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A Checklist of Marine Fungi from Kerala State, India

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Abstract: The paper deals with the data on 115 higher marine fungi on drift wood, intertidal wood, sand buried wood and mangrove wood so far recorded along Kerala coast. The checklist is based on the present study and published literature.

Key words: Marine fungi, Ascomycotina, Basidiomycotina, Deuteromycotina, Woody substrate

INTRODUCTION

Kerala state with a coastline of 560km has an average width of about 60km, between the sea and the slopes of Western Ghats. The major length of its coastline is characterized by a narrow longitudinal strip of coastal zone formed of alluvial deposits between the Arabian Sea and a chain of back water and estuaries with connection to the sea at certain points. The entire estuarine system of the Kerala coast is exposed to tide from the sea and hence the water is brackish almost throughout the year. Moreover, salinity in these estuaries may be less than 0.5 $^{0}/_{00}$ or greater than 20 $^{0}/_{00}$ in one annual. There are 44 rivers of which 41 flow westerly from Western Ghats to the Arabian Sea and 3 flows towards east [1]. The state has a humid tropical climate with an average annual rainfall of 300cm. Dead organic matter in these coastal ecosystems provides hostile for a large number of organisms like bacteria, fungi. Marine fungi are one such important microbiota in the transfer of nutrients from organic matter to the higher tropics levels in the sea [2].

Marine fungi are an ecological rather than a taxonomic group and are those able to grow and sporulate exclusively in marine habitats [3]. They occur on a variety of substrata in coastal and oceanic waters. They occur over a wide range of salinities from brackish water mangroves (5-10 $^{0}/_{00}$) to estuaries and oceanic waters (33 $^{0}/_{00}$) [4]. The marine mycota is represented by lower fungi (Haplomastigomycotina and Diplomastigomycotina) and higher fungi (Ascomycotina, Basidiomycotina and Deuteromycotina) [5]. Hyde *et al.* [6] listed 444 higher marine fungi. This young branch of biology is gaining importance not only due to taxonomic and ecological perspective but also for unique metabolites, biochemicals and enzymes from the sea.

Becker and Kohlmeyer [7] initiated the study of marine fungi from Indian peninsula by reporting the occurrence of *Antennospora quadricornuta* at the coast of Kerala and Tamil Nadu. This report stimulated further studies at different coastal region of India. Sridhar and Prasannarai [5] provided a review of 89 species from Indian Peninsula. Most of the taxonomic and ecological studies of these fungi from India were from Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu, West Bengal and Andhra Pradesh [8-15]. From Kerala researchers have made occasional collections of marine fungi [16-20]. However, these data have not been gathered together so as to comment on the biodiversity of marine fungi in Kerala, hence this paper.

MATERIALS AND METHODS

Wood materials including decaying driftwood, intertidal wood, sand buried wood, mangrove wood were collected in sterile polythene bags during low tides from various localities along the coast of Kerala during May 2005-May 2007. The collection sites include beaches (Muzhapilangad, Meenkunnu and Kasargod), estuary (Kadalundi), harbour (Azeekal and Thalayil), mangrove forest (Dharmadam and Valapatanam) and backwater system (Kavvai). Each wood samples, mostly range in size 3-12 x 1-1$^{1}/_{2}$cm, was screened for the presence of fungal structures within a week of sampling. Later, each wood was incubated separately in sterile polythene bags at

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room temperature. These wood samples were periodically screened for six months. Identifications of marine fungi were done using taxonomic keys by many researchers [21-25]. The marine fungi obtained in the present study along with a data regarding the diversity of marine fungi isolated from various substrates by the previous workers are also discussed.

