deuteromycetes from submerged wood and drift *Spartina*. Trans Br Mycol Soc 46: 135–144

154. Jones (1968) Marine Fungi. Curr Sci 13:378–379

155. Jones et al. (1999) *Dactylospora mangrovei* sp. nov. (Discomycetes, Ascomycota) from mangrove wood. Mycoscience 40:317

156. Jones and Agerer (1992) *Calathella mangrovei* sp. nov. and observations on the mangrove fungus *Halocyphina villosa*. Bot Mar 35:259–266

157. Jones and Eaton (1969) *Savoryella lignicola* gen. et sp. nov. from water cooling towers. Trans Br Mycol Soc 52:161–74

158. Jones and Hyde (1990) Observations on poorly known mangrove fungi and a nomenclatural correction. Mycotaxon 37:197–201

159. Jones and Hyde (1992) Taxonomic studies on *Savoryella* Jones et Eaton (Ascomycotina). Bot Mar 35:83–92

160. Jones et al. (1996) *Tirisporella* gen. nov., an ascomycete from the mangrove palm *Nypa fruticans*. Can J Bot 74:1487–1495

161. Jones et al. (1983) *Ocostaspora apilongissima* gen. et sp. nov: a new marine Pyrenomycete from wood. Bot Mar 26:353–360

162. Jones and Kuthubutheen (1989) Malaysian mangrove fungi. Sydowia 41:161

163. Jones and Tan (1987) Observations on manglicolous fungi from Malaysia. Trans Br Mycol Soc 89:390–392

164. Jones et al. (1988) Fungi on driftwood collected in the intertidal zone from the Philippines. Asian Marine Biology 5:103–106

165. Jones et al. (1994) *Tirispora*, a new ascomycetous genus in the Halosphaeriales. Can J Bot 72:1373–1378

166. Jones et al. (2001) *Trichocladium melhae* sp. nov., a new tropical marine fungus. Fungal Divers 7:49–52

167. Jones and Vrijmoed (2003) Biodiversity of marine fungi in Hong Kong coastal waters. Perspectives on Marine Environmental Change in Hong Kong and Southern China 1977–2001

168. Jones and Abdel-Wahab (2005) Marine fungi from the Bahamas Islands. Bot Mar 48:356–364

169. Jones and Puglisi (2006) Marine fungi from Florida. Florida Scientist 157–164

Table 1 (continued)

170. Jones et al. (2006a) Two new genera isolated from marine habitats in Thailand: *Pseudolignincola* and *Thalespora* (Halosphaeriales, Ascomycota). Nov Hedwigia 83:219–232

171. Jones et al. (2006b) Thai marine fungaldiversity. Songklanakarin Journal of Science and Technology 28, 687–708

172. Jones et al. (2009) Classification of marine Ascomycota, anamorphic taxa and Basidiomycota. Fungal Divers 35:1–187

173. Jones et al. (2017) The Halosphaeriaceae revisited. Bot Mar 60:453–468

174. Jones et al. (2019) Phylogeny of new marine Dothideomycetes and Sordariomycetes from mangroves and deep-sea sediments. Bot Mar 63:155–181 175. Kamble et al. (2008) Marine fungi from Kutcch (Gujarat cost). Resh. Link 6:67–69

176. Koch (1986) Some lignicolous marine fungi from Thailand, including two new species. Nordic journal of botany 6:497–499

177. Koch (1982) Some lignicolous marine fungi from Sri Lanka. Nordic journal of Botany 2:163–169

178. Koehn and Garrison (1981) Fungi associated with *Avicennia germinans* from the vicinity of Port Aransas. Mycologia 73:1183–1186

179. Kohlmeyer (1959) Neufunde holzbesiedelnder Meerespilze. Nova Hedwigia 1:77–99

180. Kohlmeyer (1968a) Marine fungi from the tropics. Mycologia 60:252–270

181. Kohlmeyer (1968b) A new *Trematosphaeria* from roots of *Rhizophora racemosa*. Mycopathologia et mycologia applicata 34: 1–5

182. Kohlmeyer (1969a) Ecological notes on fungi in mangrove forests. Trans Br Mycol Soc 53:237–IN5

183. Kohlmeyer (1969b) Marine fungi of Hawaii including the new genus *Helicascus*. Can J Bot 47:1469–1487

184. Kohlmeyer (1980) Tropical and subtropical filamentous fungi of the Western Atlantic Ocean. Bot Mar 23: 529–540

185. Kohlmeyer (1981a) Marine fungi from Martinique. Can J Bot 59:1314–1321

186. Kohlmeyer (1981b) Marine fungi from Easter Island and notes on *Thalassoascus*. Mycologia 73:833–843

187. Kohlmeyer (1984) Tropical marine fungi. Marine Ecology 5:329–378

188. Kohlmeyer (1985a) *Caryosporella rhizophorae* gen. et sp. nov.(Massariaceae), a marine Ascomycete from *Rhizophora mangle*. Proceedings: Plant Sciences 94:355–361

189. Kohlmeyer (1985b) *Nimbospora octonae*, a new marine ascomycete from Hawaii. Can J Bot 63:1122–1125

190. Kohlmeyer (1965) New marine fungi from mangroves and trees along eroding shore lines. Nova Hedwigia 9:89–104

191. Kohlmeyer and Kohlmeyer (1971) Marine fungi from tropical America and Africa. Mycologia 63:831–861

192. Kohlmeyer and Kohlmeyer (1977) Bermuda marine fungi.Trans Br Mycol Soc 68:207–219

193. Kohlmeyer and Schatz (1985) *Aigialus* gen. nov.(Ascomycetes) with two new marine species from mangroves. Trans Br Mycol Soc 85:699–707

194. Kohlmeyer et al. (1967) Eine neue *Corollospora* (Ascomycetes) aus dem Indischen Ozean und der Ostsee. Ber. dtsch. bot. Ges. 80:98–102

195. Kohlmeyer and Vittal (1986) *Lophiostoma mangrovis*, a new marine ascomycete from the tropics. Mycologia 78: 485–489

196. Kohlmeyer and Volkmann–Kohlmeyer (1987a) Marine fungi from Belize with a description of two new genera of ascomycetes. Bot Mar 30: 195–204

197. Kohlmeyer and Volkmann-Kohlmeyer (1987b) Marine fungi from Aldabra, the Galapagos, and other tropical islands. Can J Bot 65: 571–582

198. Kohlmeyer (1987) *Thalassogena*, a new ascomycetous genus in the Halosphaeriaceae. Syst. Ascomyc 6:223–228

199. Kohlmeyer and Volkmann-Kohlmeyer (1988) *Ophiodeira* gen. nov.(Halosphaeriales) and a survey of higher marine fungi from Saint Croix (Virgin Islands). Can J Bot 66:2062–2067

200. Kohlmeyer and Volkmann–Kohlmeyer (1989) Hawaiian marine fungi, including two new genera of Ascomycotina. Mycol Res 92:410–421

201. Kohlmeyer and Volkmann–Kohlmeyer (1990a) Revision of marine species of Didymosphaeria (Ascomycotina). Mycol Res 94:685–690

202. Kohlmeyer and Volkmann–Kohlmeyer (1990b) New species of *Koralionastes* (Ascomycotina) from the Caribbean and Australia. Can J Bot 68:1554–1559

203. Kohlmeyer and Volkmann–Kohlmeyer (1991a) Marine fungi of Queensland, Australia. Marine and Freshwater Research 42:91–99

204. Kohlmeyer (1991b) *Hapsidascus hardus* gen. et sp. nov.(Ascomycotina) from mangroves in the Caribbean. Syst. Ascomyc. 10:113–120

205. Kohlmeyer and Volkmann–Kohlmeyer (1987) Reflections on the genus *Corollospora* (Ascomycetes). Trans Br Mycol Soc 88:181–188

206. Kohlmeyer and Volkmann–Kohlmeyer (1993) Observations on Hydronectria and *Kallichroma* gen. nov. Mycol Res 97:753–761

Table 1 (continued)

207. Kohlmeyer and Volkmann–Kohlmeyer (1998a) A new marine *Xylomyces* on *Rhizophora* from the Caribbean and Hawaii. Fungal Divers 1:159–164

208. Kohlmeyer and Volkmann–Kohlmeyer (1998b) *Dactylospora canariensis* sp. nov. and notes on *D. haliotrepha*. Mycotaxon (USA) 67:247–250

209. Kohlmeyer (1964) A new marine ascomycete from wood. Mycologia 56:770–774

210. Kohlmeyer (1986) *Ascocratera manglicola* gen. et sp. nov. and key to the marine Loculoascomycetes on mangroves. Can J Bot 64:3036–3042

211. Kohlmeyer (1966) Neue meerespilze an mangroven. Berichte der Deutschen Botanischen Gesellschaft, 79: 27–37

212. Kohlmeyer (1967) Intertidal and phycophilous fungi from Tenerife (Canary Islands). Trans Br Mycol Soc 50: 137–147

213. Kohlmeyer and Kohlmeyer (1979) Marine mycology. The higher fungi. Academic Press, New York

214. Kohlmeyer and Kohlmeyer (1993) Biogeographic observations on Pacific marine fungi. Mycologia 85:337–346

215. Krylova (1980) Higher marine fungi at the coasts of the Sea of Japan. Biologiya Morya-Marine Biology 20–25

216. Kumar et al. (2019) *Rhytidhysteron mangrovei* (Hysteriaceae), a new species from mangroves in Phetchaburi Province, Thailand. Phytotaxa 401:166–178

217. Lee and Baker (1972) An ecological study of the soil microfungi in a Hawaiian mangrove swamp. Pac. Sci 26:1–10

218. Lee and Baker (1973) Fungi associated with the roots of red mangrove, *Rhizophora mangle*. Mycologia 65:894–906

219. Leightley and Eaton (1979) Nia vibrissa-a marine white rot fungus. Trans Br Mycol Soc 73:35–40

220. Leightley (1980) Wood decay activities of marine fungi. Bot Mar 23:387–395

221. Li et al. (2018) *Marinophialophora garethjonesii* gen. et sp. nov.: a new hyphomycete associated with *Halocyphina* from marine habitats in Thailand. Phytotaxa 345:1–12

222. Lintott and Lintott (2002) Marine fungi from New Zealand. InFungi Mar Environ (edKDHyde) Fungal Divers Res Ser 7:285–292

223. Liu et al. (2015) Fungal diversity notes 1–110: taxonomic and phylogenetic contributions to fungal species. Fungal Divers 72:1–197

224. Limtong et al. (2007) *Candida thaimueangensis* sp. nov., an anamorphic yeast species from estuarine water in a mangrove forest in Thailand. Int J Syst Evol Microbiol 57:650–653

225. Limtong et al. (2008) east Diversity in mangrove and terrestrial forests with descriptions of six novel ascomyceteous yeast species and screening of oleaginous yeasts for Lipid production. The 20th Annual Meeting and International Conference of Thai Society for Biotechnology TSB2008

226. Limtong and Yongmanitchai (2010) *Candida chanthaburiensis* sp. nov., *Candida kungkrabaensis* sp. nov. and *Candida suratensis* sp. nov., three novel yeast species from decaying plant materials submerged in water of mangrove forests. Antonie van Leeuwenhoek, 98: 379–388

227. Leong et al. (1990) *Payosphaeria minuta* gen. et sp. nov., an ascomycete on mangrove wood. Bot Mar 33:511–514

228. Leong et al. (1988) Lignicolous marine fungi of Singapore. Can J Bot 66:2167–2170

229. Leong et al. (1991) *Halosarpheia minuta* sp. nov., an ascomycete from submerged mangrove wood. Can J Bot 69:883–886

230. Leong et al. (1991) Fungal colonization of submerged*Bruguiera cylindrica* and *Rhizophora apiculata* wood. Bot Mar 34:69–76

231. Loilong et al. (2012) Biodiversity of fungi on the palm *Nypa fruticans*. Marine Fungi: and Fungal-like Organisms 273

232. Maekawa et al. (2005a) *Haloaleurodiscus mangrovei* gen. sp. nov.(Basidiomycota) from mangrove forests in Japan. Mycol Res 109:825–832

233. Meyers (1957) Taxonomy of marine Pyrenomycetes. Mycologia 49:475–528

234. Meyers (1969) Thalassiomycetes XI. Further studies of the genus *Lindra* with a description of *L. marinera*, a new species. Mycologia 61: 486–495

235. Meyers and Moore (1960) Thalassiomycetes II. New genera and species of Deuteromycetes. American Journal of Botany 47:345–349

236. Meyers et al. (1965) Thalassiomycetes VII. Observations on fungal infestation of turtle grass, *Thalassia testudinum* König. Bulletin of Marine Science 15: 548–564

237. Moore and Meyers (1959) Thalassiomycetes I. Principles of delimitation of the marine mycota with the description of a new aquatically adapted Deuteromycete genus. Mycologia 51:871–876

238. Manimohan et al. (2011) A comparison of diversity of marine fungi on three co-habiting mangrove plants. Mycosphere 2:533–538

239. Maria and Sridhar (2002a) Richness and diversity of filamentous fungi on woody litter of mangroves along the west coast of India. Curr Sci 1573–1580

240. Maria and Sridhar (2002b) New ascomycete, *Passeriniella mangrovei* sp. nov. from the mangrove forest of India. Indian Journal of Forestry 25:319–322

241. Maria and Sridhar (2003a) Diversity of filamentous fungi on woody litter of five mangrove plant species from the southwest coast of India. Fungal Divers 14:109–126

Table 1 (continued)

242. Maria and Sridhar (2003b) Endophytic fungal assemblage of two halophytes from west coastal mangrove habitats, India. Czech Mycol 55:241–251
243. Nakagiri (1993) Intertidal mangrove fungi from Iriomote Island. Research communications 16:24–62
244. Nakagiri et al. (1989) Succession of fungi in decomposing mangrove leaves in Japan. Recent advances in microbial ecology 297–301
245. Nakagiri and Ito (1994) *Aniptodera salsuginosa*, a new mangrove-inhabiting ascomycete, with observations on the effect of salinity on ascospore appendage morphology. Mycol Res 98:931–936
246. Nakagiri and Tokura (1987) Taxonomic studies of the genus *Corollospora* (Halosphaeriaceae, Ascomycotina) with descriptionsof seven new species. Trans Mycol Soc Japan 28:413–436
247. Nakagiri and Tubaki (1983) *Lindra obtusa*, a new marine ascomycete and its *Anguillospora* anamorph. Mycologia 75:487–497
248. Nambiar and Raveendran (2007) Estuaries marine mycoflora of North Malabar (Kerala). J. Mar. Atmos. Res 3:29–31
249. Nambiar and Raveendran (2008) A checklist of marine fungi from Kerala State, India. American-Eurasian Journal of Botany 1:73–77
250. Nambiar and Raveendran (2009) Manglicolous marine fungi of Kerala, South India. Botany Research International 2: 206–210
251. Nambiar and Raveendran (2011) *Anthostomella nypensis* and *Biconiosporella corniculata*: Additions to the marine mycoflora of India. Geobios-International Journal of Life Sciences 38:200
252. Nambiar and Raveendran (2015) Frequency of marine fungi on animal substrates along west coast of India. Current Research in Environmental and Applied Mycology 5:394–397
253. Nandan et al. (1993) Marine fungi from Goa coast (India). Biol. Ind, 4, 29–34
254. Newell et al. (1980) Mycoflora of turtlegrass (*Thalassia testudinum* König) as recorded after seawater incubation. Bot Mar 23, 265–275
255. Newell (1992) Autumn distribution of marine Pythiaceae across a mangrove–saltmarsh boundary. Can J Bot 70:1912–1916
256. Newell et al. (1981) Acute impact of an organophosphorus insecticide on microbes and small invertebrates of a mangrove estuary. Archives of environmental contamination and toxicology 10:427–435
257. Newel (1976) Mangrove fungi: the sucession in the mycoflora of red mangrove (*Rhizophora mangle* L.). Recent advances in aquatic mycology. UK: Paul Elek Scientific Books 51–91
258. Pang et al. (2013) Dyfrolomycetaceae, a new family in the Dothideomycetes, Ascomycota. Cryptog Mycol 34: 223–232
259. Pang et al. (2011) Marine mangrove fungi of Taiwan. Keelung, Taiwan: National Taiwan Ocean University
260. Pang and Jheng (2012) A checklist of marine fungi of Taiwan with a description of *Kitesporella keelungensis* gen. et sp. nov. Bot Mar 55:459–466
261. Patil and Borse (2001) Studies on higher marine fungi from Gujarat coast (India). Geobios-Jodhpur 28: 41–44
262. Patil and Borse (1982) Marine fungi from Maharashtra (India) 1. India Bot. Reptr 1:102–106
263. Patil and Borse (1983) Marine fungi from Maharashtra (India) III. Some fungi from mangroves. Indian Bot. Reptr 2:56–58
264. Patil and Borse (1983) Marine fungi from Maharshtra (India) - II Some arenicolous fungi. Indian Bot Reptr 2:86–87
265. Patil and Borse (1985) Marine fungi from Maharshtra (India). 4.some Loculoascomycetes. Trans Mycol Soc Japan 26: 271–276
266. Pawar et al. (1967) Species of *Phoma* isolated from marine soils in India. Trans Br Mycol Soc 50:259–265
267. Pawar and Borse (2004) Marine fungi from Sundarbans (India)-VI. Adv. Sci. Technol. 7:17–28
268. Pawar and Borse (2005) Marine fungi from Sunderbans (India)-V. Phytol. Res. 18:1–9
269. Poon and Hyde (1998a) Biodiversity of intertidal estuarine fungi on *Phragmites* at Mai Po marshes, Hong Kong. Bot Mar 41:41–156
270. Poon and Hyde (1998b) Evidence for the vertical distribution of saprophytic fungi on senescent *Phragmites australis* culms at Mai Po marshes, Hong Kong. Bot Mar 41:285–292
271. Poonyth et al. (2000) *Mauritiana rhizophorae* gen. et sp. nov.(Ascomycetes, Requienellaceae), with a list of terrestrial saprobic mangrove fungi. Fungal Divers.4:101–116
272. Poonyth et al. (1999) Intertidal fungi in Mauritian mangroves. Bot Mar 42:243–252
273. Phookamsak et al. (2019) Fungal diversity notes 929–1035: taxonomic and phylogenetic contributions on genera and species of fungi. Fungal Divers 95:1–273
274. Prasannarai and Sridhar (2000) *Corollospora indica*, a new marine fungal species from west coast of India. J Environ Biol, 21: 235–239
275. Prasannarai and Sridhar (2001) Diversity and abundance of higher marine fungi on woody substrates along the west coast of India. Curr Sci 304–311
276. Preedanon et al. (2017) *Helicascus mangrovei* sp. nov., a new intertidal mangrove fungus from Thailand. Mycoscience, 58: 174–180

Table 1 (continued)

277. Raghukumar (1973) Marine lignicolous fungi from India. Kavaka, 1:73–85
278. Raghukumar et al. (1988) *Cirrenalia basiminuta*: a new lignicolous marine deuteromycete from the tropics. Mycotaxon, 31: 163–170
279. Rai et al. (1969) Mycoflora of mangrove mud. Mycopathologia et mycologia applicata, 38(1–2), 17–31
280. Rajendran and Kathiresan (2007) Microbial flora associated with submerged mangrove leaf litter in India. Revista de biología tropical 55:393–400
281. Raveendran and Manimohan (2007) Marine fungi of Kerala, A Preliminary Floristic and Ecological Study. Malbar Matoral History Society, Calicat. Kerala, India. Pp 1–270
282. Ravikumar (1991) Studies on fungi from mangroves of East Coast of India (Ph.D. thesis) University of Madras, India
283. Ravikumar and Vittal (1996) Fungal diversity on decomposing biomass of mangrove plant *Rhizophora* in Pichavaram estuary, east coast of India. Indian J. Mar. Sci. 21:64–66
284. Réblová et al. (2016) Recommendations for competing sexual-asexually typified generic names in Sordariomycetes (except Diaporthales, Hypocreales, and Magnaporthales). IMA Fungus 7:131–153
285. Sadaba et al. (1995) Observations on vertical distribution of fungi associated with standing senescent *Acanthus ilicifolius* stems at Mai Po Mangrove, Hong Kong. Hydrobiologia 295: 119–126
286. Sampaio et al. (1999) *Occultifur externus* sp. nov., a new species of simple-pored auricularioid heterobasidiomycete from plant litter in Portugal. Mycologia 91:1094–1101
287. Samón-Legrá et al. (2014) Frequency of occurrence ofmarine fungi in mangrove forests of Zapata Swamp Biosphere Reserve (South of Cuba). Global Journal of Environmental Research 8:11–16
288. Sarma and Hyde (2000) *Tirispora mandoviana* sp. nov. from Chorao mangroves, Goa, the west coast of India. Aust Mycol 19:52–56
289. Sarma et al. (2001) Frequency of occurrence of mangrove fungi from the east coast of India. Hydrobiologia 455:41–53
290. Sarma and Raghukumar, S. (2013) Manglicolous fungi from Chorao mangroves, Goa, West coast of India: Diversity and frequency of occurrence. Nova Hedwigia, 97:533–542
291. Sarma and Vittal (2000) Biodiversity of mangrove fungi on different substrata of *Rhizophora apiculata* and *Avicennia* spp. from Godavari and Krishna deltas, east coast of India. Fungal Divers 5:23–41
292. Sarma and Vittal (2001) Biodiversity of manglicolous fungi on selected plants in the Godavari and Krishna deltas, east coast of India. Fungal Divers 6:115–130
293. Sarma and Vittal (2004) Manglicolous fungi recorded from Godavari Krishna deltas, AP, East coast of India along with dichotomus key notes on some taxa. Kavaka 32:65–111
294. Schatz (1985) *Adomia avicenniae*: a new ascomycetous genus from Red Sea and Australian mangroves. Trans Br Mycol Soc 84:555–559
295. Schatz (1988) *Hypoxylon oceanicum* sp. nov. from mangroves. Mycotaxon 33:413–418
296. Shini et al. (2009–10) Assemblage and diversity of fungi in two under explored mangroves of India. Kavaka 37– 38: 79–85
297. Singh and Steinke. (1992) Colonization of decomposing leaves of *Bruguiera gymnorrhiza* (Rhizophoraceae) by fungi, and in vitro cellulolytic activity of the isolates. South African Journal of Botany 58:525–529
298. Sridhar (2013) Mangrove fungal diversity of west coast of India. Mangroves of India: their biology and uses. 161–182
299. Sridhar and Prasannarai (1993) Marine fungi on Decaying wood from Mangalore coast. Mahasagar 26:33–38
300. Sridhar and Mangalagangotri (2009) Fungal diversity of Pichavaram mangroves, Southeast coast of India. Nature and Science 7
301. Statzell-Tallman et al. (2008) *Kwoniella mangroviensis* gen. nov., sp. nov.(Tremellales, Basidiomycota), a teleomorphic yeast from mangrove habitats in the Florida Everglades and Bahamas. FEMS yeast research 8:103–113
302. Statzell-Tallman et al. (2010) *Candida spencermartinsiae* sp. nov., *Candida taylorii* sp. nov. and *Pseudozyma abaconensis* sp. nov., novel yeasts from mangrove and coral reef ecosystems. Int J Syst Evol Microbiol 60(8), 1978–1984
303. Steinke and Jones. (1993) Marine and mangrove fungi from the Indian Ocean coast of South Africa. South African Journal of Botany 59:385–390
304. Steinke et al. (1990) Structural changes and associated microbial activity accompanying decomposition of mangrove leaves in Mgeni Estuary. South African Journal of Botany 56:39–48
305. Steinke and Hyde (1997) *Gloniella clavatispora*, sp. nov. from *Avicennia marina* in South Africa. Mycoscience 38:7–9
306. Stevens (1920) New or noteworthy Porto Rican fungi. Botanical Gazette 70:399–402
307. Stolk (1955) *Emericellopsis minima* sp. nov. and *Westerdykella ornata* gen. nov., sp. nov.Trans Br Mycol Soc 38:419–424
308. Suetrong et al. (2017) Distribution and occurrence of manglicolous marine fungi from eastern and southern Thailand. Bot Mar 60:503–514

Table 1 (continued)

309. Suhirman and Jones (1984) Preliminary observations on lignicolous marine fungi in the Java Sea, Indonesia. Annls. Bogorienses 8:35–49

310. Supaphon et al. (2014) Diversity and antimicrobial activity of endophytic fungi isolated from the seagrass *Enhalus acoroides*. Indian J Geo–Mar Sci 43:785–797

311. Supaphon et al. (2017) Phylogenetic community structure of fungal endophytes in seagrass species. Bot Mar 60:489–501