RESULTS AND DISCUSSION

In the present study, a total of 52 marine fungal species were obtained. This includes 39 Ascomycotina, 2 Basidiomycotina and 11 Duteromycotina. Table No. 1 shows the overall trend of marine fungal diversity in various substrates in Kerala coastal water bodies. Forty nine years of investigation on marine fungi in Kerala revealed the occurrence of 115 species belonging to 83 Ascomycetes, 2 Basidiomycetes and 30 Deuteromycetes. Raveendran and Manimohan [25] reported maximum marine fungi from Kerala i.e. 72 followed by Gayatri and Raveendran [19-21] and present study i.e. 65 species. While Sridhar and Prasannarai [5] isolated 45 taxa, Prasannarai and Sridhar [11] reported 32 taxa and Gayatri *et al.* [13] obtained 30 species. Kohlmeyer [22] and Kholmeyer *et al.* [3] isolated one species of marine fungi being *Antennospora quadricornuta* and *Corollospora pulchella* respectively.

The latest estimate obligate marine fungi are about 800 species. Table no. 1 shows the name of 115 species isolated so far from Kerala coast i.e. 14.38 % of global estimate. Hence, Kerala coast provides a unique opportunity for mycologist to explore fungal diversity and exploit their ecological, medicinal and industrial potential. However, these fungi, which are considered as backbone of coastal ecosystem, are threatened in a serious manner by the anthropogenic activities of human in the costal zone of Kerala (Gayatri and Raveendran, 2008 c). Hence, an immediate requirement of baseline data on the mycoflora of healthy and polluted coastal wetlands of Kerala is the need of time.

Table 1: List of Marine fungi from Kerala

Name of fungi	Woody Substrate	Reference
Ascomycotina		
Aigialus grandis Kohlm and Schatz	MW	1, 9
A. mangrovei Borse	INT, MW	PS, 1, 6, 7, 8, 9, 10
A. parvus Schatz and Kohlm	DRW, INT, MW	PS, 1, 9, 10
Aniptodera chesapeakensis Shearer and Miller	DRW, INT, MW	PS, 1, 2, 3, 6, 7, 8, 9, 10
A. haispora Vrijmoed, Hyde and Jones	INT, MW	1
A. indica	MW	3
A. longispora Hyde	MW	1,2,7
A. mangrovei Hyde	MW	PS, 1, 2, 3, 7, 8, 10
A. saluginosa Nakagiri	INT, MW	PS, 1, 7, 8, 9
Aniptodera sp. I	INT, MW	1
Aniptodera sp. II	INT, MW	1
Aniptodera sp. III	MW	3
Antennospora quadricornula (Cribb and Cribb) Johnson	DRW, INT, MW	PS, 1, 2, 4, 7, 8
A. salina (Meyers) Yusoff, Jones and Moss	DRW, IN, SBW	1, 2, 7, 8
Arenariomyces majusculus Kohlm and V. Kohlm	DRW, SBW	PS, 1, 7, 8
A. parvulus Koch	DRW, SBW	PS, 1, 7
A. trifurcates Hohnk	DRW, INT, SBW	PS, 1, 2, 7, 8
Ascocratera manglicola Kohlm	MW	PS, 1
Bathyascus tropicalis Kohlm	INW, MW	PS, 1, 7
Biatriospora marina Hydle and Borse	DRW,INW,SBW	PS, 1, 2, 7
Carbosporella rhizophorae Kohlm	SBW	PS, 2
Ceriosporopsis capilaceae Kohlm	SBW	PS, 2
C. halima Linder	DRW, SBW	PS, 1, 2, 7, 8
C. sundica Koch and Jones	SBW	6
Crinigera maritima Schmidt	?	2
Corollospora angusta Nakagiri andTokura	SBW	PS, 2, 6, 7, 8
C. colossa Nakagiri *et* Tokura	SBW	PS, 2, 7, 8
C. filiformis Nakagiri	DRW, SBW	PS, 1, 2, 7, 8
C. intermedia Schmidt	SBW	PS, 2
C. maritima Werdermann	SBW	PS, 2, 3, 7
C. psuedopulchella Nakagiri andTokura	SBW	PS, 1, 7, 8
C. pulchella Kohlm. Schmidt and Nair	SBW	PS, 3, 5, 7, 8
C. quinqueseptata Nakagiri	SBW	2
Corollospora sp.	?	2