312. Swart (1958) An investigation of the mycoflora in the soil of some mangrove swamps. Acta botanica neerlandica 7:741–768

313. Swart (1963) Further investigations of the mycoflora in the soil of some mangrove swamps. Acta botanica neerlandica 12:98–111

314. Swe et al. (2009) Diversity and abundance of nematode-trapping fungi from decaying litter in terrestrial, freshwater and mangrove habitats. Biodiversity and conservation, 18:1695–1714

315. Tan et al. (1989a) Occurrence of fungi on mangrove wood and its decomposition. Recent advances in microbial ecology 307–310

316. Tan et al. (1989b) Succession of fungi on wood of *Avicennia alba* and *A. lanata* in Singapore. Can J Bot 67:2686–2691

317. Tan and Leong (1990) Mangrove fungi of Singapore and some possible factors influencing their occurrence. Trans Mycol Soc Japan 31:35–44

318. Tan and Leong (1992) Lignicolous fungi of tropical mangrove wood. Mycol Res 96:413–414

319. Thorati et al. (2016) Isolation, identification of endophytic Fungi from mangrove roots along the coast of South Andaman Sea, Andaman and Nicobar Islands, India. J Mar Biol Oceanogr 5:2

320. Tubaki (1966) Marine fungi from Japan. Lignicolous I. Trans Mycol Soc Japan 7: 73–87

321. Tubaki (1968) Studies on the Japanese marine fungi- Lignicolous group II. Publications of the Seto Marine Biological Laboratory 15:357–372

322. Tubaki (1969) Studies on the Japanese marine fungi: lignicolous group (III), algicolous group and a general consideration. Osaka Inst Ferment Annu Rep.4:12–41

323. Vicenta et al. (1983) Marine fungi from Batan, Aklan. Appl Sci Bull, 35:1–16

324. Kohlmeyer et al. (1995) Decomposition of mangrove wood by marine fungi and teredinids in Belize. Marine Ecology 16:27–39

325. Vrijmoed et al. (1994a) Observations on subtropical mangrove fungi in the Pearl River estuary. Acta Scientiarum Naturalium 33:78–85

326. Vrijmoed et al. (1994b) Observations on mangrove fungi from Macau and Hong Kong, with the description of two new ascomycetes: *Diaporthe salsuginosa* and *Aniptodera haispora*. Mycol Res 98:699–704

327. Vrijmoed et al. (1996) *Melaspilea mangrovei* sp. nov., from Australian and Hong Kong mangroves. Mycol Res 100:291–294

328. Vrijmoed (1990) Preliminary observations of lignicolous marine fungi from mangroves in Hong Kong. In Proceedings of the Second International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China. Hong Kong University Press, Hong Kong pp. 707–706

329. Vrijmoed et al. (1986a) Effects of surface fouling organisms on the occurrence of fungi on submerged pine blocks in Hong Kong coastal waters. Hydrobiologia 135:123–130

330. Vrijmoed et al. (1986b) Occurrence of fungi on submerged pine and teak blocks in Hong Kong coastal waters. Hydrobiologia 135:109–122

331. Vrijmoed et al. (1982a) Seasonal patterns of primary colonization by lignicolous marine fungi in Hong Kong. Hydrobiologia 89:253–262

332. Vrijmoed et al. (1982b) Factors affecting the distribution of lignicolous marine fungi in Hong Kong. Hydrobiologia 87:143–160

333. Vánky (1986) The genus Moesziomyces (Ustilaginales). Nordic journal of botany 6:67–73

334. Wanasinghe et al. (2016) Saprobic Dothideomycetes in Thailand: *Vaginatispora appendiculata* sp. nov.(Lophiostomataceae) introduced based on morphological and molecular data. Stud Fungi 1:56–68

335. Wanasinghe et al. (2017) Phylogenetic revision of *Camarosporium* (Pleosporineae, Dothideomycetes) and allied genera. Stud Mycol 87:207–256

336. Prasannarai and Sridhar (2003a) Mangrove dieback in north Queensland, Australia. Indian. J. Mar. Sci.32,329–333

337. Walker (2012) Marine fungi of US Gulf of Mexico barrier island beaches: Biodiversity and sampling strategy Ph.D. Thesis, University of Southern Missisippi, Hattiesburg, MS, USA, December 2012

338. Whalley et al. (1994) The Xylariaceae (ascomycetes) of mangroves in Malaysia and South East Asia. Nova Hedwigia 59:207–218

339. Whalley et al. (2000) *Halorosellinia* gen. nov. to accommodate *Hypoxylon oceanicum*, a common mangrove species. Mycol Res 104: 368–374

340. Zanial and Jones (1984) Observations on some lignicolous marine fungi from Kuwait. Nova Hedwigia, 39(3–4), 569–583

341. Zainal and Jones (1986) Occurrence and distribution of lignicolous marine fungi in Kuwait coastal waters. In Biodeterioration 6. 596–600

342. Zhang et al. (2018) *Acuminatispora palmarum* gen. et sp. nov. from mangrove habitats. Mycol Prog 17: 1173–1188

Table 1 (continued)

343. Zhang et al. (2019) Striatiguttulaceae, a new pleosporalean family to accommodate *Longicorpus* and *Striatiguttula* gen. nov. from palms. MycoKeys 49:99

344. Cash (1938) New records of Hawaiian discomycetes. Mycologia 30: 97–107

345. Prasannarai and Sridhar (2003b) Exsiccata of the Dominican mycoflora (Cent. III, Nos. 201-300). Fungal Divers. 14, 127–141

346. Ciferri (1938) Meliolae of Santo Domingo (WI). Ann. mycol 36:2–3

347. Seaver and Waterston (1941) Contributions to the Mycoflora of Bermuda—II. Mycologia 33: 310–317

348. Hyde (1988) Marine mangrove fungi. Marine Ecology 9: 15–33

349. Borse and Hyde (1989) Marine fungi from India III. *Acrocordiopsis patilii* gen. et sp. nov. from mangrove wood. Mycotaxon 34: 535–540

350. Hyde (1991) *Phomopsis mangrovei*, from intertidal prop roots of *Rhizophora* spp. Mycol Res 95:1149–1151

351. Hyde (1995) *Lophiostoma asiana* sp. nov. from Thailand mangroves. Mycotaxon 55:283–288

352. Read et al. (1995) Ultrastructure of asci and ascospores of two mangrove fungi: *Swampomyces armeniacus* and *Marinosphaera mangrovei*. Mycol Res 99:1465–1471

353. Pang et al. (2016) A checklist of marine fungi of Hong Kong. Fung. Sci. 31: 7–17

354. Sarma and Vittal (2007) Biodiversity and ecology of soil fungi in Godavari and Krishna river deltaic mangroves, east coast of India. KAVAKA 35:65–83

355. Nakagiri et al. (1997) *Lanceispora amphibia* gen. et sp. nov., a new amphisphaeriaceous ascomycete inhabiting senescent and fallen leaves of mangrove. Mycoscience 38:207–213

356. Rai and Chowdhery (1975) *Hemisartorya*, a new genus of cleistothecial Ascomycetes with *Aspergillus* state Kavaka.3:73–76

357. Limtong et al. (2009) Three anamorphic yeast species *Candida sanitii* sp. nov., *Candida sekii* sp. nov. and *Candida suwanaritii*, three novel yeasts in the *Saturnispora* clade isolated in Thailand. FEMS yeast research 10: 114–122

358. Tan and Pek (1997) Tropical mangrove leaf litter fungi in Singapore with an emphasis on *Halophytophthora*. Mycol Res 101:165–168

359. Kuthubutheen (1984) Leaf surface fungi associated with *Avicennia alba* and *Rhizophora mucronata* in Malaysia. In Proceedings of the Asian Symposium on Mangrove Environment-Research and Management. pp. 153–171

360. Mehdi and Saifullah (1992) Mangrove fungi of Karachi, Pakistan. Journal of Islamic Academy of Sciences, 5: 24–27

361. Ulken (1981) The phycomycetes flora of mangrove swamps in the South Pacific. Verroff. Inst. Meeresfoasch. Bremerh, 19:45–59

362. Ulken (1983) Distribution of Phycomycetes in mangrove swamps with brackish waters and waters of high salinity. Springer, Dordrecht.111–116

363. Ulken (1972) Physiological studies on a phycomycete from a mangrove swamp at Caneia, Sao Paulo, Brazil. Veroff. Inst. Meeresforsch. Bremerh. 13: 217–230

364. El-Samawaty et al. (2019) *Saturnispora mangrovi* fa, sp. nov. from Syhat mangrove, Saudi Arabia. Int J Syst Evol Microbiol ijsem003859

365. Sarma (2012) Diversity and distribution of marine fungi on *Rhizophora* spp. in mangroves. In Biology of Marine Fungi. Springer, Berlin, Heidelberg. 243–275

366. Sakayaroj et al. (2010) Phylogenetic diversity of endophyte assemblages associated with the tropical seagrass *Enhalus acoroides* in Thailand. Fungal Divers 42: 27–45

367. Hongsanan et al. (2020a) Refined families of Dothideomycetes: Dothideomycetidae and Pleosporomycetidae Mycosphere 11: 1553–2107

368. Sarma and Devadatha (2020) Fungal diversity in mangroves of India and a note on their medicinal potential. In Biotechnological Utilization of Mangrove Resources. Academic Press. 153–224

369. Hai–Sheng et al. (2020) Fungal diversity notes 1276–1391: taxonomic and phylogenetic contributions to fungal taxa. Fungal Divers in Press

370. Alias and Jones (2000) Colonization of mangrove wood by marine fungi at Kuala Selangor mangrove stand, Malaysia. Fungal Divers 5, 9–21

371. Sridhar and Maria (2006) Fungal diversity on woody litter of *Rhizophora mucronata* in a southwest Indian mangrove. Indian J. Mar. Sci 35:318–325

372. Newell (1973) Succession and role of fungi in the degradation of red mangrove seedlings.Estuarine microbial ecology 1:467

373. Inderbitzin et al. (1999) A new species of *Cryptovalsa* from Mai Po mangrove in Hong Kong. Mycol Res 103:1628–1630

374. Hyde (1993) *Cryptovalsa halosarceicola* sp. nov. an intertidal saprotroph of *Halosarceia halocnemoides*. Mycol Res 97:799–800

375. Abdel-Wahab et al. (2001) Two new intertidal lignicolous *Swampomyces* species from Red Sea mangroves in Egypt. Fungal Divers 8:35–40

376. Hyde et al. (2020) Refined families of Sodariomycetes. Mycosphere 11: 305–1059

377.Jayasiri et al. (2019) Diversity, morphology and molecular phylogeny of Dothideomycetes on decaying wild seed pods and fruits. Mycosphere 10: 139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◂**Fig. 3** **a** Prop roots of *Rhizophora* showing colonisation by *Pyrenographa xylographoides* and exclusion of other fungi, **b, c** *Rhizophora mucronata* seedlings colonised by *Halocyphina villosa* and *Nectria* sp., respectively, **d** *Sonneratia* sp. pneumatophore colonized by fungi and attacked by marine borers. **e, f** *Sonneratia* forest at Morib mangrove, Malaysia with pneumatophores, **g, h** *Rhizophora* sp. with prop roots, **i, j** *Acanthus ilicifolius* with stems from Mai Po mangrove, Hong Kong, **k** Fern *Acrostichum donaefolium*

Seasonal variation of mangrove fungi

Spatio-temporal variations among mangrove fungi has been little investigated and relies on casual observations of collections made at different localities. Aleem (1980) found seasonal periodicity of mangrove fungi in Sierra Leone with more numbers and growth intensity in wet season (May–November). Species such as *Haligena viscidula*, *Leptosphaeria australiensis*, *L. avicenniae*, *Halorosellinia oceanica* and *Torpedospora radiata* were more frequently recorded towards the end of rainy season. Besitulo et al. (2002) observed the occurrence of mangrove fungi over a 10-month period covering wet and dry seasons in Siargao Island, Philippines by collecting *Nypa fruticans* samples at bimonthly intervals. The highest percentage occurrence of fungi was greatest in October than the other months. Most of the frequently occurring fungi e.g. *Astrosphaeriella striatispora*, *Caryosporella rhizophorae*, *Sclerococcum haliotrephum* and *Linocarpon appendiculatum* were collected in all months.

Sarma and Vittal (1998–1999) studied seasonal occurrence of marine fungi in mangroves of Godavary and Krishna deltas colonizing *Rhizophora apiculata* and *Avicennia* spp. by conducting bimonthly samplings for 2 years from January 1994 to November 1995. The east coast of Inda experiences two monsoons: south west monsoon (July to August) and North East monsoon (October to November). The number of marine fungal species dropped during summer (May) but increased to maximum during rainy season (November) in both deltas and on both hosts. The reason could be the extreme environmental factors experienced during summer (May) including very high atmospheric temperatures, surface water temperature and high salinity and lack of rain. On the contrary low temperature, low salinity as a result of heavy rains during November increased the occurrence of mangrove fungi in the November collection. A similar increase in species diversity was also found in July (South west monsoon) but not to the extent of November (North East monsoon). This also shows that most of the fungi colonizing mangrove substrata prefer moderate salinity and temperatures. Some marine mangrove fungi such as *Verruculina enalia*, *Halocryptosphaeria bathurstensis* (=*Eutypa bathurstensis*), *Lophiostoma mangrovei*, *Hypoxylon* sp., *Rhizophila marina*, *Saccardoella rhizophorae* on *Rhizophora apiculata* occurred in almost all the samplings indicating that these fungi can tolerate a wide range of temperature and salinity regimes. In contrast, the following fungi: *Halorosellinia oceanica*, *Halocyphina villosa*, *Lulworthia* sp., *Sclerococcum haliotrephum* showed seasonality in terms of their percentage occurrence. This may suggest that these fungi may not be equally tolerant when compared to the other fungi mentioned above which were recorded in all the samplings with high percentage occurrence. When the seasonal occurrence of sexual and asexual morphs of marine mangrove fungi was observed on *Rhizophora apiculata* at Godavary and Krishna deltas (Sarma and Vittal 1998–1999), asexual morphs showed more diversity and occurrence during July, November and January months at both deltaic mangroves. On *Avicennia* spp., however, no definite pattern was observed. Excepting rainfall, no other parameter seems to have a definitive effect on the distribution of sexual and asexual morph occurrence during different months of sampling. Though a few leads are available from this study, the seasonality of marine mangrove fungi requires long term observations involving multiple year examination to get any definitive conclusions on the effect of different environmental factors (Sarma and Vittal 2017).

These studies relied on field collections and documentation of sporulation of fungi on the substrate, ignoring that other taxa may already be present in the host. The subject also lacks critical experimental work by the exposure of substrates and their recovery over dry/wet seasons.

Ecological interactions of mangrove fungi

There has been enormous interest in fungal community structures as such studies help in understanding the ecosystem dynamics, such as mutualism, commensalism and antagonism (Cooke and Rayner 1984), but few examples have been reported for mangrove fungi. Sarma and Raghukumar (2013) found three different fungal assemblages of mangrove fungi viz., commensalistic, mutualistic and antagonistic life styles at Chorao mangroves, Goa, India. Commensalistic assemblages were typified by *Aigialus grandis*, *Morosphaeria ramunculicola* and *Halocyphina villosa*, fungi that occurred both in association with others, as well as singly. Mutualistic association was characterized by *Trichocladium achrasporum* and *Verruculina enalia*, fungi that occurred almost always associated with other fungi suggesting a mutualistic occurrence. *Rimora mangrovei* always occurred singly, suggesting a possible antagonistic life style (Sarma and Raghukumar 2013). In these three life styles, commensalism signifies a tolerance to other speices, while mutualism indicates a dependency on other species in a mutualistic manner to act as a community in breaking down specific parts of the substrate which is then used according

Fig. 4 **a** Brackish water palm *Nypa fruticans*, **b** Base of frond and rhizome of *N. fruticans*, **c** *Phoenix paludosa*, **d** Decaying fronds of *Ph. paludosa* **e** *Avicennia marina* with pneumatophores at Morib mangrove, Malaysia, **f** Fruit of *A. marina*, **g** *Suaeda monica*, **h** *S. maritima*

to the requirement of each individual species (Weber 2006; Pouska et al. 2013; Sarma and Raghukumar 2013).

Lichens growing on mangrove wood, branches and bark of the mangrove plants are named as manglicolous lichens (Raja et al. 2012). The diversity of lichens in mangroves are few in contrast to the lichens of terrestrial environment, as their growth is halted by high level of salinity and moisture (Logesh et al. 2013). However, these lichens occur in the aerial parts of the mangrove plants and are not intertidal. Some of them may fall on to the ground but they cannot be considered as marine and hence are not included.

Sarma and Hyde (2018) investigated the fungal species consortia on *Nypa fruticans* substrata and found three different assemblages. *Astrosphaeriella striatispora*, *Linocarpon nypae* and *Oxydothis nypae* were found to be commensalists as they occurred both singly and also in consortia with other fungi. *Linocarpon appendiculatum* and *Linocarpon bipolaris* were mutualistic which suggests they may be dependent upon other fungi for their colonization. *Anthostomella eructans*, *Anthostomella* sp., and *Trichocladium* sp. were found occurring singly on *N. fruticans* thus indicating their antagonistic potential. However, these observations need to be tested experimentally as shown by the studies of Cooke and Rayner (1984) for terrestrial fungi. Studies based on reproductive structures of fungi found on natural samples reveal limited information on causal relationships in their occurrence (Pouska et al. 2013) as the mycelial state of a fungus gives a better understanding of their functional roles (Cooke and Rayner 1984).

Few experimental studies have been undertaken on mangrove fungi to determine the interactions between taxa and their affect in the colonisation of substrates. Tan et al. (1995) investigated the interactions between mangrove fungi under laboratory conditions. Three mangrove fungi, *Aigialus parvus*, *Lignincola laevis* and *Verruculina enalia*, were grown on wood singly or mixed combinations and different effects noted. For example, sporulation of *A. parvus* was markedly reduced by *L. laevis*, while it enhanced ascocarp formation in *V. enalia*. Tam et al. (2003) carried out field experiments by the pre-inoculuation of lignicolous marine fungi into wood test blocks and their immersion in the sea are required to determine interactions in the colonization of woody substrates. Future studies on fungal species consortia or co-occurrence in mangrove fungi should include statistical analyses, in vitro studies, molecular analyses including metagenomics to have a better understanding on the co-occurrence patterns of mangrove fungi. Many factors may influence the fungal assemblages or co-occurrence including the host examined and its chemical composition, availability of moisture, salinity, and others (Jones 2000). An example of antagonistic activity by a mangrove is shown by *Pyrenographa xylographoides* on the prop roots of *Rhizophora* sp. (Figure 3a). Earlier studies suggest that the fungicolous species from mangroves are very rare (Sun et al. 2019). Li et al. (2018) introduced a new genus *Marinophialophora* typified by *M. garethjonesii* which is associated with *Halocyphina villosa* on mangrove wood of *Avicennia marina* and *Bruguiera parviflora.*

Mangrove fungi have been shown to produce a wide range of secondary metabolites: Xyloketals from mangrove fungus *Xylaria* sp. (Lin et al. 2001), enalin A and B from *Verruculina enalia* (Lin et al. 2002a), eniatin G from the mangrove fungus *Halosarpheia* sp. (Lin et al. 2002b), and Aigialomycins and related polyketide metabolites from *Aigialus parvus* (Isaka et al. 2009). Mangrove endophytes have also yielded a wide range of bioactive natural products from various chemical classes such as alkaloids, chromones, coumarins, polyketides peptides and terpenes etc. and this subject has been reviewed by few authors (Debbab et al. 2013; Xu 2015; Deshmukh et al. 2018). Deshmukh et al. (2020) listed 106 novel compounds and their anti- intfective acitivity from mangrove endophytic fungi. For example, antibacterial compound pestalotiopisorin B was extracted from endophytic fungus *Pestalotiopsis* sp., isolated from *Rhizophora stylosa* (Xu et al. 2019). Deshmukh et al. (2018) reviewed novel anticancer compounds reported from mangrove endophytic fungi. A cytotoxic compound beauvericin as obtained from *Fusarium* sp., isolated from the bark of *Kandelia candel* from mangroves of China (Tao et al. 2015).

Worldwide studies of mangrove fungi

In a comparison on the geographical distribution of mangrove fungi, it is pertinent to point out that mangrove plants vary in diversity at each location, with differences in salinity from estuarine brackish water, to sea water and locations with a salinity of 0.5% to 3.8% (e.g. Red Sea, Ulken 1986; El-Sharouny et al. 1998). Consideration must be given to tidal amplitude extant at mangroves under study. In some locations there is little tidal amplitude (e.g. Florida) while at others it is extensive (e.g. Morib, Malaysia).

Around 54 'typical mangrove' plant species and 60 'mangroves associates' occur in the new and old world (Tomlinson 1986). Mangrove plant species diversity at various geographical locations varies and is particularly more diverse in the Pacific Ocean and less common in subtropical countries (Tomlinson 1986; Spalding et al. 2010). Mangroves in Asia have greater species diversity with 30 or more tree species and this will undoubtedly support a wider range of fungal taxa (Spalding et al. 2010). Figures 3 and 4 illustrate typical substrates that have been surveyed for mangrove fungi.

It is 16 years since Schmit and Shearer (2003, 2004) documented the world distribution of mangrove fungi and therefore it is opportune to reassess their observations. For example, a number of country monographs on mangrove fungi have been published: Iraq (Al-Saadoon 2006), Malaysia (Alias and Jones 2009), Taiwan (Pang et al. 2011), Thailand (Sangtiean et al. 2014; Suetrong et al. 2016) and India (Raveendran and Manimohan 2007). Many new geographical studies, including Saudi Arabia (Abdel-Wahab et al. 2014), Guam and Bahamas (Jones and Abdel-Wahab 2005), Everglades, Florida, USA (Fell et al. 2004; Jones and Puglisi 2006) and Australia (Fryar et al. 2019) have been investigated for their mangrove fungi.

Mangrove Basidiomycota are least frequently collected when compared to Ascomycota (Jones et al. 2015). Three phylogenetic lineages of the Basidiomycota have been recognized within the homobasidiomycetes, representing three to four independent transitions from fresh water and terrestrial to marine habitats (Hibbett and Binder 2001; Maekawa et al. 2005a). The mangrove Basidiomycota are represented in two marine clades: The *Nia* clades includes *Calathella mangrovei*, *Halocyphina villosa* and *Nia vibrissa* (Hibbett and Binder 2001; Binder et al. 2006). More recently, Abdel-Wahab et al. (2019b) in introducing the taxon *Nia lenicarpa* from Red Sea mangroves in Saudi Arabia, deomstrated that these basidiomycetes group in the family Niaceae (Jülich 1981, Læssøe et al. 2016). The second clade comprises *Haloaleurodiscus mangrovei* reported from dead trunks and branches of *Sonneratia alba* in mangrove forests of Japan (Maekawa et al. 2005a, b). Jones et al. (2019) listed 22 filamentous marine basidiomycetes in 17 genera and 80 marine basidiomycete yeasts in 39 genera.

Most of the studies on mangrove fungi have been focused on the filamentous fungi, while the Chytridiomycota and Mucoromycota are poorly studied in mangroves (Jones et al. 2019). Most of the studies on Chytridiomycota in mangroves have been carried out by Ulken (1972, 1978, 1981, 1983). *Paludomyces mangrovei* was isolated and described from mud collected from mangrove swamps (Ulken 1978). Ulken (1978) studied the growth of the four *P. mangrovei* isolates in the presence of several physical factors and found that they can tolerate different saline conditions. Fungi present in the water column and sediments, chytrids and yeasts were not included in the papers by Schmidt and Shearer (2003, 2004) and this is addressed in the current study.

Taxonomic classification of mangrove fungi

The aim of the present study is to produce a checklist of mangrove fungi known from different geographic locations, and on different substrates: attached wood, intertidal wood and driftwood, fruits, leaves, seagrasses, ferns, palms as well as those to be found in the water column and sediments (Figs. 3, 4). All taxonomic groups have been included in this review: Ascomycota, Basidiomycota, Chytridiomycota, and Mucoromycota. Fungi isolated as endophytes and mangrove yeasts are covered in this compilation.

The data on mangrove fungi occurring on various mangrove sources were collected from the published literature available through the years 1950 to 2020, and their geographical distribution and hosts were reviewed to provide an accurate check list. This checklist includes different groups of marine fungi reported from various mangrove substrata. Mangrove endophytic fungi isolated from different mangrove plant tissues, roots, stems and leaves in contact with sea water and mangrove fungi isolated from mangrove water and soil or sediments are also considered in this study.

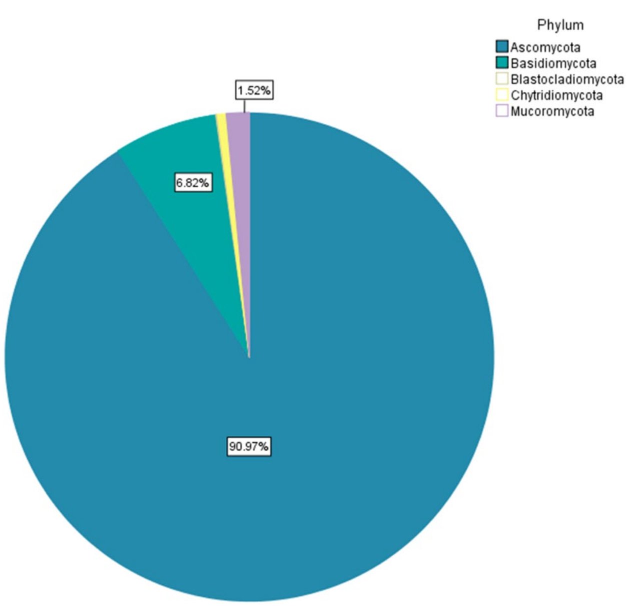


Fig. 5 Pie chart showing the percentage frequency occurrence of phyla of mangrove fungi

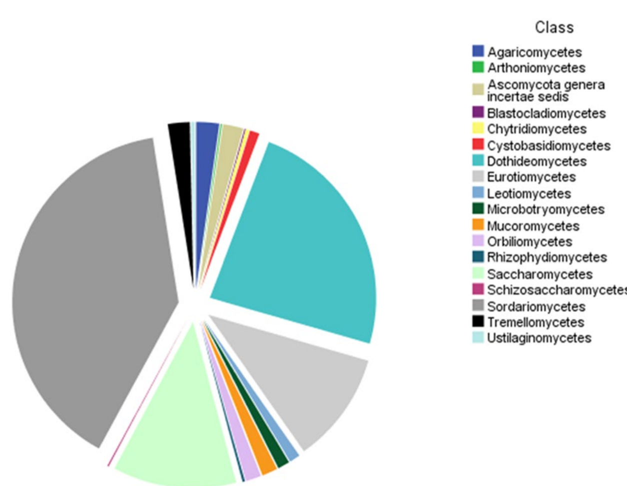


Fig. 6 Piechart showing the percentage frequency occurrence of classes of mangrove fungi

Where the asexual/sexual morph connections have been established, we have included the currently accepted name (Réblová et al. 2016).

Table 1 comprises the mangrove fungi reported from various mangroves spread across the world. The taxa recorded so far from different mangroves sources have been arranged alphabetically in four sections: Ascomycota, Basidiomycota, Chytridiomycota and Mucoromycota. Besides, different columns representing details of habitat, fungal nature, substrate, host, and distribution, we have also included adjacent to each species the relevant publication reference. Taxa and their authorities have been established by examining the websites of www.marinefungi.org, MycoBank and Index Fungorum. Their classification follows the current study of Jones et al. (2015, 2019) and for hierarchical placement of each mangrove fungal species into different fungal families is based on recent publications such as Wijayawardene et al. (2017, 2018, 2020), Refined families of Sordariomycetes (Maharachchikumbura et al. 2016; Hyde et al. 2020) and Refined families of Dothideomycetes (Hyde et al. 2013; Hongsanan et al. 2020a, b). All the mangrove fungal taxa from mangroves identified up to species level are listed in Table 1 and those identified up to genus level exempted. The checklist also includes details such as familial placement, habitat, nature of fungi, substrate and host distribution, as well as relevant references. Taxa in bold are those introduced since 2015. The results of the data have been shown in graphs, pie charts, tables to examine and discuss the diversity of mangrove fungi among the different taxonomic groups. Bar chart was generated using GraphPad Prism 5.03 software for Windows, www.graphpad.com. The heat map was generated using the Tableau Desktop 2019.2.

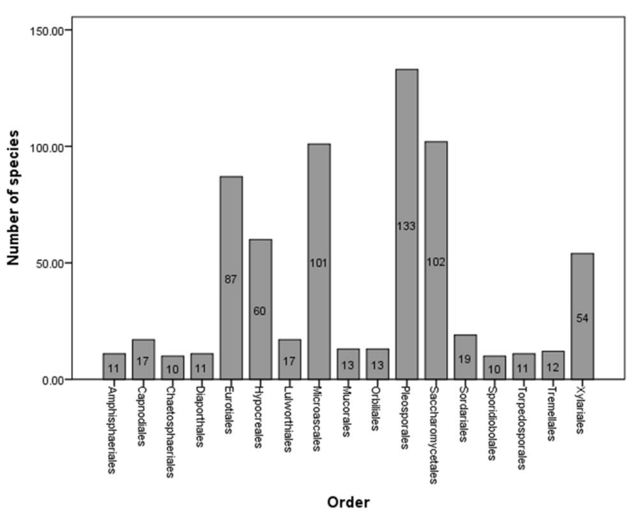


Fig. 7 Bar diagram showing the distribution of mangrove fungi among different fungal orders

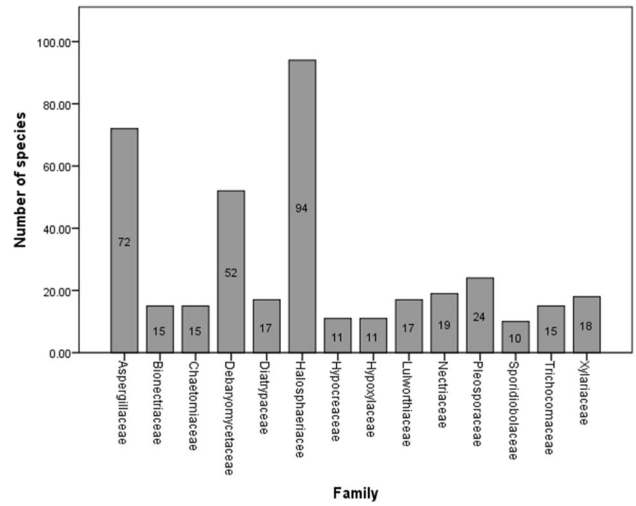


Fig. 8 Bar diagram showing the major families among different orders of mangrove fungi

Major Phyla

Schmit and Shearer (2003) recorded 625 mangrove fungi, but only 287 were considered to be found in the intertidal/submerged zone by Lee et al. (2017). Currently we list 850 species in 413 genera which belong to 161 families in 68 orders and 17 classes (Table 1), with many higher order groups recorded for the first time in the Ascomycota, Basidiomycota, Chytridiomycota and Mucoromycota. Mangrove yeasts were not included by Schmit and Shearer (2003, 2004), but we list 142 species in 55 genera that belong to 23 families in 11 orders and 6 classes. These were mainly isolated from the Everglades, USA, various mangroves in Thailand, and China and from other parts of the world (Limtong et al. 2010; Statzell-Tallman et al. 2010; Am-In et al. 2011; Fell et al. 2011; El-Samawaty et al. 2020).

Ascomycota

This is the dominant group of fungi from mangroves accounting for 90.94% (773 species) of the taxa listed (Fig. 5) and this is also the case for marine fungi in general (Jones et al. 2019). Most of the ascomycetes are reported from intertidal or submerged zones. The ascomycetes are widely distributed across the three ocean basins and dominant in contrast to other groups of mangrove fungi. The results of the collected data showed that main classes, orders, families and genera belong to this phylum. Among ascomycetes the major classes include Sordariomycetes, Dothideomycetes, Saccharomycetes and Eurotiomycetes. Major orders were Pleosporales, Microascales, Saccharomycetales, Eurotiales, Hypocreales and Xylariales.

Table 2 Most speciose genera in Ascomycota

Eurotiomycetes	Sordariomycetes	Dothideomycetes	Orbiliomycetes	Saccharomycetes
Aspergillus 53	*Corollospora* 16	*Curvularia* 9	*Arthrobotrys*12	*Candida* 39
Penicillium 17	*Trichoderma* 11	*Dyfrolomyces* 7		*Saturnispora* 6
Talaromyces 12	*Aniptodera* 10	*Leptosphaeria* 7		*Wickerhamomyces* 5
	Hypoxylon 8	*Alternaria* 6		*Pichia* 4
	Savoryella 8	*Cladosporium* 7		
	Linocarpon 7	*Phaeosphaeria* 5		
	Halosarpheia 6	*Aigialus* 5		

Table 3 Nature of different mangrove fungi

Fungal nature	Number of fungi reported
Endophytic	38
Saprobic	803
Endophytic and Saprobic	5
Parasitic	4

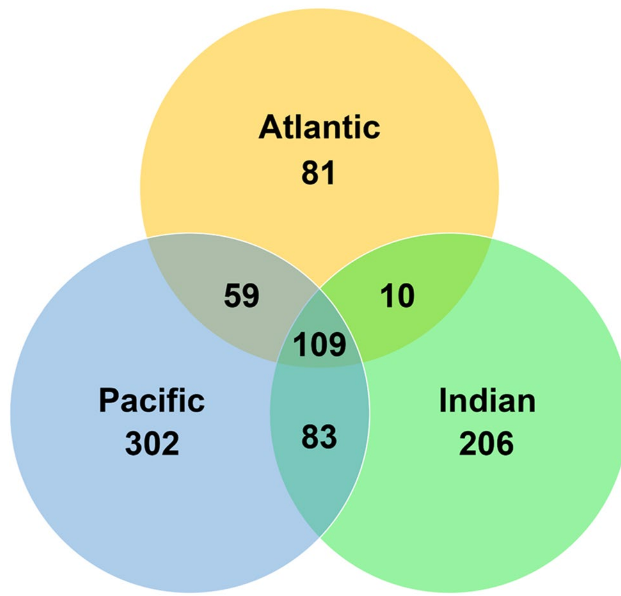


Fig. 9 Venn diagram showing the geographical distribution of mangrove fungi among three different Ocean basins

Table 4 Distribution patterns of mangrove fungi by habitat

Habitat	Number of fungi reported
Intertidal	406
Totally submerged	66
Sediment	193
Water column	96

Basidiomycota

Few mangrove fungi are basidiomycetes (6.82%) (58 species) and this also reflects the number of known marine fungi (Jones et al. 2019).

Blastocladiomycota

Only one species has been reported so far from this phylum with lowest number 0.12% (Fig. 5) of reported mangrove fungi.

Chytridiomycota

The Chytridiomycota are the most primitive true marine fungi often referred to as "the basal fungi". They are characterized by uniflagellate zoospores that necessitate water for dispersal and account for only 0.59% (5 species) (Fig. 5) of mangrove fungi.

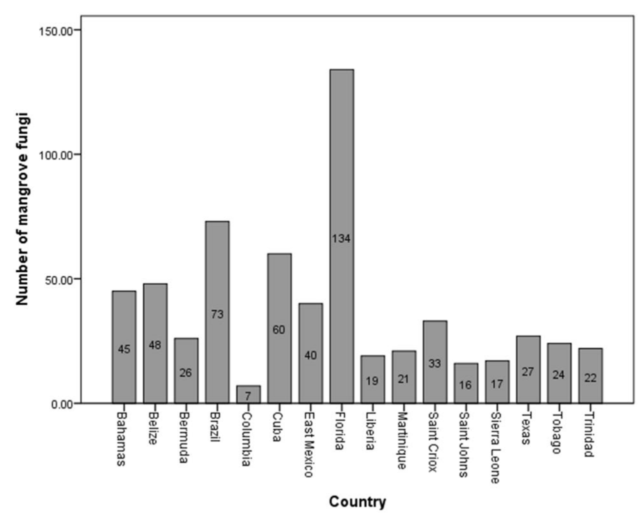


Fig. 10 Bar diagram showing the geographical distribution of mangrove fungi among the countries and regions of Atlantic Ocean

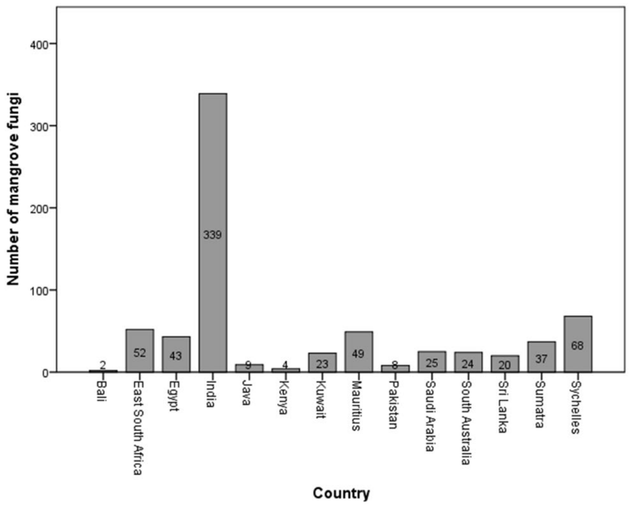


Fig. 11 Bar diagram showing the geographical distribution of mangrove fungi among the countries of Indian Ocean

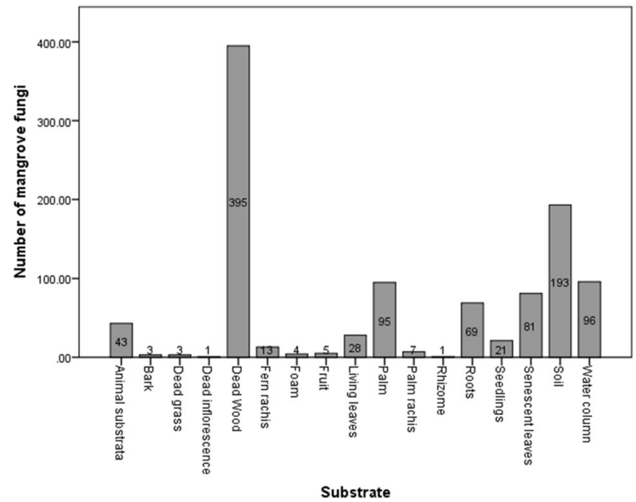


Fig. 13 Bar diagram showing the distribution of mangrove fungi among the different substrata collected from mangroves

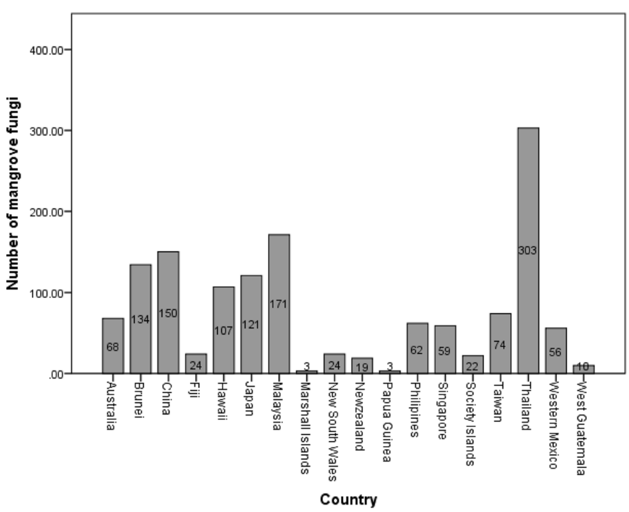


Fig. 12 Bar diagram showing the geographical distribution of mangrove fungi among the countries of the Pacific Ocean

Fig. 14 Butt rot of the mangrove tree *Xylocarpus granatum* caused by *Fulvifomes* species

Mucoromycota

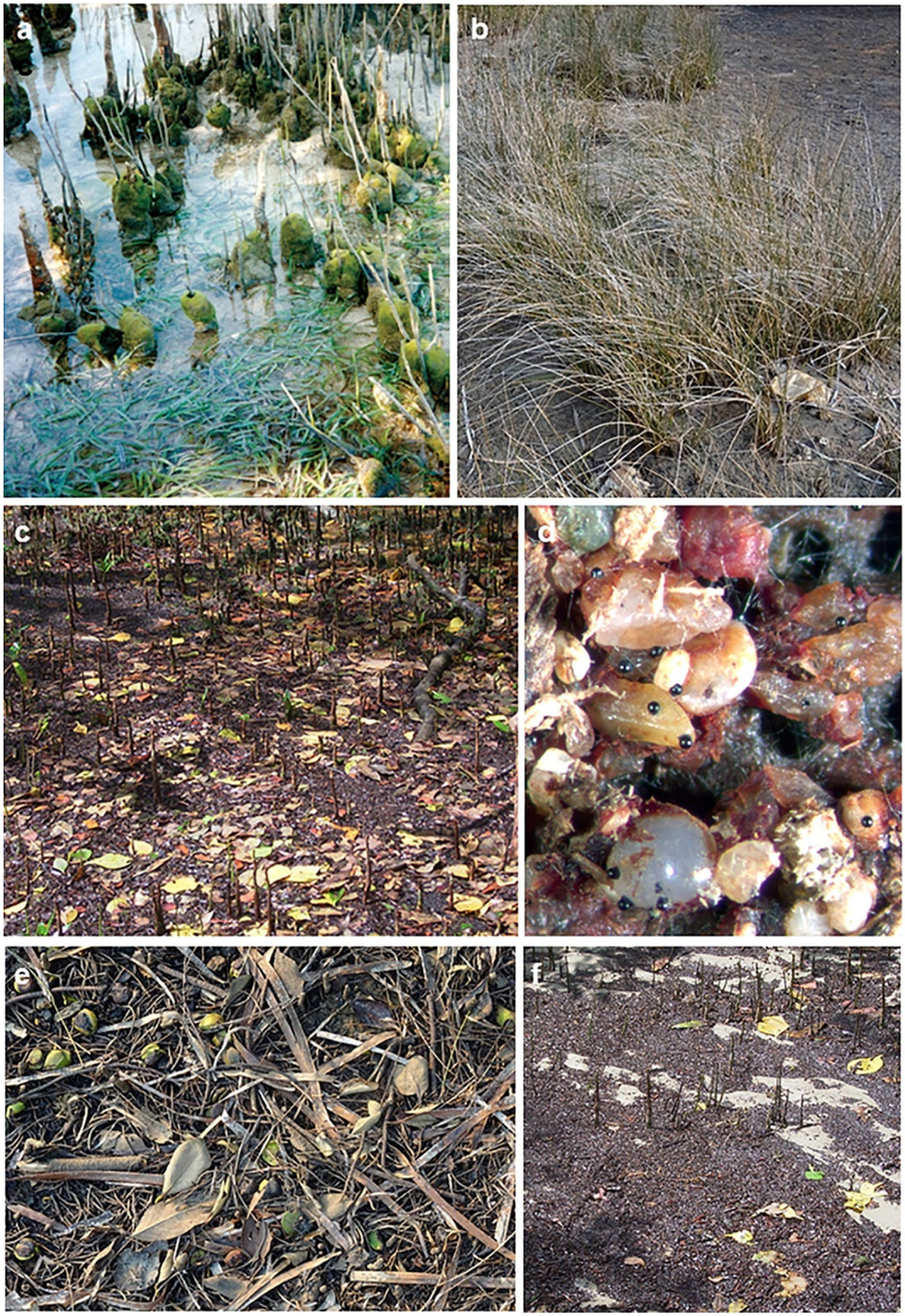
This group accounts only for 1.53% (13 species) of the total mangrove taxa listed in Fig. 5.

Major Classes

Mangrove fungi can be referred to 17 different classes (Fig. 6). The class with the largest number of species is the Sordariomycetes accommodating 39.65% of the mangrove fungi. The Dothideomycetes are the second largest class with 23.65% of the species followed by Saccharomycetes (12%), Eurotiomycetes (10.8%) and others. Ascomycetes with least mangrove species include: Orbiliomycetes (1.5%), Leotiomycetes (1.06%), Arthroniomycetes (0.1%) and Schizosaccharomycetes (0.1%). Some 2% of the mangrove fungi were not assigned to any of the above classes (Jones et al. 2019).

The Basidiomycota are fewer in number (6.8%) and have representative taxa in the classes, Tremellomycetes (2.1%), Agaricomycetes (2.2%), Microbotryomycetes (1.2%), Cystobasidiomycetes (0.9%) and Ustilaginomycetes (0.4%).

The Chytridiomycota includes only the Chytridiomycetes (0.4%) and Blastocladiomycetes (0.1%) in the Blastocladiomycota with a low diversity. Two classes are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◂**Fig. 15** **a** Seagrass and algae amongst pneumatophores of *Avicennia* and *Sonneratia* spp., **b** *Juncus kraussii* in the intertidal zone of an Australian mangrove, **c, e** leaf litter, seagrass and *Avicennia* fruits, **d** *Corollospora maritima* colonizing mangrove sediments, **f** Fragmented leaf litter at Morib mangrove, Malaysia. Gareth's photos except d which belongs to Deva

represented in the Mucoromycota: Mucoromycetes (1.5%) and Rhizophydiomycetes (0.2%) also with low diversity. This may be attributed to the substrates collected and the methods required for their enumeration. The Eurotiomycetes includes the most speciose genera *Aspergillus* and *Penicillium* with relatively higher diversity recorded from mangrove soils or sediments.

Major Orders

Mangrove fungi are diverse and distributed among 68 different fungal orders with Pleosporales being the largest order accommodating 133 species followed by Saccharomycetales (102), Microascales (101), Eurotiales (87), Hypocreales (60) and Xylariales (54) (Fig. 7).

Major Families

Mangrove fungi recorded on different mangrove substrata were distributed across161 families. The Halosphaeriaceae (94) is the largest family accommodating the highest number of taxa followed by Aspergillaceae (72), Debaryomycetaceae (52) and Pleosporaceae (24) (Fig. 8).

Most speciose genera among different classes of mangrove fungi

The most speciose genera from each class of mangrove fungi are listed in Table 2. Among the different classes of mangrove fungi, *Aspergillus* is the most speciose genus accommodating 53 species followed by *Aniptodera*, *Arthrobotrys*, *Candida*, *Corollospora*, *Penicillium* and *Trichoderma.* The genera *Aspergillus* and *Penicillium* are often referred to as marine derived fungi which are frequently isolated as endophytes and from mangrove soils and the water column.

Nature of mangrove fungi

Most fungi recorded from mangroves are saprobic with very few reports of parasitic or endophytic mangrove fungi in contact with sea water (Table 3).