Table 1: Continued

Dactylospora haliotrepha (Kohlm and Kohlm) Hafellner	INW, MW	PS,1,2,3,6,7,8,9,10
Dryosphaera tropicalis Kohlm. V. Kohlm	INW	PS, 1, 7, 8
Eutypa bathurstensis Hyde and Rappaz	?	3
Halorosellina oceanica Whalley, Jones	DRW,INW,MW	PS,1, 2, 3, 7, 8, 10
Halosarpheia abonnis Kohlm	INW, MW	PS, 1, 3, 7, 9
H. cincinnatuala Shearer *et* Crane	?	3
H. fibrosa Kohlm and Kohlm	?	3
H. hamata (Hohnk) Kohlm	INW, MW	1
H. marina (Cribb and Cribb) Kohlm	INW, MW	PS, 1, 2, 3, 6, 7, 8,10
H. minuta Leong	DRW, INW, MW	PS, 1, 7, 8, 10
H. ratnagiriensis Patil and Borse	INW, MW	PS, 1, 3, 9
H. retorquens Shearer and Crane	INW, MW	PS, 1, 3, 7
H. viscosa (Schm.) Shearer and Crane ex Kohlm and V. Kohlm	INW, MW	1, 9
Halosphaeria cucullata (Kohlm) Kohlm	DRW, INW, SBI	1
Hisalina (Meyers) Kohlm	?	2
Hypoxylon sp.	?	3
Kallichroma tethys (Kohlm and Kohlm) Kohlm and V. Kohlm	MW	PS, 3
Koralionastes sp.	INW	1
Lautospora gigantean Hyde *et* Jones	?	3
Leptosphaeria australiensis (Cribb and Cribb) Hyghes	DRW, INW, MW	1, 3, 7, 9, 10
Lignincola laevis Hohnk	INW, MW	PS, 1, 3, 7, 8, 10
L. lonirostris (Cribb and Cribb) Kohlm	INW, MW, SBW	PS, 1, 3, 6, 7, 8, 9
L. tropica Kohlm	DRW,INW,MW	1, 3, 9
Lindra hawaiiensis Schmidt	INW,MW	1
Lineolata rhizophorae (Kohlm *et* Kohlm) Kohlm *et* V. Kohlm	?	2
Lophiostoma mangrovei Kohlm and Vittal	?	3
Lulworthia grandispora Meyers	INW, MW	PS, 1, 3, 6,7, 8, 9,10
L. kniepii Kohlm	?	3
Lulworthia sp. I	INW, MW	1, 10
Lulworthia sp. II	INW, MW	1, 10
Lulworthia sp. III	DRW, INW	1
Lulworthia sp. IV	?	1
Manglicola sp	MW	1
Marinosphaera mangrovei Hyde	INW, MW	PS, 1, 6, 7, 8, 9,10
Nimbospora bipolaris Hyde *et* Jones	INW	PS, 2
Ocastaspora apilongissima	MW	1
Passeriniella mangrovei Maria *et* Sridhar	?	3
Payosphaeria minuta	INW, MW	1, 7
Pleospora pelagica Johnson	MW	1, 7, 9
Rhizophila marina Hyde and Jones	?	3
Salsuginea ramicola Hyde	MW, INW	PS, 1, 6, 8, 9
Savoryella lignicola Jones and Faton	DRW, INW, MW	PS, 1, 3, 6, 7, 8, 9,10
S. paucispora (Cribb and Cribb) Koch	DRW,INW,MW	PS, 1, 3, 6,7,8,9,10
Savoryella sp.I	INW, MW	1
Savoryella sp.II	INW	1
Torpidospora radiata Meyers	?	2, 3
Tirispora sp	?	3
Verruculina enalia (Kohlm.) Kohlm. and V. Kohlm	DRW, INW, MW	PS, 1, 3, 6, 7, 8, 9,10
Zopfiella latipes (Lundqvist) Malloch and Cain	MW	PS, 7, 8
Basidiomycotina		
Halocyphina villosa Kohlm and Kohlm	INW, MW	PS, 1, 3, 6, 7, 8, 9,10
Nia vibrissa Moore and Mayers	INW, SBW	PS, 2, 6, 7, 8
Dueteromycotina		
Anguillospora sp.	MW, INW	1
Ascochyta sp.	INW, MW	1,9
Cirrenalia basiminuta Raghukumar and Zainal	INW, MW	1
C. fusca Kohlm and Kohlm	INW, MW	1
C. macrocephala (Kohlm.) Meyers	DRW, INW, MW	1, 7, 9
C. pygmea Kohlm	DRW, INW, MW	PS, 1, 7, 8, 9,10
C. tropicalis Kohlm	MW	PS, 3, 6
Cladosporium algarum Cooke *et* Massee	?	3
Cladosporium sp.	MW	1, 8
Cytospora rhizophorae Kohlm and Kohlm	?	3
*Clavatospora bulbosa (*Anast.) Nakagiri and Tubaki	SBW,MW,INW	PS, 2, 6, 7, 8, 9
Cumilospora marina Schmidt	INW,MW	PS, 7, 9

Table 1: Continued

Dendryphiella salina (Sutherland)Pugh and Nicot	INW, MW	1, 7, 8, 9
Dictysporium pelagicum	MW	PS, 2
Perinconia prolifica Anastasiou	DRW,INW,MW	PS, 2, 3, 7,8,9,10
Phoeoisaria clematides (Fuckel) Hughes	?	3
Phialophora sp.	?	3
Phialophorophoma litoralis	INW,MW	1
Phoma sp. I	INW,MW	1, 7, 9
Phoma sp.II	?	2
Phomopsis sp.	INW	1
Tetraploa aristata Berk *et* Br.	SBW, INW	PS, 3, 7
Trichocladium achrasporum (Meyers (Moore) Dixon	INW, MW	PS, 2, 3, 6, 7, 8, 9
T. alopallonellum (Meyer and Moore) Kohlm and V. Kohlm	DRW, INW,MW	PS, 1,2,6,7,8,9,10
T. linderi Crane *et* Shearer	?	3
T. constrictum Schmidt	SBW	1
Trichocladium sp.	INW, MW	1, 8
Zalerion maritimum (Linder) Anastasiou	DRW,INW,MW	PS, 1, 2, 3, 7, 8
Z. varium Anastasiou	DRW,INW,MW	PS, 1,2,3,6,7,8,10
Zalerion sp.	MW	1

Where SBW-Sand buried wood; DRW-drift wood; INW-intertidal wood; MW-mangrove wood; ?-not mentioned; PS-present study; [1] Raveendran and Manimohan (2007); [2] Prasannarai and Sridhar (2001); [3] Maria and Sridhar (2002); [4] Becker and Kohlmeyer (1958); [5] Kohlmeyer *et al.* (1967); [6] Gayatri and Raveendran (2009); [7] Gayatri and Raveendran (2008 a); Gayatri and Raveendran (2007); Gayatri *et al.* (2008); Gayatri and Raveendran (2008 b), * Unidentified species reported by these authors were not included in the list