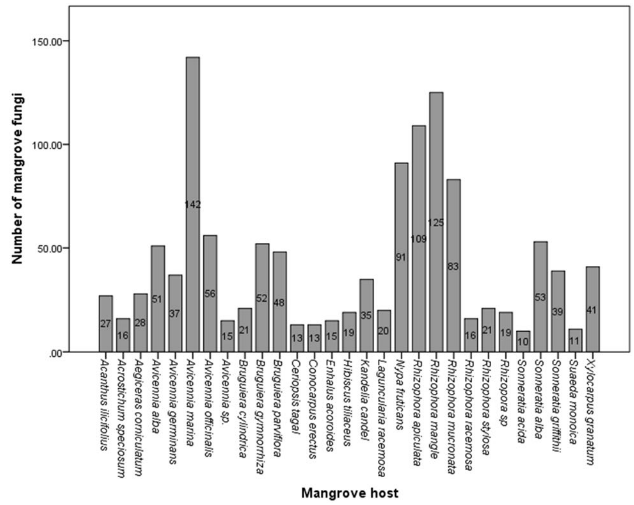


Fig. 16 Bar diagram showing the distribution of mangrove fungi among the different mangrove plants

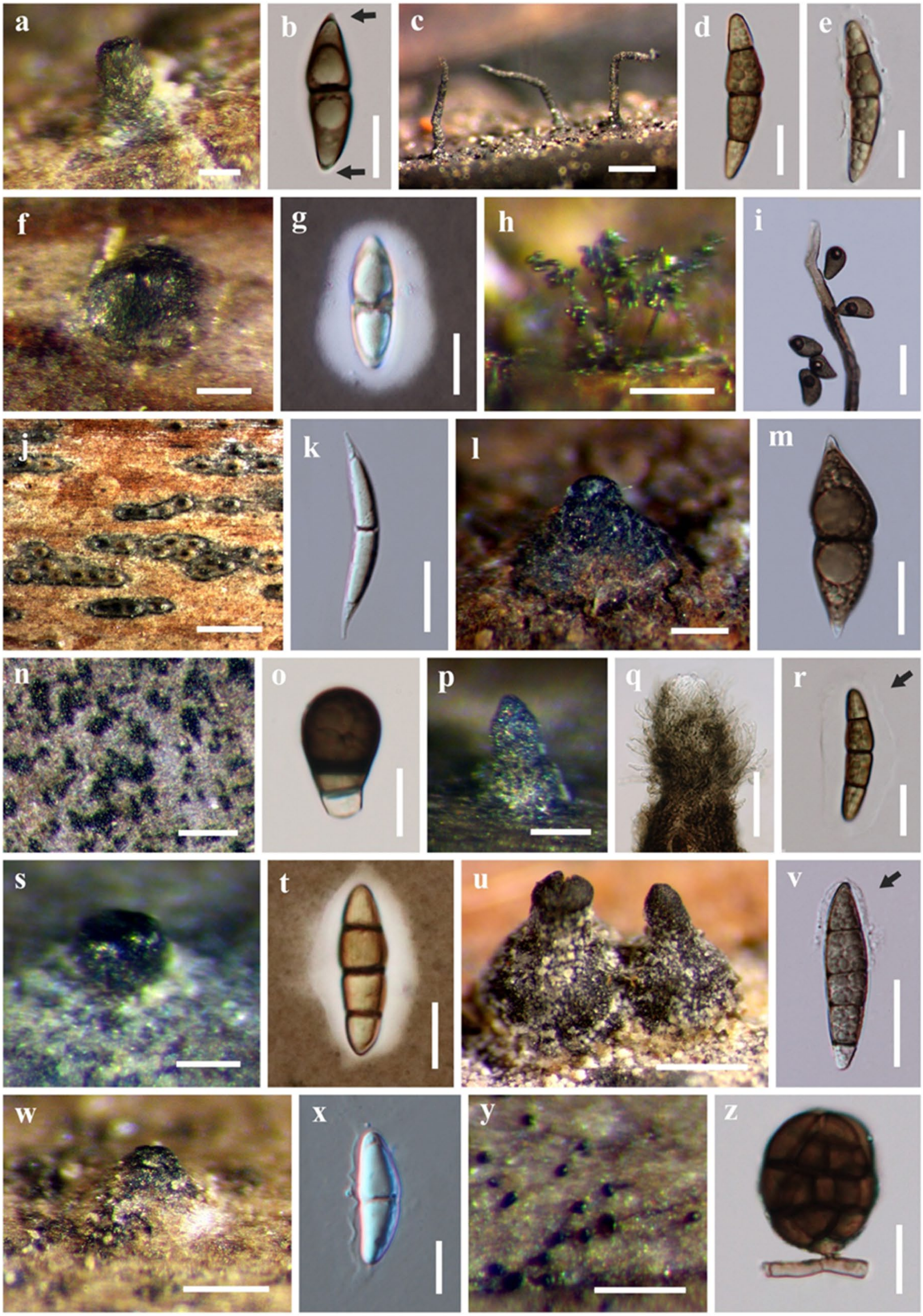
Distribution patterns of mangrove fungi by habitat

Most of the fungi reported from mangrove forests belong to the intertidal parts of mangrove substrata. Very few mangrove fungi are reported from totally submerged mangrove substrata (Table 4).

Distribution of mangrove fungi by oceans

Geographically a larger number of mangrove fungi were recorded from the Pacific Ocean (553) which is known as the largest ocean, followed by Indian (408) and Atlantic Oceans (259) (Fig. 9). Among the 850 mangrove fungi recorded from the three different oceans, 302 mangrove fungi are exclusively reported from Pacific, 206 from Indian and 81 from Atlantic Oceans, with 109 common to Atlantic, Indian and Pacific Oceans (Fig. 9). Ten mangrove fungi overlapped between Atlantic and Indian Oceans. Likewise, 83 mangrove fungi were common to both Indian and Pacific Oceans. While 59 mangrove fungi were found to be common between Atlantic and Pacific Oceans (Fig. 9). Among the countries with reports of mangrove fungi, India accommodates the highest number of mangrove fungi (339) followed by Thailand (303), Malaysia (171), Florida (134) and Brunei (134).

A total of 259 mangrove fungi were recovered from the Atlantic Ocean mangroves, of which 81 fungi are restricted to Atlantic Ocean, with Florida state (USA) accounting for 134 species followed by Brazil (73) and Cuba (60). Mangrove studies in the following countries yielded fewer taxa: Belize (48), Bahamas (45) and East Mexico (40) (Fig. 10).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◂**Fig. 17** Fungi found from *Nypa fruticans* and *Phoenix paludosa* in Thai mangroves. **a, b** *Acuminatispora palmarum* (found from both hosts). **c–e** *Longicorpus striataspora* (found from both hosts). **f, g** *Kirschsteiniothelia phoenicis*. **h, i** *Melanographium phoenicis*. **j, k** *Oxydothis phoenicis*. **l, m** *Salsuginea phoenicis*. **n, o** *Savoryella nypae*. **p, r** *Striatiguttula nypae*. **s, t** *Striatiguttula phoenicis*. **u, v** *Tirisporella beccariana* (seems only found on the submerged petiole of *Nypa fruticans*). **w, x** *Vaginatispora palmae* (found from immersed rachides of *N. fruticans*). **y, z** *Yunnanomyces phoenicis*. Substrates: **h, i, j, k** were found from fallen rachides and petioles; others were found from rachides or petioles that immersed in mangrove mud and water. Scale bars: **j** = 1 mm, **c, u** = 500 µm, **l, n, w** = 200 µm, **a, f, h, p, s, y** = 100 µm, **q** = 50 µm, **i, k, m, v, w** = 20 µm, **b, d, e, g, o, r, t, x, z** = 10 µm

The Indian Ocean accounted for 408 mangrove fungi with 206 fungi are specific to the Indian Ocean. Indian Ocean mangrove forests include those of India and Bangladesh and is the largest in the world (Fig. 11). About 83% of the mangrove fungi recorded for the Indian Ocean were reported from India (339 species). Fewer mangrove fungi were reported from Seychelles (68), Mauritius (49) and Egypt (43). India, with a vast coastline covering west and east coasts is covered by extensive mangroves in various states and most of the studies were conducted on decaying mangrove woody substrata and leaf litter.

The highest number of mangrove fungi is documented for the Pacific Ocean (553) and can be attributed to the intense number of studies carried out in Thailand and Malaysia. Numbers of fungi listed for the major countries are: Thailand (303), Malaysia (171), China (150), Brunei (134), and Hawaii (107) (Fig. 12).

The Pacific Ocean supports the greatest number and diversity of mangrove fungi with 553 species while the recorded number for the Atlantic Ocean is 259 taxa which mirrors the findings of Schmit and Shearer (2003). Although a wider range of substrates have been sampled (sediment/mud, water) and new locations surveyed since 2003 (Bahamas, Florida, and temperate mangroves of Egypt, Saudi Arabia) with an increase in the number of species listed, the total remains lower than for the Pacific and Indian Oceans. Intensive surveys conducted in Brunei, India and Thailand may well account for the greater number of fungi documented for theses geographical locations. Various reasons have been advanced to account for the differences observed including: sampling bias, some of the fungi described from the Pacific Ocean have only recently been described and reported only once, while the Atlantic Ocean has fewer host plants (Tomlinson 1986; Schmit and Shearer 2004).

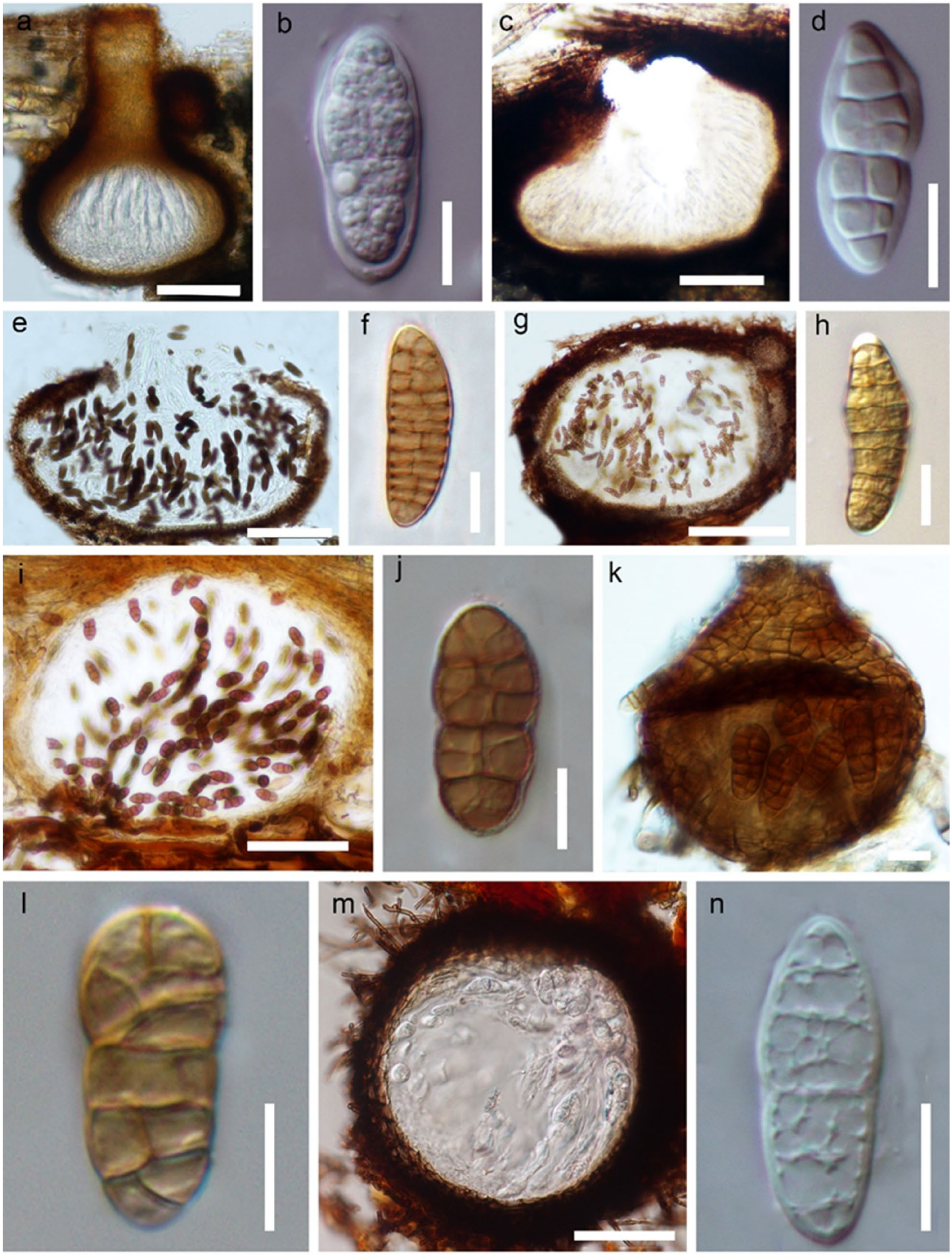
Eighty-one fungi listed in Table 1 appear to be unique to the Atlantic Ocean, many only recently described and with no corresponding studies in the Indian/Pacific Oceans e.g. the yeasts *Kwoniella mangrovensis*, *Papiliotrema mangalensis*, *Rhodotorula evergladensis*, *Sakaguchia cladiensis* and others. Sixty-nine of those listed are unique to the Pacific Ocean and include: *Fulvifomes siamensis*, *Haloaleurodiscus mangrovei*, *Lasiodiplodia avicenniarum*, *Lautospora simillima* and *Naganishia albida* to mention but a few. Recently described fungi from the Indian Ocean include *Phaeoseptum manglicola*, *Peroneutypa mangrovei*, *Pontoporeia mangrovei*, *Pseudoastrosphaeriellopsis kaveriana* and others. Further studies are required to determine if these are unique to the different ocean basins. Clearly, the greater diversity of mangrove trees in the Indian and Pacific Oceans may account for a rich mangrove fungal occurrence, as well they have been surveyed extensively for mangrove fungi.

Distribution patterns of mangrove fungi by substrate types

Figure 13 lists the substrates from which mangrove fungi have been reported and it shows that dead and decomposing wood supports the greatest diversity with 395 species, while fungi isolated from soils and sediments numbered 193. Mangrove palms were rich in fungi (95 species) the majority being Ascomycota and yielded a wide range of new taxa. Yeasts isolated from mangrove water column yielded 96 species, with senescent and decaying leaves of various plants totalled 81 taxa. Thirty-eight endophytes were isolated from living leaves of seagrasses and the roots of various tree species. Substrates supporting lower numbers of fungi include seedlings (21), fruit (5), bark (3), foam (4), and dead grasses (3) while 43 mangrove fungi were isolated from various animal hosts such as corals, molluscs, endoskeleton of *Sebia* sp., and feathers (Amend et al. 2012).

Considerable strides have been made in documenting the occurrence of marine yeasts in the Everglades, USA and mangroves in Thailand (Am-In et al. 2011; Fell et al. 2011), and fungi isolated from mangrove sediments (Garg 1983). Other new substrates explored for mangrove fungi are endophytes of seagrasses, and roots of mangrove trees (Sakayaroj et al. 2012). Most of the taxa listed (Table 1) are saprobic (803) on various substrates with a greatest number from woody tissue. This is hardly surprising as this is the most abundant material found in mangroves, and it is easy to document the fungi present. Ligninolytic fungi possess powerful enzymes and play a major role in the decomposition of woody tissue, in particular in mangroves (Sridhar 2012; Velmurugan and Lee 2012). Their activity leads to breakdown of complex lignocellulose and fragmentation of the substrate (Pointing et al. 1998, 1999; Bucher et al. 2004; Sridhar 2012; Jones et al. 2019).

Taxonomically the Ascomycota dominate the list of fungi found on mangrove substrates, although a number of Basidiomycota are also quite common: *Calathella mangrovei*, *Halocyphina villosa* and *Nia vibrissa*, with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◂**Fig. 18** Mangrove Dothideomycetes found in Muthupet mangroves, India. **a, b** *Thyridariella mangrovei*. **c, d** *Thyridariella mahakoshae*. **e, f** *Phaeoseptum manglicola* (found from both *A. marina* and *S. monoica*). **g, h** *Phaeoseptum carolshearerianum* (found from *A. marina*) **i, j** *Deniquelata vittalii* (found from *S. monoica).* **k, l** *Verruconis mangrovei* (found from both *Excoecaria agallocha* and *Aegiceras corniculatum*). **m, n** *Raghukumaria keshaphalae*. (found from *Ae. corniculatum*) Substrates: **a, c, e, g, i, k, m** found from dead and decaying mangrove wood and stems. Scale bars: **a, c, e, g, i, m** = 100 µm, **b, d, f, h, j, k, l, n** = 10 µm

Haloaleurodiscus mangrovei less common (Alias et al. 2010; Maekawa et al. 2005a). Three bracket forming *Fulvifomes* basidiomycete species (*F. halophilus*, *F. siamensis* and *F. xylocarpicola*) have been shown to be aggressive in causing butt rot of the mangrove tree *Xylocarpus granatum* (Fig. 14) (Sakayaroj et al. 2012; Hattori et al. 2014). A significant addition to mangrove basidiomycetes has been the isolation of yeasts (39 species) from the water column e.g. *Kwoniella mangrovei*, *Occultifur externus*, *Papiliotrema laurentii* and *Pseudozyma hubeiensis.*

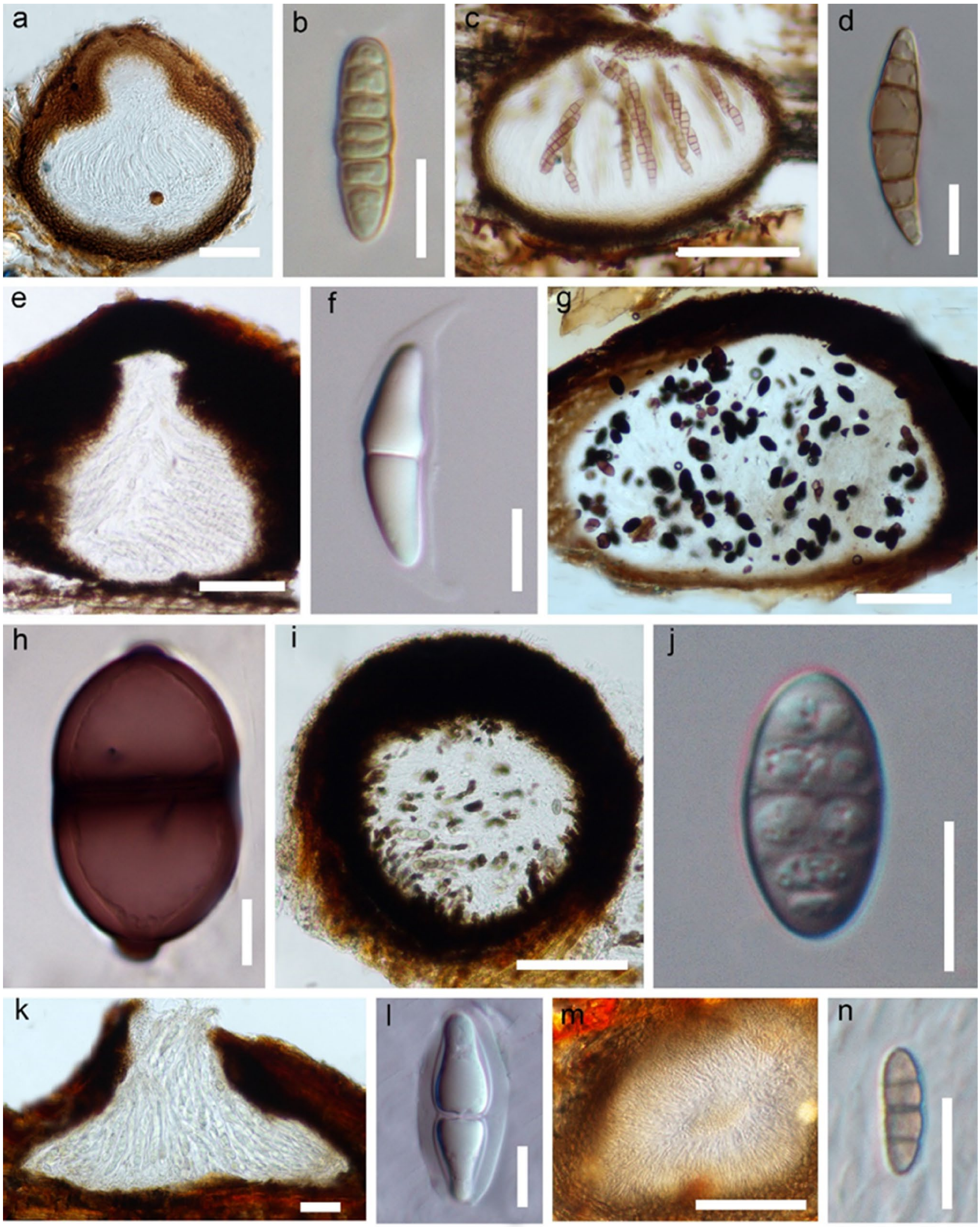
Other woody substrates found in mangroves are the prop roots and pneumatophores of trees and these are very often colonized by specific fungi. *Okeanomyces cucullatus* and *Mycosphaerella pneumatophorae* are often found colonizing the pneumatophores of *Sonneratia alba* and *Avicennia* species, respectively. Prop roots of *Rhizophora apiculata* are also colonised by fungi such as *Halocyphina villosa*, *Halorosellinia oceanic*a, *Halojullela avicenniae* and *Pyrenographa xylographoides* (Alias and Jones 2000b) (Fig. 3a).

Over the past 10 years many new taxa have been described from mangrove wood and studied intensively at the molecular level with the new genera and species: *Acuminatispora palmarum* (Zhang et al. 2018), *Amarenographium solium* (Hodhod et al. 2012), *Amphisphaeria mangrovei* (Phookamsak et al. 2019*)*, *Annabella* (Fryar et al. 2019), *Bacusphaeria* (Abdel-Wahab et al. 2017), *Diatrypasimilis australiensis* (Chalkley et al. 2010), *Dyfrolomyces tiomanensis* (Pang et al. 2013), *Farasanispora* (Li et al. 2016), *Halocryptosphaeria*, *Halotestudina* and *Halodiatrype* (Dayarathne et al. 2016, 2020a, b), *Moleospora* (Abdel-Wahab et al. 2010), *Kallichroma asperum* and *K. ellipsoideum* (Abdel-Wahab et al. 2016), *Nia lenicarpa* (Abdel-Wahab et al. 2019b), *Phaeoseptum manglicola* (Dayarathne et al. 2020b), *Pseudoastrosphaeriellopsis* (Phookamsak et al. 2019), *Raghukumaria* (Jones et al. 2019b), *Saagaromyces mangrovei* (Liu et al. 2015), *Striatiguttula* (Zhang et al. 2019), *Tirisporella* (Jones et al. 1996), *Thyridariella*, *Vittaliana* (Devadatha et al. 2018a, 2019) and many others, see www.marinefungi.org. All fungi introduced since 2015 are in bold in Table 1 and a selection are illustrated in Figs. 17, 18, 19 and 20. This surge in the discovery of new Ascomycota can be attributed to the intensive studies on mangrove fungi in India, Saudi Arabia and Thailand (Ariyawansa et al. 2015; Liu et al. 2015; Li et al. 2016; Abdel-Wahab et al. 2016, 2017, 2019a, b; Devadatha et al. 2017, 2018a, b, 2019; Dayarathne et al. 2019a, b, 2020a, b; Zhang et al. 2019).

Mangrove fungi reported from mangrove soils and sediments total 193, the second largest group of taxa after those on woody substrates. Most of the fungi reported from soil or sediments comprises asexual fungi e.g. *Acremonium* species, *Acrophialophora fusispora*, *Penicillium vermiculatum*, and *Scopulariopsis silvatica* (Lee and Baker 1973; Garg 1983). However, soil fungi in mangroves are understudied and further investigations are warranted. As these fungi have been isolated on various media by sampling mangrove sediments, it is difficult to determine if they are active in the mangrove ecosystem, or just present as spores. Figure 15 illustrates different stages in substrate deposition and decomposition and its fragmentaion prior to exportation to the open ocean.

Many mangrove trees (e.g. *Rhizophora harrisonii*) have never been investigated for mangrove fungi and likewise a plethora of saltmarsh plants that form part of the mangrove ecosystem (Sainty et al. 2012). Alva et al. (2002) and Sakayaroj et al. (2010) investigated endophytic fungi of seagrasses in the Philippines and Thailand, but we know little on those in other countries and continents. Sainty et al. (2012) lists no fewer than 20 seagrasses for Australia, but fungi growing as saprobes or endophytes are documented for only the Philippines, Thailand and USA, with no data for Australia (Alva et al. 2002; Sakayaroj et al. 2012). Other mangrove substrata rarely surveyed are mangrove seaweeds with some 23 species listed for Australian mangroves (Sainty et al. 2012) and others in Malaysia and Thailand (Fig. 15). Mangroves are also rich in vegetation other than the classic trees but few have been examined for fungi e.g. *Acanthus ilicifolius* (Sadaba et al. 1995), *Suaeda maritima* and *Salicornia* species (Furtado et al. 2019). Recently, fungi on *Suaeda monoica* and *Phoenix paludosa* have been surveyed for mangrove fungi and many new species have been described (Devadatha et al. 2018a, b; Zhang et al. 2019) (Figs. 17, 18, 19, 20). Many low and high salt marsh plants also form part of the mangrove ecosystem such as *Juncus kraussii* in Australia (Fig. 15) and remain to be surveyed for fungi (Sainty et al. 2012).

One of the major factors in determing the frequency of occurrence of mangrove fungi is substrate preference. Sarma and Vittal (2000) investigated diversity of mangrove fungi on different substrata: *Rhizophora apiculata* and *Avicennia* species (*Avicennia officinalis*, *A. marina*) from Godavari and Krishna river deltaic mangroves, East coast of India. *Rhizophora apiculata* prop roots yielded the highest number of fungi (61 species from 2524 samples) when compared to wood (24 species from 192 samples) and seedlings (21 species from 273 samples). The lower number of fungi recorded on seedlings and wood of *R. apiculata* may be attributed to the availability of these substrata. Ravikumar and Vittal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◂**Fig. 19** Mangrove Dothideomycetes found in Muthupet, Parangipettai and Pondicherry mangroves of India. **a, b** *Vittaliana mangrovei* (found from *A. marina*). **c, d** *Pseudoastrosphaeriellopsis kaveriana* (found from both *A. marina* and *S. monoica*). **e, f** *Vaginatispora microarmatispora*. (found from *Aegiceras corniculatum*) **g, h** *Pontoporeia mangrovei* (found from both *A. marina* and *S. monoica*) **i, j** *Neodevriesia manglicola*. **k, l** *Morosphaeria muthupetensis* (found from *Rhizophora mucronata*). **m, n** *Nigrograna samueliana* (found from *A. marina*) Substrates: **a, c, e, g, i, k, m** found from dead and decaying mangrove wood and stems. Scale bars: **a, c, e, g, i, k, m** = 100 µm, **b, d, f, h, j, l, n** = 10 µm

(1996) also reported higher species numbers on prop roots of *R. apiculata* from Pichavaram mangroves, Tamil Nadu, East coast of India. Alias and Jones (2009) opined that the amount of substratum available for colonization is the overriding factor in determining fungal diversity. Fungi recorded with higher percentage occurrence on *R. apiculata* wood were *Verruculina enalia*, *Sclerococcum haliotrephum*, *Hysterium* sp., *Rimora mangrovei* and *Epicoccum purpurascens.* On prop roots, *Verrucullina enalia*, *Rhizophila marina*, *Hydea pygmea*, *Halodiatrype mangrovei* and *Sclerococcum haliotrephum* were the fungi recorded with a high percentage occurrence. On seedlings, *Verrucullina enalia*, *Phomopsis mangrovei*, *Dyfrolomyces rhizophorae* and *Rimora mangrovei* had highest percentage occurrence. In the case of *Avicennia* species three substrata were studied viz., wood, roots and pneumatophores. Of these substrates, wood (61 species from 1775 samples) had highest diversity when compared to roots (17 species from 118 samples) or pneumatophores (14 species from 111 samples). Fungi with highest percentage occurrence on wood were *Halocryptosphaeria bathurstensis*, *Verruculina enalia*, *Rimora mangrovei*, *Halocyphina villosa*, *Lulworthia* sp.; on roots *Verruculina enalia*, *Lulworthia* sp., *Rimora mangrovei*, *Hypoxylon* sp., *Halorosellinia oceanica* and *Halocyphina villosa;* on pneumatophores, *Verruculina enalia*, *Camarosporium roumeguerii*, *Lulworthia* sp., *Leptosphaeria australiensis*, and *Bathyascus avicenniae.* Thus, it may be concluded that fungi colonizing the host plant may show a preference for a particular part of a mangrove tree as in this case or for *Rhizophora* species as mentioned above (Ravikumar and Vittal 1996; Sarma and Vittal 2000).

There is little evidence of strict host specificity in mangrove fungi as most species have been collected and reported on multiple hosts. Loilong et al. (2012) list 77 fungi growing on the brackish water palm *Nypa fruticans* of which 31 are host specific and not reported from other mangrove plants. These fungi include: *Anthostomella nypicola*, *Arecophila nypae*, *Carinispora nypae*, *Helicascus nypae*, *Tirisporella beccariana*, *Plectophomella nypae* and *Pleurophomopsis nypae* (Loilong et al. 2012; Jones et al. 2019).

Richness of mangrove fungi among different mangrove plant hosts

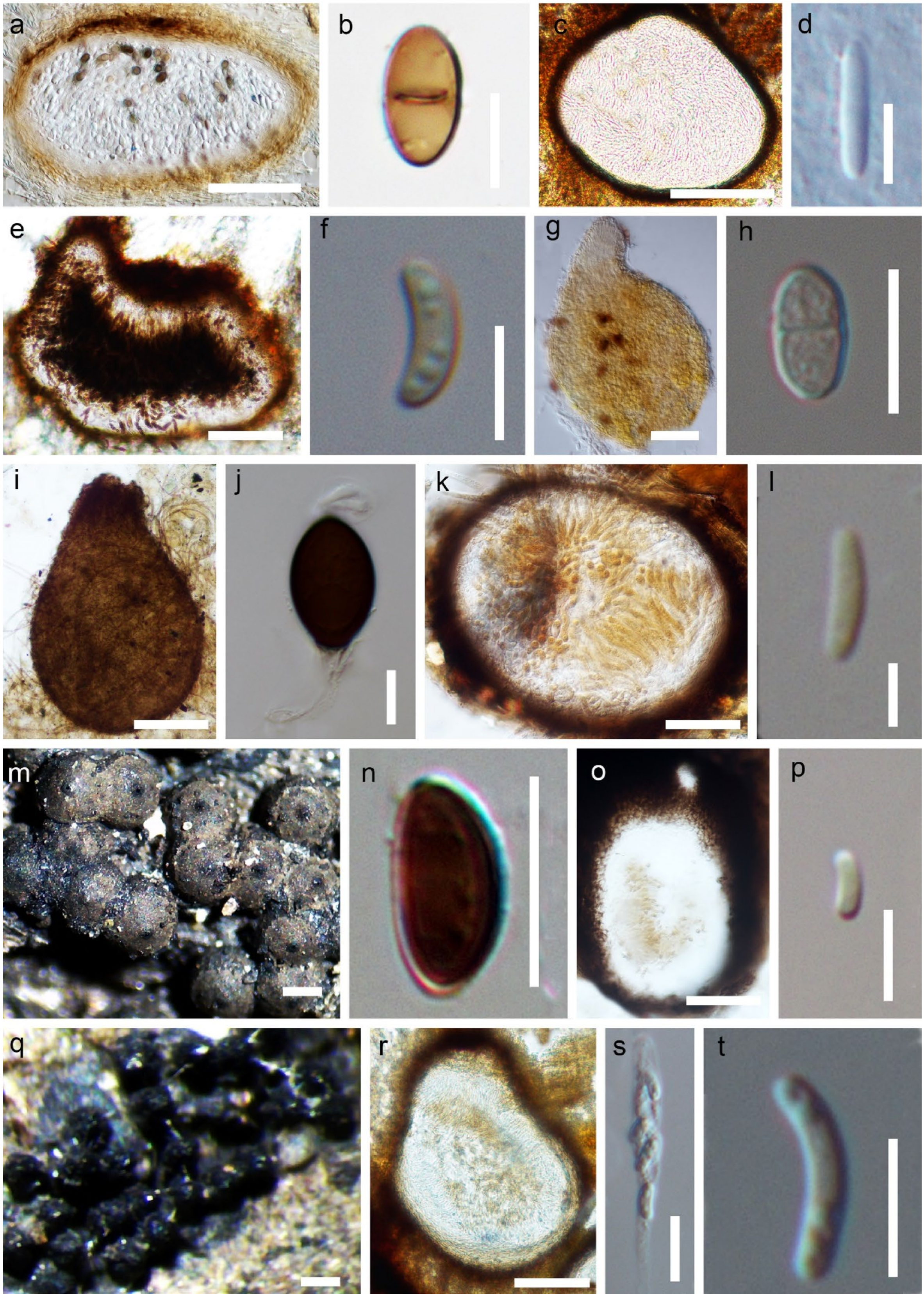
Several mangrove trees and associates, salt marsh plants inhabiting mangroves, distributed across the different countries of the world have been examined for mangrove fungi. Among them *Avicennia marina* accommodated highest number of taxa (142), followed by *Rhizophora mangle* (125), *R. apiculata* (109) (Fig. 16). *Nypa fruticans* (91) hosts highest taxa among the mangrove palms (Fig. 16).

Mangrove yeasts

Ninety-six yeasts have been isolated from water samples taken in mangroves, primarily in the Everglades, USA (Statzell-Tallman et al. 2010; Fell et al. 2011), and Thailand (Limtong et al. 2010; Am-In et al. 2011). These studies considerably enhance our knowledge of aquatic yeasts and their potential role in the mangrove ecosystem. Many of these taxa were new to science e.g. *Candida laemsonensis*, *Kluyveromyces siamensis*, *Kwoniella mangrovensis* and *Saturnispora mangrovi* (Statzell-Tallman et al. 2008; Am-In et al. 2011; El-Samawaty et al. 2019). Some yeasts were isolated at multiple times in the mangrove section of the Everglades e.g. *Candida thimueangensis* and *Kwoniella mangroviensis*, while others were restricted to the freshwater sector e.g. *Kregervanrija fluxuum* and *Sporobolomyces beijingensis* (Fell et al. 2011). Although a wide range of yeasts have been isolated from mangroves and other marine locations, their role remains speculative. The study by Fell et al. (2011) indicates what little is known about aquatic yeast ecology and highlights the need for further studies to determine the role of this unique group of fungi play in mangrove ecosystems.

Mangrove fungi on palms

Another substrate that supports a rich diversity of fungi are mangrove palms: *Phoenix paludosa* and *Oncosperma tigillarium* found in the upper reaches of mangroves, and *Nypa fruticans* common in estuaries and shallow lagoons in the Indian and Pacific Oceans (Tomlinson 1986). A total of 95 mangrove fungi have been recorded on the fronds, petioles and fruits of palms (Table 1) with Loilong et al. (2012) listing 77 on the brackish water palm *Nypa fruticans*. Many of the fungi colonizing *N. fruticans* are unique to this host, circa 31, e.g. *Anthostomella nypae*, *Fasciatispora nypae*, *Helicascus nypae* and *Pleurophomopsis nypae* (Hyde et al. 1999; Hyde and Alias 2000; Loilong et al. 2012). Some of the fungi on *Nypa fruitcans* are restricted to the petioles: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◂**Fig. 20** Mangrove Sordariomycetes found in Muthupet and Pondicherry mangroves of India. **a, b** *Amphisphaeria mangrovei.* **c, d** *Lanspora cylindrospora* (found from *Suaeda monoica*). **e, f** *Cryptosphaeria avicenniae*. **g, h** *Fusicolla bharatavarshae* (found from *Avicennia marina*) **i, j** *Zopfiella indica* (found from intertidal mangrove wood). **k, l** *Peroneutypa polysporae* (found from *Suaeda monoica*). **m, n** *Hypoxylon teeravasati* (found from both *A. marina* and *S. monoica*) **o, p** *Peroneutypa mangrovei* (found from *A. marina*) **q–t** *P. indica* (found from *S. monoica*). Substrates: **a, c, e, g, i, k, m, o, q** were found from dead and decaying mangrove wood and stems. Scale bars: **m, q** = 200 µm, **a, c, e, g, i, k, o, q** = 100 µm, **b, f, h, j, n, s** = 10 µm, **d, l, p, t** = 5 µm

Bacusphaeria nypae, *Manglicola guatemaelensis* and *Tirisporella baccariana* (Jones et al. 1996; Suetrong et al. 2009; Abdel-Wahab et al. 2017). Two new genera introduced growing on submerged rachis and petioles of palms are *Acuminatispora* (*A. palmarum*) on both *Nypa fruticans* and *Phoenix paludosa* (Zhang et al. 2018) and *Striatiguttula* (*S. nypae* on *N. fruticans*; *S. phoenicis* on both *N. fruticans* and *Ph. paludosa*) (Zhang et al. 2019). A few fungi have also been recovered from *Nypa* fruits: *Anthostomella* spp., *Fasciatispora* spp., and *Vaginatispora nypae*) (Jayasiri et al. 2019; Zhang unpublished data).

Mangrove endophytes

A wide range of endophytic fungi have been isolated from mangrove plants, but most are from aerial terrestrial parts and are not included in this review (Pang et al. 2008; Chareprasert et al. 2010; Sakayaroj et al. 2012; Chi et al. 2019; Rashmi et al. 2019). Only a few studies have been devoted to submerged parts of mangrove trees (roots) and mangrove seagrasses (Ananda and Sridhar 2002; Maria and Sridhar 2003; Sakayaroj et al. 2010; Supaphon et al. 2017). Of the 38 endophytes listed in Table 1, most are species of *Cladosporium*, *Colletotrichum*, *Glomerella*, *Fusarium*, *Mycosphaerella*, *Phyllosticta*, *Phoma* and *Sporormiella*, and the obligate mangrove fungi e.g. *Cumulospora marina*, *Hydea pygmea*, *Lulwoana uniseptata*, *Sammeyersia grandispora* and *Trichocladium alopallonellum* (Ananda and Sridhar 2002; Maria and Sridhar 2003). Endophytes may play a key role in the early stages of mangrove leaf decomposition, becoming saprobes on senescence of leaf material (Hyde and Soytong 2008). Mangrove endophytes have also been shown to be a rich source of secondary metabolites (Rukachaisirikul et al. 2011).

Fungi on fallen mangrove leaves

The earliest studies on the breakdown of leaves in mangroves was by Fell and Masters (1973) and Fell et al. (1975). They found that the attached but senescent leaves harbor a number of parasitic and saprobic terrestrial fungi. They reported that during the first week of submergence straminipilous organisms (Labyrinthulomycetes) were prevalent, and a few other primary invaders appeared, mostly asexual morphs. Within the second and third week the first obligate mangrove fungi, *Lulworthia* sp. and *Halenospora varia* (as *Zalerion varium*), were observed, while at the end of this period most of the straminipilous organisms have disappeared. Raghukumar et al. (1994, 1995) have studied mangrove litter degradation by fungi by using litterbags (both in the field and laboratory). *Halophytophthora* species and thraustrochytrids were found to colonize the leaves initially followed by a few asexual morphs e.g. *Acremonium* sp., *Aspergillus* spp., *Cladosporium herbarum*, *Cirrenalia basiminuta*, *Fusarium moniliforme* and *Penicillium* spp.

Other studies listed fungi isolated from senescent leaves, mostly asexual morphs with taxa such as *Pestalotiopsis* spp., *Zygosporium* spp., *Aspergillus* spp., *Cephalosporium* spp., *Cladosporium oxysporum*, *Penicillium* spp., (Kuthubutheen 1984; Ananda and Sridhar 2004). Hyde and Sarma (2006) documented fungi occurring on the mangrove palm *Nypa fruticans* and listed 25 taxa including *Aniptodera chesapeakensis*, *A. mangrovei*, *Astrosphaeriella nypae*, *A. striatispora*, *Helicascus nypae*, *Helicorhoidon nypicola*, *Lignincola laevis*, *Linocarpon appendiculatum*, *L. bipolaris*, *L. longisporum*, *L. nypae*, *Marinosphaera mangrovei*, *Oxydothis nypae* and *Trichocladium nypae.*

Decomposers and shreders of mangrove leaves include straminipilous organisms, crabs and filamentous mangrove fungi (Newell 1976; Leano et al. 1998; Fan et al. 2002). Three stages can be discerned in the decomposition of senescent leaves once they fall into the water.

Stage 1 Leaching of minerals, phenolics/tannins and early colonization by fungi (Cundell et al. 1979). Bremer (1995) reported labyrinthulids and thraustochytrids colonising exposed leaves of *Sonneratia* within 24 h in mangrove waters. Early fungi are those that may have been present as endophytic fungi and other filamentous fungi, initially typical terrestrial genera: *Aspergillus*, *Cladosporium* and *Phoma* species (Nakagiri et al. 1989; Ananda et al. 2008)

Stage 2 This is the most active phase in terms of increase in recruitment of fungi such as the asexual morphs: *Hydea pygmea*, *Periconia prolifera* and *Trichcladium alopallonellum* and the ascomycete *Lulworthia* sp. (Nakagiri et al. 1989; Ananda et al. 2008; Sridhar et al. 2012). Nakagiri et al. (1997) report the ascomycete *Lanceispora amphibia* on fallen leaves of *Bruguiera gymmorhiza*, while Maldonado-Ramírez and Torres-Pratts (2005)

Table 5 Top cited mangrove fungi cited in Table 1

Cited 40–61 times	Cited 30 or more	Cited 20–29 times
Anntenospora quadricornuta	*Aigialus grandis*	*Acrocordiopsis patilii*
Lignincola laevis	*A. parvus*	*Aniptodera chesapeakensis*
Sammeyersia grandispora	*Arenariomyces trifurcatus*	*Aniptodera mangrovei*
Sclerococcum haliotrephum	*Corollospora maritima*	*Ascocratera manglicola*
Verruculina enalia	*Haiyanga salina*	*Caryosporella rhizophorae*
	Halorosellinia oceanica	*Cirrenalia macrocephala*
	Marinosphaera mangrovei	*Cirrenalia pseudomacrocephala*
	Neptunella longirostris	*Clavariopsis bulbosa*
	Okeanomyces cucullatus	*Ceriosporopsis halima*
	Torpedospora radiata	*Corollospora puchella*
		Cucullosporella mangrovei
		Dictyosporium pelagicum
		Etheirophora blepharspora
		Halomassarina thalassiae
		Halosphaeria marina
		Helicascus kanaloanus
		Kallichroma tethys
		Leptosphaeria australiensis
		Lineolata rhizophorae
		Matsusporium tropicale
		Morosphaeria velatispora
		Panorbis viscosus
		Passeriniella savoryellopsis
		Quintaria lignatilis
		Rhizophila marina
		Rimora mangrovei
		Saagaromyces abonnis
		Saagaromyces glitra
		Savoryella lignincola
		Savoryella paucispora
		Swampomyces triseptatus

report the basidiomycete *Clathrus* c.f. *crispus* on decomposing leaves of *Rhizophora mangle* in Puerto Rico

Stage 3 This stage is characterized by fragmentation of leaf material, loss in weight and a decrease in C/N ratio (Raghukumar 2017). Numerous studies have examined the degradation of leaf material in mangrove habitats (Fell and Masters 1973; Fell et al. 1975; Newell 1973, 1976; Cundell et al. 1979; Steinke et al. 1990; Raghukumar et al. 1995), while others have focused on the rate and biochemical changes in mangrove leaf decomposition (Fell et al. 1980; Misra et al. 1984; Narayanasamy and Kathiresan 2007)

Mangrove fungal diversity on animal substrata

Mangrove fungi play a vital role in the decomposition of dead animals and animal parts (Hyde et al. 1998). Few mangrove fungi live in commensalistic association with mangrove animals or as saprobes on animal substrates. Araujo et al. (1995) reported 322 yeast cultures on marine invertebrates of which 37 are identified from molluscs and crabs from Brazilian mangroves. Ananda and Sridhar (2001) recorded *Aspergillus* spp., *Corollospora intermedia*, *Epicoccum nigrum* and *Scolecobasidium* spp as the most frequent mangrove fungi from molluscans, cuttle fish endoskeletons, crab exoskeletons and bird feathers collected from mangroves of Karnataka, India. Bird feathers accommodated the highest number (14) of mangrove fungi among the different animal substrata examined (Ananda and Sridhar 2001).

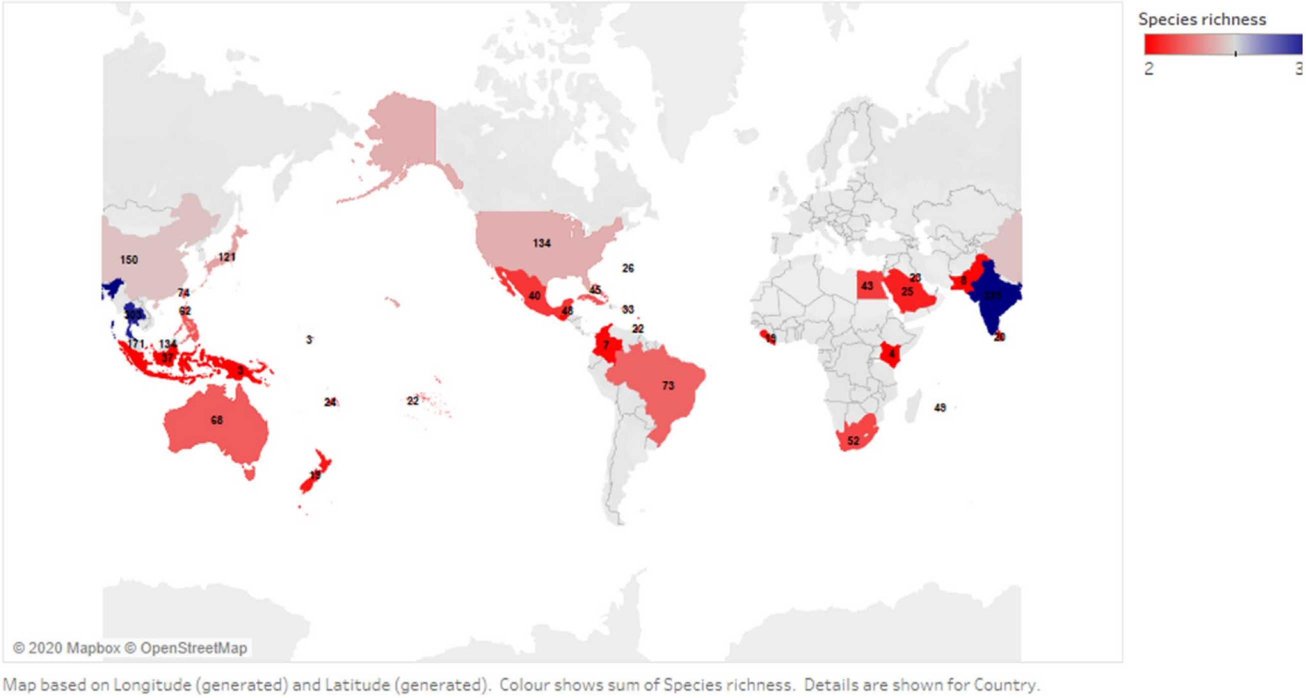

Fig. 21 Heat map to show the distribution of mangrove fungi

Fig. 22 Accumulation of rubbish at a mangrove in Guam

Calcareous shells produced by marine animals such as molluscs, barnacles and corals become colonized by endolithic fungi (Kohlmeyer and Kohlmeyer 1979; Golubic et al. 2005; Raghukumar 2008). Kohlmeyer and Volkmann-Kohlmeyer (1991, 1992) recorded 23 marine fungi on calcareous materials. Ten mangrove fungi were reported from calcareous shells of molluscans from Karnataka coast, India (Ananda and Sridhar 2001). *Arenariomyces parvulus* and *Corollospora intermedia* are the dominant mangrove fungi found on the calcareous shells of molluscans.

Many studies reported the occurrence of fungi as pathogens and saprobes on marine animals from marine environment (Ananda et al. 1998; Kohlmeyer and Volkmann-Kohlmeyer 2003; Gleason et al. 2011; Raghukumar 2017; Godinho et al. 2019). However, studies on fungi occurring on animal substrata from mangroves are very rare (Araujo et al. 1995; Ananda and Sridhar 2001). Hence, further studies are required to document the mangrove fungal diversity on different animal substrata from mangroves (Jones 2011; Jones et al. 2019).

Common mangrove fungi

Hyde and Jones (1988), Sarma and Hyde (2001), Maria and Sridhar (2003) and others, have attempted to draw up lists of common mangrove fungi, but this is difficult as sampling procedures are not comparable as discussed in the introduction. Alias and Jones (2009) list the ten most common mangrove fungi based on an analysis of nine surveys from different parts of the tropics: *Dictyosporium pelagicum*, *Halocyphina villosa*, *Halorosellinia oceanica*, *Halosarpheia marina*, *Hydea pygmea*, *Kallichroma tethys*, *Leptopshaeria australiensis*, *Lignincola laevis*, *Sammeyersia grandispora*, *Sclerococcum haliotrephum* and *Verruculina enalia*. The most frequently reported mangrove fungi in this study are listed in Table 5, with *Anntenospora quadricornuta* and *Sclerococcum haliotrephum* most frequently cited.