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REFERENCES

1. Nair, N.B., Tresa, V. Fernandez, M. Salim and M. Balakrishnan, 1987. Ecobiology of estuarine boring organisms along the south west coast of India, In: Proceedings of the National Seminar on Estuarine Management, Trivandrum, pp: 492-500.
2. Hyde, K.D. and S.Y. Lee, 1995. Ecology of mangrove fungi and their role in nutrient cycle. What gaps occur in our knowledge? Hydrobiol., 295: 107-118.
3. Kohlmeyer, J., I. Schmidt and Nair, 1967. Eine neue *Corollospora* (Ascomycetes) under Indischen ocean under ostie. Ber. Dtsch. Bot. Ges., 80: 98-102.
4. Jones, E.B.G., 2000. Marine fungi: some factors influencing biodiversity. Fungal Diversity, 4: 53-73.
5. Sridhar. K.R. and K. Prasannarai, 2001. Biogeography and Biodiversity of Higher marine fungi in Tropics-A Review, Ecol. Env. and Cons., 7: 219-234.
6. Hyde, K.D., V.V. Sarma and E.B.G. Jones, 2000. Morphology and taxonomy of higher marine fungi. In: ***Marine Mycology-A*** Practical Approach edited by Hyde. K.D and Pointing, S.B (Fungal Diversity Research Series), pp: 172-204.
7. Becker, G. and J. Kohlmeyer, 1958. Deterioration of wood by marine fungi and its special significance for fishing crafts, Journal of the Timber Dryers and Preserver's Association of India, 4: 1-10
8. Borse, B.D., D.J. Kelkar and A.C. Patil, 2000. Frequency of occurrence of marine fungi from Pirotan island (Gujarat), India, Geiobios, 27: 145-148.
9. Patil, S.D. and B.D. Borse, 1983. Marine fungi from Maharashtra (India)-II. Some arenicolous fungi, Indian bot. Rept., 2: 83-87.
10. Borse, B.D., S.N. Nandan and D.N. Shinde, 1999. Higher marine fungi from Goa coast (India) ***BRI's JAST*** 2: 52-55.
11. Prasannarai, K. and K.R. Sridhar, 1993. Marine fungi from decaying wood from Mangalore coast. Mahasagar, 24: 33-38.
12. Ravikumar, D.R. and B.P.R. Vittal, 1996. Fungal diversity on decomposing biomass of mangrove plant *Rhizophora* in Pichavaram estuary, east coast of India. Indian J. Mar. Sci., 25: 142-146.
13. Gayatri, R. Nambiar, K. Raveendran, Zho Chanxing and C.A. Jaleel, 2008b. A glimpse of lignicolous marine fungi occurring in costal water bodies of Tamil Nadu (India). C.R. Biologies, 331: 475-480.
14. Borse, B.D. and N.S. Pawar, 2001. *Carbosphaerella* and *Dryosphaera*-Two New Generic records of marine ascomycetes from West Bengal (India), Geiobios, 28: 117-120.

15. Sarma, V.V. and B.P.R. Vittal, 2001. Biodiversity of manglicolous fungi on selected plants in the Godavari and Krishna delta east coast of India, Fungal Diversity, 6: 115-130.
16. Borse, B.D., 2000. Marine fungi from Maharashtra (India) V-A checklist. J. Phytol. Res., 13: 123-128.
17. Gayatri, R. Nambiar and K. Raveendran, 2007. Estuarine marine mycoflora of North Malabar (Kerala). J. Mar. Atmos. Res., 3: 29-31.
18. Gayatri, R., Nambiar and K. Raveendran, 2008a. Marine and manglicolous fungal diversity in the coastal wetland of Kerala. Seaweed Res. Utlin., 30: 107-111.
19. Gayatri, R., Nambiar and K. Raveendran, 2008b. Impact of coir retting on manglicolous marine fungi of Kerala coastal waters. Poll. Res., 27: 481-483.
20. Gayatri, R. Nambiar and K. Raveendran, 2009. Lignicolous marine fungi in selected wetland of North Malabar (Kerala) In: A compendium on Wetland Biodiversity and Conservation (eds S. Bijoy Nandan, M. Salim, G.S. Pillai and Reeny Varghese) pp: 136-140.
21. Gayatri, R. Nambiar, C.A. Jaleel and K.A Raveendran, 2008a. comparative account of back water and brackish water marine mycoflora of North Malabar (Kerala) India. C.R. Biologies, 331: 294-297.
22. Kohlmeyer, J. and E Kohlmeyer, 1979. ***Marine Mycology-The Higher Fungi.*** *(*Academic Press, New York).
23. Maria, G.L. and K.R. Sridhar, 2002. Richness and diversity of filamentous fungi on wood litter of mangroves along with west coast of India. Curr. Sci., 12: 1573-1583.
24. Prasannarai, K. and K.R. Sridhar, 2001. Diversity and abundance of higher marine fungi on wood substrates along the west coast of India. Curr. Sci., 81: 304-311.
25. Raveendran, K. and P. Manimohan, 2007. Marine fungi of Kerala-A preliminary floristic and ecological study (Malabar Natural History Society, Calicut, Kerala).