The frequency of occurrence of mangrove fungi varies greatly between different studies, typically only a few fungi will dominate a given area, while the others will be rarely encountered (Cooke and Rayner 1984). Generally, surveys of mangrove fungi have been grouped as 'most common' or 'very frequent' followed by 'frequent', 'infrequent' and 'rare'. Hyde (1986) used a formula to calculate the percentage occurrence of mangrove fungi as follows: Percentage occurrence = Number of occurrences of a particular fungus/Total number of samples supporting sporulating fungi × 100. This was subsequently revised by Hyde and Jones (1988) as Percentage occurrence = Number of occurrences of a particular fungus/Total number of samples examined × 100. This modified formula has been used by other workers (Leong et al. 1991; Alias et al. 1995). *Antennospora quadricornuta*, *Halocryptosphaeria bathurstensis*, *Halocyphina villosa*, *Halorosellinia oceanica*, *Halosarpheia marina*, *Kallichroma tethys*, *Leptosphaeria australiensis*, *Lulworthia* sp., *Rimora mangrovei*, *Rhizophila marina*, *Sammeyersia grandispora*, *Savoryella longispora*, *Sclerococcum haliotrephum* and *Verruculina enalia* are the very frequently encountered fungi in the Indian Ocean mangroves in addition to several frequently recorded species (Sarma and Hyde 2001). In the case of Pacific Ocean, *Caryosporella rhizophorae*, *Halocyphina villosa*, *Halosarpheia marina*, *Hydea pygmea*, *Lignincola laevis*, *Linocarpon appendiculatum*, *Lophiostoma acrostichi*, *Lulworthia* sp., *Morosphareria velatospora*, *Phomopsis* sp., *Sammeyersia grandispora*, *Sclerococcum haliotrephum*, *Torpedospora radiata* and *Trichocladium linderii* were reported to be very frequently recorded species (Sarma and Hyde 2001). It can be found from the above list that there is an overlap of very frequently recorded species between the Indian and Pacific Oceans (Sarma and Hyde 2001). Very meagre information is available from Atlantic Ocean. Jones and Abdel-Wahab (2005) reported the following mangrove fungi as 'core group' from Bahamas Islands, Atlantic Ocean: *Anthostomella* sp., *Kallichroma tethys*, *Leptosphaeria australiensis*, *Sammeyersia grandispora* and *Verruculina enalia.*

Molecular diversity of mangrove fungi

Circa 77.4% of the mangrove fungi listed in Table 1 are supported by molecular data and this compares with that for pelagic marine fungi (49%) (Hassett et al. 2019). This has implications when inventorying fungal populations employing metagenomics and determining their functional role in the ecosystem (Arfi et al. 2012a, b; Vanegas et al. 2019). A number of studies have looked at the molecular diversity of the fungal mangrove community using 454 pyrosequencing in the region of the mangrove trees *Avicennia marina* and *Rhizophora stylosa* (Arfi et al. 2012a, b) and *Avicennia germinans* (Vanegas et al. 2019). Arfi et al. (2012a) recorded 209,544 reads from exposed and submerged parts of *A. marina* and *R. stylosa* and showed that the Ascomycota dominated (82%) while Basidiomycota were rare (3%), thus supporting the observations of more traditional surveys (Jones et al. 2019). The most abundant taxonomic classes in the four microhabitats studied were Dothideomycetes, Lecanoromycetes and Sordariomycetes, and surprisingly a low Eurotiomycetes diversity (Arfi et al. 2012a). Vanegas et al. (2019) noted 854,662 reads with 680 OTU's and 46 genera in the rhizosphere of *A. germninans*. Saprotrophs dominated all salinity levels (high 23.2% salt, median 14.6% salt, low 2.8% salt) in the mangroves with such genera as *Amorosia*, *Aspergillus*, *Penicillium Talaromyces* and *Trichoderma.* At high salinity, *Aspergillus*, *Cystofilobasidium*, *Podosphaera Saitozyma* and *Trichoderma* species were most abundant; at low salinity *Amorosia*, *Aspergillus*, *Phaeoacremonium*, *Talaromyces* and *Trichoderma* species were dominant while at median salinity *Aspergillus*, *Cystobasdium*, *Penicillium* and *Trichoderma* species were most abundant.

Simões et al. (2015) also undertook a metagenomic study of soil and rhizosphere associated fungi in an *Avicennia marina* mangrove in the Red Sea and noted that the Ascomycota were dominant (76–85% of all reads), the Basidiomycota with 14–24% reads and minor occurrence of taxa belonging to Blastocladiomycota, Chytridiomycota, Glomeromycota and Neocallimastigomycota. Within the Ascomycota, dominant classes included members of the Eurotiomycetes and Saccharomycetes, with *Aspergillus* and *Schizosaccharomyces* dominating in the samples examined in the study. Several taxa in the mycobiome were not previously reported as mangrove-associated fungi: *Ajellomyces capsulatus*, *Blastocladiella emersoni*, *Neocallimastix*, *Orpinomyces*, *Piromyces*, or listed in www.marinefungi.org. Clearly further studies are required to explore these undocumented fungi.

Conclusions

This extensive search of the literature on mangrove fungi yielded 850 taxa, which greatly enhances our knowledge of their world distribution and documents species not previously included in the reviews of Schmit and Shearer (2003, 2004). Taxonomical groups that are poorly represented in mangroves are the Chytridiomycota (5 species) and Mucoromycota (13) with no change from those listed by Schmit and Shearer (2003). This can only be attributed to lack of interest by marine mycologists to study these groups. It is vital to survey mangroves for these organisms as chytrids are often associated with infections of phytoplankton (Scholz et al. 2016; Hassett et al. 2019). Baiting mangrove swampy muddy soils, mud flats, volcanic muds with keratin and pollen may yield additional isolates and taxonomic diversity. Greater effort to examine plankton samples for chytrids may help to better understand their ecology in mangrove habitats.

Mangrove fungi have been widely surveyed as the results of this review shows (Fig. 21), but still many mangrove forests remain unexplored, especially those in Africa, Australia, New Zealand and South America. The mangrove forests of Bangladesh, China, Indonesia, Myanmar, Pakistan and Sri Lanka, are also understudied for mangrove fungi. Hence, more fungal surveys in search of a better understanding of their ecology needs to be conducted throughout the world.

Field (1995) opines that climate change will significantly affect the ecology of mangroves and their distribution with the major factor's temperature, carbon dioxide concentration, salinity of seawater and sea level rise. The constant pollution of mangroves with rubbish and plastics will surely also impact on the mycota of coastal waters (Fig. 22).

The checklist presented in this study significantly extends earlier lists of mangrove fungi (Schmit and Shearer 2003; Sridhar et al. 2012). This is due to the inclusion of yeasts and lower mangrove fungi whereas earlier lists have excluded them. This study comprises 850 mangrove fungi that are exclusive to mangrove environments excluding the terrestrial fungi on mangroves.

Metagenomic analyses of mangrove fungi from mangrove soil, water and litter is a target topic that requires undertaking so as to enhance our knowledge of fungal interactions in the mangroves of America and Asia. Many mangrove plants have been extensively studied, e.g. *Avicennia*, *Nypa* and *Rhizophora* species, while others have been neglected: *Aegiceras*, *Excoecaria* and *Sonneratia* species. The most neglected substrates are mangrove seagrasses and saltmarsh plants that extend into estuarine mangroves and phytoplankton and seaweeds. For example: Australian mangroves commonly have 22 seaweeds, 20 seagrasses. Clearly, studies of mangrove fungi and their role in marine ecosystems remain a challenge for present day mycologists, ecologists and physiolgists.

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References

Abdel-Wahab MA (2005) Diversity of marine fungi from Egyptian Red Sea mangroves. Bot Mar 48:348–355

Abdel-Wahab MA, Pang KL, Nagahama T, Abdel-Aziz FA, Jones EBG (2010) Phylogenetic evaluation of anamorphic species of *Cirrenalia* and *Cumulospora* with the description of eight new genera and four new species. Mycol Prog 9:537–558

Abdel-Wahab MA, Hodhod MS, Bakhali AH, Jones EBG (2014) Marine fungi of Saudi Arabia. Bot Mar 57:323–335

Abdel-Wahab MA, Bahkali AH, Jones EBG, Elgorbani A, Abdel-Aziz FA, Hodhodi MS, Al-Hebshi MO (2016) Two new species of *Kallichroma* (Bionecteriaceae, Hypocreales) from mangroves of Saudi Arabia. Phytotaxa 260:66–74

Abdel-Wahab MA, Dayarathne MC, Suetrong S, Guo SY, Alias SA, Bahkali AH, Nagahama T, Elgorban AM, Abdel-Aziz FA, Hodhod MS, Al-Hebshi MO, Hyde KD, Nor NA, Pang KL, Jones E (2017) New saprobic marine fungi and a new combination. Bot Mar 60:469–488

Abdel-Wahab MA, Jones EBG, Bahkali AH, El-Gorban AM (2019a) Marine fungi from Red Sea mangroves in Saudi Arabia with *Fulvocentrum rubrum* sp. nov. (Torpedosporales, Ascomycota). Nova Hedwigia 108:365–377

Abdel-Wahab MA, Jones EBG, Bahkali AH, El-Gorban AM (2019b) *Nia lenicarpa* sp. nov. (Niaceae, Agaricales) from Red Sea mangroves in Saudi Arabia with comments on *Nia vibrissa*. Phytotaxa 406:157–168

Aleem AA (1980) Distribution and ecology of marine fungi in Sierra Leone (tropical West Africa). Bot Mar 23:679–688

Alias SA, Jones EBG (2000a) Colonization of mangrove wood by marine fungi at Kuala Selangor mangrove stand, Malaysia. In: Aquatic Mycology Across the Millennium. (eds KD Hyde, WH Ho, SB. Pointing). Fungal Divers 5:9–21

Alias SA, Jones EBG (2000b) Vertical distribution of marine fungi on *Rhizophora apiculata* at Morib mangrove, Selangor, Malaysia. Mycoscience 41:431–436

Alias SA, Jones EBG (2009) Fungi from mangroves of Malaysia. Inst Ocean Earth Sci Uni Malaya 54:1–109

Alias SA, Jones EBG, Kuthubutheen AJ (1995) Frequency of occurrence of fungi on wood in Malaysian mangroves. Hydrobiologia 295:97–106

Alias SA, Zianuddin N, Jones EBG (2010) Biodiversity of marine fungi in Malaysian mangroves. Bot Mar 53:545–554

Al-Saadoon AH (2006) A new arenicolous species of *Corollospora* from Iraq. Marsh Bull 2:134–139

Alva P, McKenzie EHC, Pointing SB, Pena-Muralla R, Hyde KD (2002) Do sea grasses harbour endophytes? Fungal Divers Res Ser 7:167–178

Amend AS, Barshis DJ, Oliver TA (2012) Coral-associated marine fungi form novel lineages and heterogeneous assemblages. ISME J 6:1291–1301

Amend A, Burgaud G, Cunliffe M, Edgcom VP, Ettinger CL, Gutiérrez MH, Heitman J, Hom EFY, Ianiri G, Jones AC, Kagami M, Picard KT, Quandt CA, Raghukumar S, Riquelme M, Stajich J, Vargas-Muñiz J, Walker AK, Yarden O, Gladfelterp AS (2019) Fungi in the marine environment: open questions and unsolved problems. Ecol Evol Sci 10:e01189–18

Am-In S, Limtong S, Yongmanichai W, Jindamorakot S (2011) *Candida andamanensis* sp. nov., *Candida laemsonensis* sp. nov. and *Candida ranongensis* sp. nov., anamorphic yeast species isolated from estuarine waters in a Thai mangrove forest. Int J Syst Evol Microbiol 61:454–461

Ananda K, Sridhar KR (2001) Mycoflora on dead animal materials of mangrove habitats of Karnataka Coast, India. Sri Lanka. J Aqua Sci 6:85–93

Ananda K, Sridhar KR (2002) Diversity of endophytic fungi in the roots of mangrove species on the west coast of India. Can J Microbiol 48:871–878

Ananda K, Sridhar KR (2004) Diversity of filamentous fungi on decomposing leaf and woody litter of mangrove forests of southwest coast of India. Curr Sci 87:1431–1437

Ananda K, Prasannarai K, Sridhar KR (1998) Occurrence of higher marine fungi on marine animal substrates of some beaches along the west coast of India. Indian J Mar Sci 27:233–236

Ananda K, Sridhar KR, Raviraja NS, Barlocher (2008) Breakdown of fresh and dried *Rhizophora mucronata* leaves in a mangrove of Southwest India. Wet Ecol Manage 16:1–9

Araujo FV, Soares CAG, Hagler AN (1995) Ascomycetous yeast communities of marine invertebrates in a Southeast Brazilian mangrove ecosystem. Antonie Van Leeuwenhoek 68:91–99

Arfi Y, Buee M, Marchand C, Levasseur A, Record E (2012a) Multiple markers pyrosequencing reveals highly diverse and host-specific fungal communities on the mangrove *trees Avicennia marina* and *Rhizophora stylosa*. FEMS Microbiol Immunol 79:433–444

Arfi Y, Marchand C, Wartel M, Record E (2012b) Fungal diversity in anoxic-sulfidic sediments in a mangrove soil. Fungal Ecol 5:282–285

Ariyawansa HA, Hyde KD, Jayasiri SC, Buyck B, Chethana KWT, Dai DQ, Dai YC, Daranagama DA, Jayawardena RS, Lucking R, Ghobad-Nejhad M, Niskanen T, Thambugala KM, Voigt K, Zhao RL, Li GJ, Doilom M, Boonmee S, Yang ZL, Cai Q, Cui YY, Bahkali AH, Chen J, Cui BK, Chen JJ, Dayarathne MC, Dissanayake AJ, Ekanayaka AH, Hashimoto A, Hongsanan S, Jones EBG, Larsson E, Li WJ, Li QR, Liu JK, Luo ZL, Maharachchikumbura SSN, Mapook A, McKenzie EHC, Norphanphoun C, Konta S, Pang KL, Perera RH, Phookamsak R, Phukhamsakda C, Pinruan U, Randrianjohany E, Singtripop C, Tanaka K, Tian CM, Tibpromma S, Abdel-Wahab MA, Wanasinghe DN, Wijayawardene NN, Zhang JF, Zhang H, Abdel-Aziz FA, Wedin M, Westberg M, Ammirati JF, Bulgakov TS, Lima DX, Callaghan TM, Callac P, Chang CH, Coca LF, Dal Forno M, Dollhofer V, Fliegerova K, Greiner K, Griffith GW, Ho HM, Hofstetter V, Jeewon R, Kang JC, Wen TC, Kirk PM, Kytovuori I, Lawrey JD, Xing J, Li H, Liu ZY, Liu XZ, Liimatainen K, Lumbsch HT, Matsumura M, Moncada B, Nuankaew S, Parnmen S, de Azevedo Santiago ALCM, Sommai S, Song Y, de Souza CAF, de Souza-Motta CM, Su HY, Suetrong S, Wang Y, Wei SF, Wen TC, Yuan HS, Zhou LW, Reblova M, Fournier J, Camporesi E, Luangsa-ard JJ, Tasanathai K, Khonsanit A, Thanakitpipattana D, Somrithipol S, Diederich P, Millanes AM, Common RS, Stadler M, Yan JY, Li XH, Lee HW, Nguyen TTT, Lee HB, Battistin E, Marsico O, Vizzini A, Vila J, Ercole E, Eberhardt U, Simonini G, Wen HA, Chen XH (2015) Fungal diversity notes 111–252 taxonomic and phylogenetic contributions to fungal taxa. Fungal Divers 75:1–248

Besitulo AD, Samra VV, Hyde KD (2002) Mangrove fungi from Siargao Island, Philippines. In: Hyde KD (ed) Fungi in marine environments. Fungal Diversity Research Series 7. Fungal Divers Press, Hong Kong, pp 267–283

Binder M, Hibbett DS, Wang Z, Farnham WF (2006) Evolutionary relationships of Mycaureola dilseae (Agaricales), a basidiomycetes pathogen of a subtidal Rhodophyte. Am J Bot 93:547–556

Bremer G (1995) Lower marine fugi (Labyrinthulomycetes) and the decay of mangrove leaf. Hydrobiologia 295:89–95

Bucher VVC, Hyde KD, Pointing SB, Reddy CA (2004) Production of wood decay enzymes, mass loss and lignin solubilization in wood by marine ascomycetes and their anamorphs. Fungal Divers 15:1–14

Byrne PJ, Jones EBG (1974) Lignicolous marine fungi. Veroff Inst Meeresf 5:301–320

Byrne P, Jones EBG (1975) Effect of salinity on spore germination of terrestrial and marine fungi. Trans Bri mycol Soc 64:497–503

Chalkley DB, Suh SO, Volkmann-Kohlmeyer B, Kohlmeyer J, Zhou JJ (2010) *Diatrypasimilis australiensi*s, a novel xylarialean fungus from mangrove. Mycologia 102:432

Chareprasert S, Piapukiew J, Whalley AJS, Sihanonth P (2010) Endophytic fungi from mangrove plant species of Thailand: their antimicrobial and anticancer potentials. Bot Mar 53:555–564

Chen W, Shearer CA, Crane JL (1999) Phylogeny of *Ophioceras* spp. based on morphological and molecular data. Mycologia 91:84–94

Chi WC, Chen WL, He CC, Guo SY, Cha HJ, Tsang LM, Ho TW, Pang KL (2019) A highly diverse fungal community associated with leaves of the mangrove plant *Acanthus ilicifolius* var *xiamenensis* revealed by isolation and metabarcoding analyses. Peer J. https://doi.org/10.7717/peerj.7293

Chinnaraj S (1993) Manglicolous fungi from Atollos Maldives. Indian Ocean Ind J Mar Sci 22:14–142

Cooke RC, Rayner ADM (1984) Ecology of saprophytic fungi. Longman, London

Cribb AB, Cribb JW (1955) Marine fungi from Queensland. University of Queensland Press, Brisbane

Cundell AM, Brown MS, Stanford R, Mitchell R (1979) Microbial degradation of *Rhizophora mangle* leaves immersed in the sea. East Coast Mar Sci 9:281–286

Dayarathne MC, Phookamsak R, Hyde KD, Manawasinghe IS, To-Anun C, Jones EBG (2016) *Halodiatrype*, a novel diatrypaceous genus from mangroves with *H. salinicola* and *H. avicenniae* spp. nov. Mycosphere 4:363–454

Dayarathne MC, Maharachchikumbura SSN, Jones EBG, Wei D, Devadatha B, Yang Jing, Ekanayake H, De Silva W, Samra VV, Al-Sadi AM, Khongphinitbunjong K, Hyde KD, Zhao RL (2019a) Phylogenetic revision of Savoryellaceae and evidence for its ranking as a subclass. Front Microbiol 10:84

Dayarathne MC, Maharachchikumbura SSN, Jones EBG, Al-Sadi AM, Hyde KD, Chomnunti P (2019b) Sexual morph of *Phaeoacremonium aureum* from *Rhizophora mucronata* collected in southern Thailand. Phytotaxa 387:21–39

Dayarathne MC, Devadatha B, Wanasinghe DN, Abeywickrama P, Jones EBG, Chomnunti P, Sarma VV, Liu JK, Hyde KD (2020a) Modern taxonomic approaches to identifiying Diatrypaceous fungi from marine habitats, a novel genus *Halocryptovalsa* and expansion of *Halodiatrype*. Cryptogamie Mycologie 41:21–67

Dayarathne MC, Jones EBG, Maharachchikumbura SSN, Devadatha B, Sarma VV, Khongphinitbunjong K, Chomnunti P, Hyde KD (2020b) Morpho-molecular characterization of microfungi associated with marine based habitats. Mycosphere 11:1–188

Debbab A, Aly AH, Proksch P (2013) Mangrove derived fungal endophytes – a chemical and biological perception. Fungal Divers 61:1–27

Deshmukh SK, Gupta MK, Prakash V, Reddy MS (2018) Mangrove-associated fungi: a novel source of potential anticancer compounds. J Fungi 4:101

Deshmukh SK, Agrawal S, Prakash V, Gupta MK, Reddy MS (2020) Anti-infectives from mangrove endophytic fungi. S Afr J Bot 16:1–27

Devadatha B, Sarma VV (2018) *Pontoporeia mangrovei* sp. nov, a new marine fungus from an Indian mangrove along with a new geographical and host record of *Falciformispora lignatilis*. Curr Res Environ Appl Mycol 8:238–246

Devadatha B, Sarma VV, Wanasinghe DN, Hyde KD, Jones EBG (2017) Introducing the new Indian mangrove species, *Vaginatispora microarmatispora* (Lophiostomataceae) based on morphology and multigene phylogenetic analysis. Phytotaxa 329:139–149

Devadatha B, Sarma VV, Jeewon R, Wanasinghe DN et al (2018a) *Thyridareilla* a novel marine fungal genus from India: morphological characterization and phylogeny inferred from multigene DNA sequence analyses. Mycol Prog. https://doi.org/10.1007/s11557-018-1387-4

Devadatha B, Sarma VV, Ariyawansa HA, Jones EBG (2018b) *Deniquelata vittalii* sp. nov., a novel Indian saprobic marine fungus on *Suaeda monoica* and two new records of marine fungi from Muthupet mangroves, East coast of India. Mycosphere 9:565–582

Devadatha B, Mehta N, Wanasinghe DN, Baghela A, Sarma VV (2019) *Vittaliana mangrovei*, gen. nov., sp. nov. (Phaeosphaeriaceae) from mangroves near Pondicherry (India), based on morphology and multigene phylogeny. Cryptogam Mycol 40:117–132

El-Samawaty AMA, Boekhout T, Yassin MA, Abdel-Wahab MA (2019) *Saturnispora mangrovi* f.a., sp. nov. from Syhat mangrove, Saudi Arabia. Int J Syst Evol Microbiol 70:977–981

El-Sharouny HM, Raheem AM, Abdel-Wahab MA (1998) Manglicolous fungi of the Red Sea in Upper Egypt. Mycol Res 153:81–96

Fan KW, Vrijmoed LLP, Jones EBG (2002) Physiological studies of subtropical mangrove Thraustochytrids. Bot Mar 45:50–57

FAO (2007) The world's mangroves 1980–2005. FAO forestry paperno. 153. Rome, Forest Resources Division, FAO, pp 77

Fell JW, Masters IM (1973) Fungi associated with the degradation of mangrove (*Rhizophora mangle* L.) leaves south Florida. In: Stevenson HL, Colwell RR (eds) Estuarine microbial ecology. University of South Carolina Press, Columbia

Fell JW, Masters IM (1995) Phycomycete (*Phytophthora* spp. nov. and *Pythium* sp. nov.) associated with degrading mangrove leaves. Can J Bot 53:2908–2922

Fell JW, Cefalu RC, Master IM, Tallman AS (1975) Microbial activities in the mangrove (*Rhizophora mangle*) leaf detrital system. In: Walsh G, Snedaker S, Teas H (eds) Proc Int Symp Biol Managmt Mangroves. University of Florida, Gainesville, pp 661–679

Fell JW, Masters IM, Newell SY (1980) Laboratory model of'the potential role of fungi (*Phytophthora* spp.) in the decomposition of red mangrove (*Rhizophora mangle*) leaf litter. In: Tenore KR, Coull BC (eds) Marine Benthic dynamics. University of South Carolina Press, Columbia, pp 359–363

Fell JW, Statzall-Tallman A, Kurtzman CP (2004) *Lachancea meyersii* sp. nov., an ascosporogenous yeast from mangrove regions in the Bahama Islands. Stud Mycol 50:359–363

Fell JW, Statzell-Tallman S, Scorzetti G, Gutiérrez MH (2011) Five new species of yeasts from fresh water and marine habitats in the Florida Everglades. Anton Leeuw 99:533–549

Field CD (1995) Impact of expected climate change on mangroves. Hydrobiologia 295:75–81

Frisvad JC (2015) Fungal chemotaxonomy. In: Zeilinger S, Martín J-F, García-Estrada C (eds) Biosynthesis and molecular genetics of fungal secondary metabolites, vol 2. Springer, New York, pp 103–121

Frisvad JC, Andersen B, Thrane U (2008) The use of secondary metabolite profiling in chemotaxonomy of filamentous fungi. Mycol Res 112:231–240

Fryar SC, Booth W, Davies J, Hodgkiss IJ, Hyde KD (2004) Distribution of fungi on wood in the Tuton River, Brunei. Fungal Divers 17:17–38

Fryar SC, Haelewaters D, Catcheside DEA (2019) *Annabella australiensis* gen. and sp. nov. (Helotiales, Cordieritidaceae) from South Australian mangroves. Mycol Prog 18:973–981

Furtado BU, Gołebiewski M, Skorupa M, Hulisz P, Hrynkiewicz K (2019) Bacterial and fungal endophytic microbiomes of *Salicornia europaea*. Appl Environ Microbiol 85:e00305–e00319

Garg GK (1983) Vertical distribution of fungi in Sunderban mangrove mud. Indian J Mar Sci 12:48–51

Gleason FH, Küpper FC, Amon JP, Picard K et al (2011) Zoosporic fungi in marine ecosystems: a review. Mar Freshw Res 62:383–393

Godinho VM, de Paula MT, Silva DA, Paresque K, Martins AP, Colepicolo P, Rosa CA, Rosa LH (2019) Diversity and distribution of hidden cultivable fungi associated with marine animals of Antarctica. Fungal Biol 123(7):507–516

Golubic S, Radtke G, Le Campion-Alsumard T (2005) Endolithic fungi in marine ecosystems. Trends Microbiol 13:229–235

Hassett BT, Vonnahme TR, Peng XF, Jones EBG, Heuzé C (2019) Global diversity and geography of the planktonic marine fungi. Bot Mar 63:121–139

Hattori T, Sakayaroj J, Jones EBG, Suetrong S, Preedanon S, Klaysuban A (2014) Three species of *Fulviformes* (Basidiomycota, Hymenochaetales) associated with rots on mangrove tree *Xylocarpus granatum* in Thailand. Mycoscience 55:344–354

Hawksworth DL, Eriksson OE (1986) The names of accepted orders of Ascomycetes. Syst Ascom 5:175–184

Hibbett DS, Binder M (2001) Evolution of marine mushrooms. Biol Bull 201:319–322

Hibbett DS, Binder M, Bischoff JF, Blackwell M, Cannon PF, Eriksson OE, Huhndorf S, James T, Kirk PM, Lucking R, Thorsten Lumbsch H, Lutzoni F, Matheny PB, McLaughlin DJ, Powell MJ, Redhead S, Schoch CL, Spatafora JW, Stalpers JA, Vilgalys R, Aime MC, Aptroot A, Bauer R, Begerow D, Benny GL, Castlebury LA, Crous PW, Day Y-C, Gams W, Geiser DM, Griffith GW, Gueidan C, Hawksworth DL, Hestmark G, Hosaka K, Humber RA, Hyde KD, Ironside IE, Koljalg U, Kurtzman CP, Larsson K-H, Lichtwardt R, Longcore J, Miądlikowska J, Miller A, Moncalvo J-M, Mozley-Standtridge S, Oberwinkler F, Parmasto E, Reeb W, Rogers J-D, Roux C, Ryvarden L, Sampaio JP, Schussler A, Sugiyama J, Thorn RG, Tibell L, Untereiner WA, Walker C, Wang Z, Weir A, Weiss M, White MM, Winka K, Yao Y-J, Zhang N (2007) A higher- level phylogenetic classification of the Fungi. Mycol Res 111:509–547

Hodhod MS, Abdel-Wahab MA, Bahkali AH, Hyde KD (2012) *Amarenographium solium* sp. nov. from Yanbu mangroves in the Kingdom of Saudi Arabia. Cryptogam Mycol 33:285–295

Hongsanan S, Maharachchikumbura SSN, Hyde KD, Samarakoon MC et al (2017) An updated phylogeny of Sordariomycetes based on phylogenetic and molecular clock evidence. Fungal Divers 84:25–41

Hongsanan S, Hyde KD, Phookamsak R, Wanasinghe DN, McKenzie EHC, Sarma VV, Boonmee S, Lücking R, Pem D, Bhat JD, Liu N, Tennakoon DS, Karunarathna A, Jiang SH, Jones EBG, Phillips AJL, Manawasinghe I, Tibpromma S, Jayasiri SC, Sandamali D, Jayawardena RS, Wijayawardene NN, Ekanayaka AH, Jeewon R, Lu YZ, Dissanayake AJ, Zeng XY, Luo ZL, Tian Q, Phukhamsakda C, Thambugala KM, Dai DQ, Chethana TKW, Ertz D, Doilom M, Liu JK, Pérez-Ortega S, Suija A, Senwanna C, Wijesinghe SN, Konta S, Niranjan M, Zhang SN, Ariyawansa HA, Jiang HB, Zhang JF, de Silva NI, Thiyagaraja

V, Zhang H, Bezerra JDP, Miranda-Gonzáles R, Aptroot A, Kashiwadani H, Harishchandra D, Aluthmuhandiram JVS, Abeywickrama PD, Bao DF, Devadatha B, Wu HX, Moon KH, Gueidan C, Schumm F, Bundhun D, Mapook A, Monkai J, Chomnunti P, Samarakoon MC, Suetrong S, Chaiwan N, Dayarathne MC, Jing Y, Rathnayaka AR, Bhunjun CS, Xu JC, Zheng JS, Liu G, Feng Y, Xie N (2020a) Refined families of Dothideomycetes: Dothideomycetidae and Pleosporomycetidae. Mycosphere 11(1):1553–2107

Hongsanan S, Hyde KD, Phookamsak R, Wanasinghe DN, McKenzie EHC, Sarma VV, Lücking R, Boonmee S, Bhat JD, Liu N, Tennakoon DS, Pem D, Karunarathna A, Jiang SH, Jones EBG, Phillips AJL, Manawasinghe I, Tibpromma S, Jayasiri SC, Sandamali D, Jayawardena RS, Wijayawardene NN, Ekanayaka AH, Jeewon R, Lu YZ, Dissanayake AJ, Zeng XY, Luo ZL, Tian Q, Phukhamsakda C, Thambugala KM, Dai DQ, Chethana TKW, Ertz D, Doilom M, Liu JK, Pérez-Ortega S, Suija A, Senwanna C, Wijesinghe SN, Konta S, Niranjan M, Zhang SN, Ariyawansa HA, Jiang HB, Zhang JF, de Silva NI, Thiyagaraja V, Zhang H, Bezerra JDP, Miranda-Gonzáles R, Aptroot A, Kashiwadani H, Harishchandra D, Aluthmuhandiram JVS, Abeywickrama PD, Bao DF, Devadatha B, Wu HX, Moon KH, Gueidan C, Schumm F, Bundhun D, Mapook A, Monkai J, Chomnunti P, Samarakoon MC, Suetrong S, Chaiwan N, Dayarathne MC, Jing Y, Rathnayaka AR, Bhunjun CS, Xu JC, Zheng JS, Liu G, Feng Y, Xie N (2020b) Refined families of Dothideomycetes: orders and families incertae sedis in Dothideomycetes. Fungal Divers 105:17–318

Hyde KD (1986) Frequency of occurrence of lignicolous marine fungi in the tropics. In: Moss ST (ed) The biology of marine fungi. Cambridge Univeristy Press, Cambridge, pp 311–322

Hyde KD (1988) Studies on the tropical marine fungi of Brunei. Bot J Linn Soc 98:135–151

Hyde KD (1990a) Intertidal fungi from warm temperate mangroves of Australia, including *Tunicatispora australiensis*, gen. et sp. nov. Aust Syst Bot 3:711–718

Hyde KD (1990b) A study of the vertical zonation of intertidal fungi on *Rhizophora apiculata* at Kampong Kapok mangrove, Brunei. Aquatic Bot 36:255–262

Hyde KD (1991) Fungal colonization of *Rhizophora apiculata* and *Xylocarpus granatum* poles in Kampong Kapok mangrove, Brunei. Sydowia 43:31–38

Hyde KD, Alias SA (2000) Biodiversity and distribution of fungi associated with decomposing *Nypa fruticans*. Biol Cons 9:393–402

Hyde KD, Jones EBG (1986) Marine fungi from Seychelles. IV. *Cucullospora mangrovei* gen. et sp. nov. from dead mangrove. Bot Mar 29:491–495

Hyde KD, Jones EBG (1988) Marine mangrove fungi. Mar Ecol 9:15–38

Hyde KD, Jones EBG (1989) Marine fungi from Seychelles. VIII. *Rhizophila marina*, a new ascomycete from mangrove prop roots. Mycotaxon 34:527–533

Hyde KD, Lee SY (1995) Ecology of mangrove fungi and their role in nutrient cycling: what gaps occur in our knowledge? Hydrobiologia 295:107–118

Hyde KD, Sarma VV (2006) Biodiversity and ecological observations on filamentous fungi of mangrove palm *Nypa fruticans* Wurumb (Liliopsida-Arecales) along the Tutong River, Brunei. Indian J Mar Sci 35:297–307

Hyde KD, Soytong K (2008) The fungal endophyte dilemma. Fungal Divers 33:163–173

Hyde KD, Chalermpongse A, Boonthavikoon T (1990) Ecology of intertidal fungi at Ranong mangrove, Thailand. Trans Mycol Soc Jpn 31:17–27

Hyde KD, Jones EBG, Leaño E, Pointing SB, Poonyth AD, Vrijmoed LLP (1998) Role of fungi in marine ecosystems. Biodivers Conserv 7:1147–1161

Hyde KD, Goh TK, Lu BS, Alias SA (1999) Eleven new intertidal fungi from *Nypa fruticans*. Mycol Res 103:1409–1422

Hyde KD, Jones EBG, Ariyawansa H, Liu JK, Binder M, Jayawardene N, Boehm E, Boonmee S, Chomnunti P, Dai DQ, Doilom M, Lücking R, Monkai J, Nelsen MP, Phookamsak R, Shearer CA, Wu ZH, Diederich P, Lawrey JD, Suetrong S, Tanaka K, Gueidan C, Knudsen K, Muggia L, Braun U, Yacharoen S, Wikee S, Li YM, Aptroot A, Bezerra JL, Raja HA, Alias SA, Bhat JD, Chukeatirote E, Dissanayake A, Doveri F, Crous PW, De Hoog S, Jayawardena R, Pang KL, Zhang Y, Hirayama K, Miller A (2013) Families of Dothideomycetes. Fungal Divers 63:1–313

Hyde KD, Norphanphoun C, Maharachchikumbura SSN, Bhat DJ, Jones EBG, Bundhun D, Chen YJ, Bao DF, Boonmee S, Calabon MS, Chaiwan N, Chethana KWT, Dai DQ, Dayarathne MC, Devadatha B, Dissanayake AJ, Dissanayake LS, Doilom M, Dong W, Fan XL, Goonasekara ID, Hongsanan S, Huang SK, Jayawardena RS, Jeewon R, Karunarathna A, Konta S, Kumar V, Lin CG, Liu JK, Liu NG, Luangsa-ard J, Lumyong S, Luo ZL, Marasinghe DS, McKenzie EHC, Niego AGT, Niranjan M, Perera RH, Phukhamsakda C, Rathnayaka AR, Samarakoon MC, Samarakoon SMBC, Sarma VV, Senanayake IC, Shang QJ, Stadler M, Tibpromma S, Wanasinghe DN, Wei DP, Wijayawardene NN, Xiao YP, Yang J, Zeng XY, Zhang SN, Xiang MM (2020) Refined families of Sordariomycetes. Mycosphere 11:305–1059

Isaka M, Yngchum A, Intamas S, Kocharin K, Jones EBG, Kongsaree P, Prabpai S (2009) Aigialomycins and related polyketide metabolites from the mangrove fungus *Aigialus parvus* BCC 5311. Tetrahedron 65:4396–4403

Jayasiri SC, Hyde KD, Jones EBG, McKenzie EHC, Jeewon R, Phillips AJL, Bhat DJ, Wanasinghe DN, Liu JK, Lu YZ, Kang JC, Xu JC, Karunarathna SC (2019) Diversity, morphology and molecular phylogeny of Dothideomycetes on decaying wild seed pods and fruits. Mycosphere 10(1):1–186

Jones EBG (1963) Marine fungi 2. Ascomycetes and Deuteromycetes from submerged wood and drift *Spartina*. Trans Br Mycol Soc 46:135–144

Jones EBG (2000) Marine fungi: some factors influencing biodiversity. Fungal Divers 4:53–73

Jones EBG (2011) Are there more marine fungi to be described? Bot Mar 54:343–354

Jones EBG, Abdel-Wahab MA (2005) Marine fungi from the Bahamas Islands. Bot Mar 48:356–364

Jones EBG, Hyde KD (1988) Methods for the study of marine fungi from the mangroves. In: Agate AD, Subramanian CV, Vannucci M (eds) Mangrove microbiology. Role of microorganisms in nutrient cycling of mangrove soils and waters. UNDP/UNESCO, New Delhi, pp 9–27

Jones EBG, Oliver AC (1964) Occurrence of aquatic hyphomycetes on wood submerged in fresh and brackish water. Trans Br mycol Soc 47:45–48

Jones EBG, Puglisi MP (2006) Marine fungi from Florida. Florida Sci 69:157–164

Jones EBG, Hyde KD, Read SJ, Moss ST, Alias SA (1996) *Tirisporella* gen. nov., an ascomycete from the mangrove palm *Nypa fruticans*. Can J Bot 74:1487–1495

Jones EBG, Sakayaroj J, Sueterong S, Somrithipol A, Pang KL (2009) Classification of marine Ascomycota, anamorphic taxa and Basidiomycota. Fungal Divers 35:1–187

Jones EBG, Suetrong S, Sakayaroj J, Bahkali AH, Abdel-Wahab MA, Boekhout T, Pang KL (2015) Classification of marine Ascomycota, Basidiomycota, Blastocladiomycota and Chytridiomycota. Fungal Divers 73:1–72

Jones EBG, Devadatha B, Abdel-Wahab MA, Dayarathne MC, Zhang SN, Hyde KD, Liu JK, Bahkali AH, Samra VV, Zhang H, Wang MM, Liu F, Cai L (2019a) New marine fungal genera and species. Bot Mar 63:155–181

Jones EBG, Pang KL, Abdel-Wahab MA, Scholz B, Hyde KD, Boekhout T, Ebel R, Rateb ME, Henderson L, Sakayaroj J, Suetrong S, Dayarathne MC, Kumar V, Raghukumar S, Sridhar KR, Bahkali AH, Gleason F, Norphanphoun C (2019b) An online resource for marine fungi. Fungal Divers 96:347–433

Jülich W (1981) Higher taxa of Basidiomycetes. Bibliotheca Mycologica 85:1–485

Kohlmeyer J (1969) Marine fungi from Hawaii including the new genus *Helicascus*. Can J Bot 47:1469–1487

Kohlmeyer J, Kohlmeyer E (1979) Marine mycology: the higher fungi. Academic Press, New York

Kohlmeyer J, Volkmann-Kohlmeyer B (1989) Hawaiian marine fungi, including two new genera of Ascomycotina. Mycol Res 92:410–421

Kohlmeyer J, Volkmann-Kohlmeyer B (1991) Marine fungi from Queensland, Australia. Aust J Mar Freshw Res 42:91–99

Kohlmeyer J, Volkmann-Kohlmeyer B (1992) Two Ascomycotina from coral reefs in the Caribbean and Australia. Cryptogam Bot 2:367–374

Kohlmeyer J, Volkmann-Kohlmeyer B (2003) Marine ascomycetes from algae and animal hosts. Bot Mar 46:285–306

Kong RYC, Chan PC, Mitchell JI, Vrijmoed LLP, Jones EBG (2000) Relationships of *Halosarpheia*, *Lignincola* and *Nais* inferred from partial 18S rDNA. Mycol Res 104:35–43

Kuthubutheen AJ (1984) Leaf surface fungi associated with *Avicennia alba* and *Rhizophora mucronata* in Malaysia. In: Proceedingd of the Asian symposium on mangrove environment - research and management, Kuala Lumpur pp 153–171

Læssøe T, Davey ML, Petersen JH (2016) A new species of *Maireina* on *Filipendula* ulmaria. Karstenia 56:39–46

Leańo EM, Vrijmoed LLP, Jones EBG (1998) Physiological studies on *Halophytophthora vesicular* (Straminipilous Fungi) isolated from fallen mangroves leaves from Mai Po, Hong Kong. Bot Mar 41:411–419

Lee BKH, Baker GE (1973) Fungi associated with the roots of the red mangrove. Mycologia 656:894–906

Lee SY, Jones EBG, Diele K, Castellanos-Galindo GA, Nordhaus I (2017) Biodiversity. In: Rivera-Monry Lee (ed) Mangrove ecosystems: a global biogeographic perspective. Springer, New York, pp 55–84

Leong WF, Tan TK, Jones EBG (1988) Lignicolous marine fungi of Singapore. Can J Bot 66:2167–2170

Leong WF, Tan TK, Jones EBG (1991) Fungal colonization of submerged *Bruguiera cylindrica* and *Rhizophora apiculata* wood. Bot Mar 34:69–76

Li GJ, Hyde KD, Zhao RN, Hongsanan S, Abdel-Aziz FA, Abdel-Wahab MA, Alvarado P, Alves-Silva G, Ammirati JF, Ariyawansa HA, Baghela A, Bahkali AH, Beug M, Bhat DJ, Bojantchev D, Boonpratuang T, Bulgakov TS, Camporesi E, Boro MC, Ceska O, Chakraborty D, Chen JJ, Chethana KWT, Chomnunti P, Consiglio G, Cui BK, Dai DQ, Dai YC, Daranagama DA, Das K, Dayarathne MC, Crop ED, De Oliveira RJV, de Souza CAF, de Souza JI, Dentinger BTM, Dissanayake AJ, Doilom M, Drechsler-Santos ER, Ghobad-Nejhad M, Gilmore SP, Goes-Neto A, Gorczak M, Haitjema GH, Hapuarachchi KK, Hashimoto A, He MQ, Henske JK, Hirayama K, Iribarren MJ, Jayasiri SC, Jayawardena RS, Jeon SJ, Jeronimo GH, Jesus AL, Jones EBG, Kang JC, Karunarathna SC, Kirk PM, Konta S, Kuhnert E, Langer E, Lee HS, Lee HB, Li WJ, Li XH, Liimatainen K, Lima DX, Lin CG, Liu JK, Liu XZ, Liu ZY, Luangsa-ard JJ, Lucking R, Lumbsch HT, Lumyong S, Leano EM, Marano AV, Matsumura M, McKenzie EHC, Mongkolsamrit S, Mortimer PE, Nguyen TTT, Niskanen T, Norphanphoun C, O'Malley MA, Parnmen S, Pawłowska J, Perera RH, Phookamsak R, Phukhamsakda C, Pires-Zottarelli CLA, Raspe O, Reck MA, Rocha SCO, de Santiago ALCMA, Senanayake IC, Setti L, Shang QJ, Singh SK, Sir EB, Solomon KV, Song J, Srikitikulchai P, Stadler M, Suetrong S, Takahashi H, Takahashi T, Tanaka K, Tang LP, Thambugala KM, Thanakitpipattana D, Theodorou MK, Thongbai B, Thummarukcharoen T, Tian Q, Tibpromma S, Verbeken A, Vizzini A, Vlasak J, Voigt K, Wanasinghe DN, Wang Y, Weerakoon G, Wen HA, Wen TC, Wijayawardene NN, Wongkanoun S, Wrzosek M, Xiao YP, Xu JC, Yan JY, Yang J, Yang SD, Hu Y, Zhang JF, Zhao J, Zhou LW, Persoh D, Phillips AJL, Maharachchikumbura SSN (2016) Fungal diversity notes 253–366: taxonomic and phylogenetic contributions to fungal taxa. Fungal Diversity 78:1–237

Li J, Jeewon R, Phookamsak R, Bhat DJ, Mapook A, Chukeatirote E, Hyde KD, Lumyong S, Mckenzie EH (2018) *Marinophialophora garethjonesii* gen. et sp. nov.: a new hyphomycete associated with *Halocyphina* from marine habitats in Thailand. Phytotaxa 345(1):1–2

Limtong S, Kaewwichian R, Am-In S, Boonmark C, Jindamorakot S, Yongmanitchai W, Srisuk N, Kawasaki H, Nakase T (2010) Three anamorphic yeast species *Candida sanitii* sp. nov., *Candida sekii* sp. nov., and *Candida suwanaritii*, three novel yeasts in the *Saturispora* clade isolated in Thailand. FEMS Yeast Res 10:114–122

Lin YC, Wu XY, Fenf SA, Jiang GC, Luo JH, Zhou SN, Vrijmoed LLP, Jones EBG, Krohn K, Steingrover K, Zsila F (2001) Five unique compounds: Xyloketals from mangrove fungus *Xylaria* sp. from the South China Sea. J Organic Chem 66:6252–6256

Lin YC, Wu X, Deng Z, Wang J, Zhou S, Vrijmoed LLP, Jones EBG (2002a) The metabolites of the mangrove fungus *Verruculina enalia* No 2606 from a salt lake in the Bahamas. Phytochem 59:469–471

Lin YC, Wang J, Wu XY, Zhou SN, Vrijmoed LLP, Jones EBG (2002b) A novel compound eniatin G from the mangrove fungus *Halosarpheia* sp. (#732) from the South China Sea. Aust J Chem 55:225–227

Liu JK, Hyde KD, Gareth Jones EB, Ariyawansa HA, Bhat DJ, Boonmee S, Maharachchikumbura SSN, McKenzie EHC, Phookamsak R, Phukhamsakda C, Shenoy BD, Abdel-Wahab MA, Buyck B, Chen J, Chethana KWT, Singtripop C, Dai DQ, Dai YC, Daranagama DA, Dissanayake AJ, Doilom M, Dsouza MJ, Fan XL, Goonasekara ID, Hirayama K, Hongsanan S, Jayasiri SC, Jayawardena RS, Karunarathna SC, Li WJ, Mapook A, Norphanphoun C, Pang KL, Perera RH, Peršoh D, Pinruan U, Senanayake IC, Somrithipol S, Suetrong S, Tanaka K, Thambugala KM, Tian Q, Tibpromma S, Udayanga D, Wijayawardene NN, Wanasinghe DN, Wisitrassameewong K, Zeng XY, Abdel-Aziz FA, Adamčik S, Bahkali AH, Boonyuen N, Bulgakov T, Callac P, Chomnunti P, Greiner K, Hashimoto A, Hofstetter V, Kang JC, Lewis D, Li XH, Liu XZ, Liu ZY, Matsumura M, Mortimer PE, Rambold G, Randrianjohany E, Sato G, Sri-Indrasutdhi V, Tian CM, Verbeken A, von Brackel W, Wang Y, Wen TC, Xu JC, Yan JY, Zhao RL, Camporesi E (2015) Fungal diversity notes 1–110: taxonomic and phylogenetic contributions to fungal species. Fungal Divers 72:1–197

Liu JK, Hyde KD, Jeewon R, Phillips AJ, Maharachchikumbura SS, Ryberg M, Liu ZY, Zhao Q (2017) Ranking higher taxa using divergence times: a case study in Dothideomycetes. Fungal Divers 84:75–99

Logesh AR, Kalaiselvam M, Upreti DK, Nayaka S, Kathiresan K (2013) Mangroves – An abode for unique lichens Coastal ecosystems of India, special publication. Annamalai University, Parangipettai, pp 39–44

Loilong A, Salayaroj J, Ringjindamain Choeyklin R, Jones EBG (2012) Biodiversity of fungi on the palm *Nypa fruticans*. In: Jones EBG, Pang KL (eds) Marine and fungal-like organisms. De Gruyter, Germany, pp 273–290

Maekawa N, Suhara H, Kinjo K, Kondo R, Hoshi Y (2005) *Haloaleurodiscus mangrovei* gen. sp. nov. (Basidiomycota) from mangrove forests in Japan. Mycol Res 109:825–832

Maharachchikumbura SSN, Hyde KD, Jones EBG, McKenzie EHC, Bhat J, Dayarathne MC, Huang SK, Norphanphoun C, Senanayake IC, Perera RH, Shang Q, Xiao Y, Dsouza MJ, Hongsanan S, Jayawardena RS, Daranagama DA, Konta S, Goonasekara ID, Zhuang WY, Jeewon R, Phillips AJL, Abdel-Wahab MA, Al-Sadi AM, Bahkali A, Boonmee S, Boonyuen N, Cheewangkoon R, Disanayake AJ, Kang J, Li QR, Liu JK, Liu ZY, Pang KL, Phookamsak R, Promputtha I, Suetrong S, Wen TC, Wijayawardene NN (2016) Families of Sordariomycetes. Fungal Divers 72:199–301

Maldonado-Ramírez SL, Torres-Pratts H (2005) First report of *Clathrus* cf *crispus* (Basidiomycota: Clathraceae) occurring on decomposing leaves of *Rhizophora mangle* in Puerto Rico. Caribbean J Sci 41:357–359

Manimohan P, Amritha M, Sairabanu NK (2011) A comparison of diversity of marine fungi on three co-habiting mangrove plants. Mycosphere 2:533–538

Maria GL, Sridhar KR (2003) Endophytic fungal assemblage of two halophytes from west coast mangrove habitats, India. Czech Mycol 55:241–251

Meyers SP, Reynolds ES (1958) A wood incubation method for the study of lignicolous marine fungi. Bull Mar Sci Gulf Caribbean 8:342–347

Misra S, Vijaykumar Y, Amitabha G, Dutta J (1984) Microbial decomposition of *Aviccenia officinalis* leaf litter in a mangrove forest biome: biochemical changes during decomposition. In: Krshnamurthy V, Untawale AH (eds) Marine plants. Seaweed Research Utilization Association, Madras, pp 257–262

Nakagiri A, Tokumasu S, Araki H, Koreeda S, Tubaki K (1989) Succession of fungi in decomposing mangrove leaves in Japan. In: Hattori T, Ishida Y, Maruyama Y, Morita RY, Uchida A (eds) Recent advances in microbial ecology (proceeding of the 5th international symposium on microbial ecology). Japan Scientific Societies Press, Tokyo, pp 297–301

Nakagiri A, Okane I, Ito T, Katumoto K (1997) *Lanceispora amphibia* gen. et sp. nov., a new amphisphaericeous ascomycete inhabiting senescent and fallen leaves of mangrove. Mycoscience 38:207–213

Narayanasamy R, Kathiresan K (2007) Microbial flora associated with submerged leaf litter in India. Rev Biol Tropl 55:34–44

Nayak SS, Gonsalves V, Nazareth S (2011) Isolation and salt tolerance of halophilic fungi from mangroves and solar salterns - India. Indian J Geo-Mar Sci 41:164–172

Newell SY (1973) Succession and role of fungi in the degradation of red mangrove seedlings. In: Stevenson LH, Colwell RR (eds) Estuarine microbial ecology. Univ. of South Carolina Press, Columbia, pp 467–480

Newell SY (1976) mangrove fungi: the succession in mycoflora of red mangrove (*Rhizophoara mangle* L.) seedlings. In: Jones EBG (ed) Recent advances in aquatic mycology. Elsevier, London, pp 51–91

Overy DP, Rämä T, Oosterhuis R, Walker A, Pang KL (2019) The neglected marine fungi *sensu stricto* and their isolation for natural products discovery. Marine Drugs 17:42

Pang KL, Vrijmoed LLP, Goh TK, Plaingam N, Jones EBG (2008) Fungal endophytes associated with *Kandelia candel* (Rhizophoraceae) in Mai Po Nature Reserve, Hong Kong. Bot Mar 51:171–178

Pang KL, Jheng JS, Jones EBG (2011) Marine mangrove fungi of Taiwan. National Taiwan Ocean University, Chilung, pp 1–131

Pang KL, Hyde KD, Alias SA, Suetrong S, Guo SY, Idid R, Jones EBG (2013) Dyfrolomycetaceae, a new family in the Dothideomycetes, Ascomycota. Cryptogam Mycol 34:223–232

Phookamsak R, Hyde KD, Jeewon R, Bhat DJ, Jones EBG, Maharachchikumbura SSN, Raspé O, Karunarathna SC, Wanasinghe DN, Hongsanan S, Doilom M, Tennakoon DS, Machado AR, Firmino AL, Ghosh A, Karunarathna A, Mešić A, Dutta AK, Thongbai B, Devadatha B, Norphanphoun C, Senwanna C, Wei DP, Pem D, Ackah FK, Wang GN, Jiang HB, Madrid H, Lee HB, Goonasekara ID, Manawasinghe IS, Kušan I, Cano J, Gené J, Li JF, Das K, Acharya K, Raj KNA, Latha KPD, Chethana KWT, He MQ, Dueñas M, Jadan M, Martín MP, Samarakoon MC, Dayarathne MC, Raza M, Park MS, Telleria MT, Chaiwan N, Matočec N, de Silva NI, Pereira OL, Singh PN, Manimohan P, Uniyal P, Shang QJ, Bhatt RP, Perera RH, Alvarenga RLM, Nogal-Prata S, Singh SK, Vadthanarat S, Oh SY, Huang SK, Rana S, Konta S, Paloi S, Jayasiri SC, Jeon SJ, Mehmood T, Gibertoni TB, Nguyen TTT, Singh U, Thiyagaraja V, Sarma VV, Dong W, Yu XD, Lu YZ, Lim YW, Chen Y, Tkalčec Z, Zhang ZF, Luo ZL, Daranagama DA, Thambugala KM, Tibpromma S, Camporesi E, Bulgakov TS, Dissanayake AJ, Senanayake IC, Dai DQ, Tang LZ, Khan S, Zhang H, Promputtha I, Cai L, Chomnunti P, Zhao RL, Lumyong S, Boonmee S, Wen TC, Mortimer PE, Xu JC (2019) Fungal diversity notes 929–1035: taxonomic and phylogenetic contributions on genera and species of fungi. Fungal Divers 95:1–273

Pointing SB, Vrijmoed LLP, Jones EBG (1998) A qualitative assessment of lignocellulose degrading enzyme activity in marine fungi. Bot Mar 41:293–298

Pointing SB, Buswell JA, Jones EBG, Vrijmoed LLP (1999) Extracellular cellulolytic enzyme profiles of five lignicolous mangrove fungi. Mycol Res 103:696–700

Poon MOK, Hyde KD (1998) Biodiversity of intertidal estuarine fungi on *Phragmites* at Mai Po marshes, Hong Kong. Bot Mar 41:141–155

Poonyth AD, Hyde KD, Peerally A (2001) Colonization of *Bruguiera gymnorrhiza* and *Rhizophora mucronata* wood by marine fungi. Bot Mar 44:75–80

Pouska V, Svoboda M, Leps J (2013) Co-occurrence patterns of wood-decaying fungi on *Picea abies* log: does *Fomitopsis pinicola* influence the other species? Polish J Ecol 61:119–134

Raghukumar C (2008) Marine fungal biotechnology: an ecological perspective. Fungal Divers 31:19–35

Raghukumar S (2017) Fungi in coastaland oceanic marine ecosytems. Springer, New York, pp 1–364

Raghukumar S, Sharma S, Raghukumar C, Sathe-Pathak V (1994) Thraustochytrid and fungal component of marine detritus. IV. Laboratory studies on decomposition of leaves of them mangrove *Rhizophora apiculata* Blume. J Exp Mar Biol Ecol 183:113–131

Raghukumar S, Sathe-Pathak V, Sharma S, Raghukumar C (1995) Thraustochytrid and fungal component of marine detritus. III. Field studies on the decomposition of leaves of the mangrove *Rhizophora apiculata* Blume. Aquat Microbiol Ecol 9:117–125

Rai JN, Tewari JP, Mukerji KG (1969) Mycoflora of mangrove mud. Mycopathol Mycol Appl 38:17–31

Raja AR, Upreti DK, Kalaiselvam M, Nayaka S, Kandasamy K (2012) Lichen flora of Pichavaram and Muthupet mangroves (Southeast Coast of India). Mycosphere 3:884–888

Rashmi M, Kushveer JS, Sarma VV (2019) A worldwide list of endophytic fungi with notes on ecology and diversity. Mycosphere 10:798–1079

Raveendran R, Manimohan P (2007) Marine fungi of Kerala, A preliminary floristic and ecological study. Malabar Natural History

Society (MNHS), 17/548, Indira Gandhi Link Road, Calicut - 673 004, Kerala, India
Ravikumar DR, Vittal BPR (1996) Fungal diversity on decomposing biomass of mangrove plant *Rhizophora* in Pichavaram estuary, east coast of India. Indian J Mar Sci 25:142–144
Réblová M, Miller AN, Rossman AY, Seifert KS, Crous PW, Hawksworth DL, Abdel-Wahab MA, Cannon PF, Daranagama DA, De Beer ZW, Huang SK, Hyde KD, Jayawardena R, Jaklitsch W, Jones EBG, Ju YM, Judith C, Maharachchikumbura SSN, Pang KL, Petrini LE, Raja HA, Romero AI, Shearer CA, Senanayake IC, Voglmayr H, Weir BS, Wijayawarden NN (2016) Recommendations for competing sexual-asexually typified generic names in Sordariomycetes (except Diaporthales, Hypocreales, and Magnaporthales). IMA Fungus 7:131–153
Richards TA, Jones MD, Leonard G, Bass D (2012) Marine fungi: their ecology and molecular diversity. Annu Rev Mar Sci 4:495–522
Rukachaisirikul V, Rodglin A, Phongpaichit S, Buatong J, Sakayaroj J (2011) alpha Pyrone and seiricuprolide derivatives from the mangrove-derived fungi *Pestalotiopsis* spp. PSU-MA92 and PSU-MA 119. Phytochem Lett 5:13–17
Sadaba RB, Vrijmoed LLP, Jones EBG, Hodkiss IJ (1995) Observations on vertical distribution of fungi associated with standing senescent *Acanthus ilicifolius* stems at Mai Po mangrove, Hong Kong. Hydrobiology 295:119–126
Sainty GR, Hosking J, Carr G, Adan P (eds) (2012) Estuary plants and what's happening to them in south-east Australia. Sainty and Associates Pty Ltd., Australia
Sakayaro J, Preedanon S, Phongpaichit S, Buatong J, Chaowalit P, Rukachaisirikul A (2012) Diversity of endophytic and marine-derived fungi associated with marine plants and animals. In: Jones EBG, Pang KL (eds) Marine fungi and fungal-like organisms. De Gryter, Berlin, pp 291–328
Sakayaroj J, Pang KL, Phongpaichi S, Jones EBG (2005) A phylogenetic study of the genus *Haligena* (Halosphaeriales, Ascomycota). Mycologia 97:804–811
Sakayaroj J, Preedanon S, Supaphon O, Jones EBG, Phongpaichit S (2010) Phylogenetic diversity of endophyte assemblages associated with tropical seagrass *Enhalus acoroides* from Thailand. Fungal Divers 41:27–45
Sakayaroj J, Preedanon S, Suetrong S, Klaysuban A et al (2012) Molecular characterization of basidiomycetes associated with the decayed mangrove tree *Xylocarpus granatum* in Thailand. Fungal Divers 56:145–156
Sangtiean T, Suetrong S, Sakayaroj J, Unakul P, Preedanon S, Klaysuban A (2014) Species diversity of manglicolous marine fungi at Trat Province. The Agricultural Co-operative Federation of Thailand Limited, Bangkok, pp 1–86
Sarma VV, Hyde KD (2001) A review of frequently occurring fungi in mangroves. Fungal Divers 8:1–34
Sarma VV, Hyde KD (2018) Fungal species consortia on *Nypa fruticans* at Brunei. Stud Fungi 3:19–26
Sarma VV, Raghukumar S (2013) Manglicolous fungi from Chorao mangroves, Goa, West coast of India: observations on fungal species consortia. Kavaka 41:18–22
Sarma VV, Vittal BPR (1998–1999) Ecological studies on mangrove fungi from east coast of India. Observations on seasonal occurrence. Kavaka: 26 & 27:105–120
Sarma VV, Vittal BPR (2000) Biodiversity of mangrove fungi on different substrata of *Rhizophora apiculata* and *Avicennia* spp. from Godavari and Krishna deltan, east cost of India. In: Hyde, K.D., Ho, W.H. and Pointing, S.B. (eds.) Aquatic Mycology across the Millennium. Fungal Divers 5:23–41
Sarma VV, Vittal BPR (2002) A preliminary study on vertical distribution of manglicolous fungi on prop roots of *Rhizophora apiculata* Blume at Krishna delta, east coast of India. Kavaka 30:21–29
Sarma VV, Vittal BPR (2017) Seasonal occurrence of marine ascomycetes and anamorphic marine fungi in mangroves of Godavari and Krishna deltas, East coast of India. Kavaka 48:61–69
Sarma VV, Newell SY, Hyde KD (2001) *Koorchaloma spartinicola* sp. nov., a new marine sporodochial fungus from *Spartina alterniflora*. Bot Mar 44:321–326
Schmit JP, Shearer CA (2003) A checklist of mangrove occurring fungi, their geographical distribution and known host plants. Mycotaxon 85:432–477
Schmit JP, Shearer CA (2004) Geographic and host distribution of lignicolous mangrove micro-fungi. Bot Mar 47:496–500
Scholz B, Kupper FC, Vyverman W, Karsten U (2016) Effects of eukaryotic pathogens (Chytridiomycota and Oomycota) on marine microphytobenthic diatom community compositions in the Soltho¨rn tidal flat (southern North Sea, Germany). Eur J Phycol 5:253–269
Shearer CA (1972) Fungi of the Chesapeake Bay and its tributaries. III. The distribution of wood-inhabiting ascomycetes and fungi imperfecti of the Patuxent river. Am J Bot 59:961–969
Simões MF, Antunes A, Ottoni CA, Amini MS, Alam I, Alzubaidy H, Mokhtar NA, Archer JAC, Bajic VB (2015) Soil and rhizosphere associated fungi in gray mangroves (*Avicennia marina*) from the Red Sea—a metagenomic approach. Genomics Proteomics Bioinform 13:310–320
Spalding M, Kainuma M, Collins L (2010) Word atlas of mangroves. Earthscan, London
Spatafora JW, Blackwell M (1994) The polyphyletic origins of ophiostomatoid fungi. Mycol Res 98:1–9
Spatafora JW, Volkmann-Kohlmeyer B, Kohlmeyer J (1998) Independent terrestrial origins of the Halosphaeriales (marine Ascomycota). Am J Bot 85:1569–1998
Sridhar KR (2012) Decomposition of materials in the sea. In: Jones EBG, Pang KL (eds) Marine fungi and fungal-like organisms. Walter de Gruyter GmbH & Co. KG, Berlin, pp 475–500
Sridhar KR, Alias SA, Pang KL (2012) Mangrove fungi. In: Jones EBG, Pang KL (eds) Marine fungi and fungal-like organisms. Walter de Gruyter GmbH & Co. KG, Berlin, pp 253–271
Statzell-Tallman A, Belloch C, Fell JW (2008) *Kwoniella mangroviensis* gen. nov., sp. nov. (Tremellales, Basidiomycota), a teleomorphic yeast from mangrove habitats in the Florida Everglades and Bahamas. FEMS Yeast Res 8:103–113
Statzell-Tallman A, Scorzetti G, Fell JW (2010) *Candida spencermartinsiae* sp. nov., *Candida taylorii* sp. nov. and *Pseudozyma abaconensis* sp. nov., novel yeasts from mangrove and coral reef ecosystems. Inter J Syst Evol Microb 60:1978–1984
Steinke TD, Barnabas AD, Somaru R (1990) Structural changes and associated microbial activity accompanying decomposition of mangrove leaves in Mgeni Estuary. S Afr J Bot 56:39–48
Stevens FL (1920) New or noteworthyPorto Rican fungi. Bot Gaz 70:399–402
Stevens GN (1979) Distribution and related ecology of macrolichens on mangroves on the east Australian coast. Lichenologist 11:293–305
Suetrong S, Schoch CL, Spatafora JW, Kohlmeyer J, Volkman-Kohlmeyer B, Sakayaroj J, Phongpaichit S, Tanaka K, Hirayama K, Jones EBG (2009) Molecular systematics of the marine Dothideomycetes. Stud Mycol 64:155–173
Suetrong S, Sakayaroj J, Unakul P, Somrithipol S, Preedanon S, Gundool W, Klaysuban A, Sangtiean T, Promchu W (2016) Species diversity of manglicolous marine fungi at Nakhon Si Thammarat, Phetchaburi and Prachuap Khiri Khan Provinces. The Agricultural Co-operative Federation of Thailand Limited, Bangkok
Sun JZ, Liu XZ, McKenzie EHC, Jeewon R, Liu JK, Zhang XL, Zhao Q, Hyde KD (2019) Fungicolous fungi: terminology, diversity, distribution, evolution and species checklist. Fungal Divers 95:1–94

Supaphon P, Phongpaichit S, Sakayaroj J, Rukachaisirikul V, Kobmoo N, Spatafora JW (2017) Phylogenetic community structure of fungal endophytes in seagrass species. Bot Mar 60:489–502

Tam WY, Pang KL, Jones EBG (2003) Ordinal placement of selected marine Dothideomycetes inferred from small subunit ribosomal DNA sequence analysis. Bot Mar 46:487–494

Tan TK, Leong WF, Jones EBG (1989a) Succession of fungi on wood of *Avicennia alba* and *A. lanata* in Singapore. Can J Bot 67:2686–2691

Tan TK, Leong WF, Mouzouras R, Jones EBG (1989b) Occurrence of fungi on mangrove wood and its decomposition. In: Hattori T, Ishida Y, Maruyama Y, Morita RY, Uchida A (eds) Recent advances in microbial ecology. Japan Scientific Societies Press, Tokyo, pp 307–310

Tan TK, Teng CL, Jones EBG (1995) Substrate type and microbial interactiona as factors affecting ascocarp formation by mangrove fungi. Hydrobiologia 195:127–134

Tang AMC, Jeewon R, Hyde KD (2007) Phylogenetic utility of protein (RPB2, b-tubulin) and ribosomal (LSU, SSU) gene sequences in the systematic of Sordariomycetes (Ascomycota, Fungi). Antonie Van Leeuwenhoek 91:327–349

Tao YW, Lin YC, She ZG, Lin MT, Chen PX, Zhang JY (2015) Anticancer activity and mechanism investigation of beauvericin isolated from secondary metabolites of the mangrove endophytic fungi. Anti-Cancer Agents Med Chem 15(2):258–266

Tomlinson TB (1986) The botany of mangroves. Cambridge University Press, Cambridge, p 413

Tsui CKM, Hyde KD (2004) Biodiversity of fungi on submerged wood in a stream and estuaries in the Tai Ho Bay, Hong Kong. Fungal Divers 15:171–186

Ulken A (1972) Physiological studies on a phycomyceten from a mangrove at Cananeia, Sao Paulo, Brazil. Veroff. Inst. Meeresforsch. Bremerhaven 13:217–230

Ulken A (1978) Growth experiments with different isolates of *Phlyctochytrium mangrovis* (Phycomycetes). Veröffentlichen Institut Meeresforschung Bremerhaven 17:21–31

Ulken A (1981) The phycomycetes flora of mangrove swamps in the South Pasific. Verroff. Inst. Meeresfoasch. Bremerh 19:45–59

Ulken A (1983) Distribution of Phycomycetes in mangrove swamps with brackish waters and wates of high salinity, Chapter 8. In: Teas HJ (ed) Biology and ecology of mangroves tasks for vegetations science, vol 8. Springer, Amsterdam, pp 111–116

Ulken A (1986) Estimation of Thraustochytrid propagules in two mangrove swamps. Bot Mar 29:85–89

Vanegas J, Munoz-García A, Pérez-Parra KA, Figueroa-Galvis I, Mestanza O, Polanía J (2019) Effect of salinity on fungal diversity in the rhizosphere of the halophyte *Avicennia germinans* from a semi-arid mangrove. Fungal Ecol 42:1–9

Velmurugan N, Lee YS (2012) Enzymes from marine fungi: current research and future prospects. In: Jones EBG, Pang KL (eds) Marine fungi and fungal-like organisms. De Gryter, Berlin, pp 441–474

Vrijmoed LLP, Hyde KD, Jones EBG (1994a) Observations on mangrove fungi from Macau and Hong Kong, with the description of two new ascomycetes: *Diaporthe salsuginosa* and *Aniptodera haispora*. Mycol Res 98:699–704

Vrijmoed LLP, Jones EBG, Hyde KD (1994b) Observations on subtropical mangrove fungi in the Pearl River Estuary. Acta Scientiarum Naturalium Universitalis Sunyatseni 33:78–85

Vrijmoed LLP, Jones EBG, Alias SA (1996) Preliminary observations on marine and mangrove fungi from Hainan island in Southern China. Asian J Trop Biol 2:31–38

Weber RWS (2006) On the ecology of fungal consortia of spring sapflows. Mycologist 20:140–143

Wijayawardene NN, Hyde KD, Rajeshkumar KC, Hawksworth DL, Madrid H, Kirk PM, Braun U, Singh RV, Crous PW, Kukwa M, Lucking RL, Kurtzman CP, Yurkov A, Haelewaters D, Aptroot A, Lumbsch T, Timdal E, Ertz D, Etayo J, Phillips AJL, Groenewald JZ, Papizadeh M, Selbmann L, Dayarathne MC, Weerakoon G, Jones EBG, Suetrong S, Tian Q, Castaneda-Ruiz RF, Bahkali AH, Pang KL, Tanaka K, Dai DQ, Sakayaroj J, Hujslova M, Lombard L, Shenoy BD, Suija A, Maharachchikumbura SSN, Thambugala KM, Wanasinghe DN, Sharma BO, Gaikwad S, Pandit G, Zucconi L, Onofri S, Egidi E, Raja HA, Kodsueb R, Caceres MES, Perez-Ortega S, Fiuza PO, Monteiro JS, Vasilyev LN, Shivas RG, Prieto M, Wedin M, Olariaga I, Lateef AA, Agrawal Y, Fazeli SAS, Amoozegar MA, Zhao GZ, Pfliegler WP, Sharma G, Oset M, Abdel-Wahab MA, Takamatsu S, Bensch K, de Silva NI, De Kesel A, Karunarathna A, Boonmee S, Pfister DH, Lu YZ, Luo ZL, Boonyuen N, Daranagama DA, Senanayake IC, Jayasiri SC, Samarakoon MC, Zeng XY, Doilom M, Quijada L, Rampadarath S, Heredia G, Dissanayake AJ, Jayawardana RS, Perera RH, Tang LZ, Phukhamsakda C, Hernandez-Restrepo M, Ma X, Tibpromma S, Gusmao LFP, Weerahewa D (2017) Notes for genera: Ascomycota. Fungal Divers 86:1–594

Wijayawardene NN, Hyde KD, Lumbsch T, Liu JK, Maharachchikumbura SSN, Ekanayaka AH, Tian Q, Phookamsak R (2018) Outline of Ascomycota—2017. Fungal Divers 88:167–263

Wijayawardene NN, Hyde KD, Al-Ani LKT, Tedersoo L, Haelewaters D, Rajeshkumar KC, Zhao RL, Aptroot A, Leontyev DV, Saxena RK, Tokarev YS, Dai DQ, Letcher PM, Stephnson SL, Ertz D, Lumbsch HT, Kukwa M, Issi IV, Madrid H, Phillips AJL, Slebmann L, Pfliegler WP, Horváth E, Bensch K, Kirk PM, Kolaříková K, Raja HA, Radek R, Papp V, Dima V, Ma J, Malosso E, Takamatsu S, Rambold G, Gannibal PB, Triebel D, Gautam AK, Avasthi S, Suetrong S, Timdal E, Fryar SC, Delgado G, Réblová M, Doilom M, Dolatabadi S, Pawłowska JZ, Humber RA, Kodsueb R, Sánchez-Castro I, Goto BT, Silva DKA, de Souza FA, Oehl F, da Silva GA, Silva IR, Błaszkowski J, Jobim K, Maia LC, Barbosa FR, Fiuza PO, Divakar PK, Shenoy BD, Castañeda-Ruiz RF, Somrithipol S, Lateef AA, Karunarathna SC, Tibpromma S, Mortimer PE, Wanasinghe DN, Phookamsak R, Xu J, Wang Y, Tian F, Alvarado P, Li DW, Kušan I, Matočec N, Mešić A, Tkalčec Z, Maharachchikumbura SSN, Papizadeh M, Heredia G, Wartchow F, Bakhshi M, Boehm E, Youssef N, Hustad VP, Lawrey JD, Santiago ALCMA, Bezerra JDP, Souza-Motta CM, Firmino AL, Tian Q, Houbraken J, Hongsanan S, Tanaka K, Dissanayake AJ, Monteiro JS, Grossart HP, Suija A, Weerakoon G, Etayo J, Tsurykau A, Vázquez V, Mungai P, Damm U, Li QR, Zhang H, Boonmee S, Lu YZ, Becerra AG, Kendrick B, Brearley FQ, Motiejūnaitė J, Sharma B, Khare R, Gaikwad S, Wijesundara DSA, Tang LZ, He MQ, Flakus A, Rodriguez-Flakus P, Zhurbenko MP, McKenzie EHC, Stadler M, Bhat DJ, Liu JK, Raza M, Jeewon R, Nassonova ES, Prieto M, Jayalal RGU, Erdoğdu M, Yurkov A, Schnittler M, Shchepin ON, Novozhilov YK, Silva-Filho AGS, Gentekaki E, Liu P, Cavender JC, Kang Y, Mohammad S, Zhang LF, Xu RF, Li YM, Dayarathne MC, Ekanayaka AH, Wen TC, Deng CY, Pereira OL, Navathe S, Hawksworth DL, Fan XL, Dissanayaka LS, Kuhnert E, Grossart HP, Thines M (2020) Outline of Fungi and fungus-like taxa. Mycosphere 11:1060–1456

Xu J (2015) Bioactive natural products derived from mangrove-associated microbes. RSC Adv 5(2):841–892

Xu Z, Wu X, Feng Li G, Xu Z (2019) Pestalotiopisorin B, a new isocoumarin derivative from the mangrove endophytic fungus *Pestalotiopsis* sp. HHL101. Nat Prod Res 34(7):1002–1007

Zhang N, Castlebury LA, Miller AN, Huhndorf SM, Schoch CL, Seifert KA, Rossman AY, Rogers JD, Kohlmeyer J, Volkmann-Kohlmeyer B, Sung GH (2006) An overview of the systematics of the Sordariomycetes based on four-gene phylogeny. Mycologia 98:1077–1088

Zhang SN, Hyde KD, Jones EBG, Cheewangkoon R, Liu JK (2018) *Acuminatispora palmarum* gen. et sp. nov. from mangrove habitats. Mycol Prog 17:1–16

Zhang SN, Hyde KD, Jones EBG, Jeewon J, Cheewangkoon R, Li JK (2019) Striatiguttulaceae, a new pleosporalean family to accommodate *Longicorpus* and *Striatiguttula* gen. nov. from palms. MycoKeys 49:99–129