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Fungi Diversity in Different Coastal Marine Ecosystem along South East Coast of India

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Abstract: Fungi are major decomposers of woody and herbaceous substrata entering marine ecosystems. In the present study, 39 species of fungi were isolated. The Pazhaiyar (S1) were represented by 21 species followed by Poombugar (S2) by 19 species, Karaikal (S3) by21 species and Nagapattinam (S4) by 22 species and Velankanni (S5) represented by 20 species. The maximum fungi species diversity was recorded from Nagapattinam (S4) and minimum in Poombugar (S2). Therefore it could be concluded that there is no uniformity in the diversity of marine fungi and their distribution pattern in different geographical regions. The factors which affecting the distribution of fungi were discussed in this manuscript.

Key words: Biodiversity · Ecological distribution · Habitats · Salinity · Temperature

INTRODUCTION

Marine fungi are an ecological rather than a taxonomic group and comprise a predictable 1500 species, excluding those that from lichens. Marine fungi are major decomposers of woody and herbaceous substrates in marine ecosystems. These fungi grow on a wide variety of substrata ranging from wood to sediments, mud's, soils, sand, algae and corals, calcareous tubes of mollusks, decaying leaves of mangroves, intertidal grasses and living animals, to those growing in the guts of crustaceans [1-2]. The distribution of fungi in the marine environment has not been well studied as compared with the studies on the fungi in freshwater and terrestrial ecosystems. They are poorly represented in the sea since the marine fungi account for only 5% of the total fungal flora. Although fungi occur widely in marine environment on dead organic matter and as parasites of living organisms still their distribution has not fully evaluated. So, in the present study fungal distribution was documented from Nagapattinam and Karaikal district, Tamilnadu and Puducherry, respectively.

MATERIALS AND METHODS

The study was conducted during September-2007 to August-2008.The fungi was collected from five different stations of south east coast of India. The water samples were collected from Pazhaiyar (Ss1), Poombugar (Ss2), Karaikal (Ss3), Nagapattinam beach (Ss4) and Velankanni (Ss5) located on the southern east coast of the Peninsular India. Totally, 250 ml of water sample were collected in each station in sterilized glass container and then transferred to sterilized polythene bags and properly sealed. Similar to water sampling, soil sediment were also collected in each sampling station once in a month for the entire study periods. The sediment samples were collected manually by wearing hand gloves then transferred to sterile polythene bags and sealed properly. After sampling within 24 hours, the water sample from each station was subjected to appropriate dilution (10^{-2} - 10^{-5}) and transferred 0.1 ml of sample aseptically into the agar containing plates like Potato dextrose agar, (Zapak - fox agar) corn meal agar / rose Bengal agar (hi-media) with addition of mixtured antibiotics the tetracycline and penicillin (spread plate method). The semi permanent

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studies for the fungi isolated were prepared using lacto phenol cotton blue staining method [3] and sealed with DPX mountain spare and time. The identification of the fungi taxa followed as the standard books of Hyphomycetes [1-4] Dematiaceous hyphomycetes and more dematiaceous hyphomucetes [5,6].

RESULTS

Totally, 39 species of fungi were isolated by plating techniques, identified and enumerated. Among 39 species isolated the Hyphomycetes were represented by 31 species, Zygomycetes 4, Pyrenomycetes 1, Coelomycetes 1 and Hemiascomycetes 1 species.

DISCUSSION

Among 39 species of fungi isolated, the Pazhaiyar (S1) were represented by 21 species followed by Poombugar (S2) by 19 species, Karaikal (S3) by21 species and Nagapattinam (S4) by 22 species and Velankanni (S5) represented by 20 species. From these, it was evident that maximum fungi diversity were in Nagapattinam (S4) and minimum in Pombugar (S2) (Table 2).

Besides the above, maximum number of species diversity was encounted with the fungal species belonging to the class Hyphomycetes (11 genera and 32 species) followed by Zygomycetes (2 genera and 4 species), Pyrenomycetes (1 genus and 1 species), Plectomycetes (1 genus and 1 species), Hemiascomycetes (1 genus and 1 species) and Coelomycetes (1genus and 2 species) (Table 1). Among the species isolated from Hyphomycets, Aspergilli and Penicillia were seems to be the predominant genera with 15 and 4 species respectively [7] estimated that there are 269 species of higher marine fungi from mangroves, while [8] listed 280 fungi (198 Ascomycetes, 78 Mitosporic and 4 Basidiomycetes) worldwide.

The fungi isolated during the present study was during summer 18, post monsoon 21, monsoon 25 and pre- monsoon 17 species for all sampling stations, respectively. Among 39 species, only 25 are common to both seasons whereas, only 5 species are isolated exclusively during summer and 9 species were isolated exclusively in monsoon, 5 species in post monsoon and 6 species in pre-monsoon. The physico-chemical parameters recorded during the present study was not adversely affected the distribution of fungi in the coastal waters. Salinity and temperature are the major factors affecting the diversity of marine fungi as is well illustrated by the data of [9]. The ocean of the world is varied greatly in intertidal amplitude and salinity of the waters, all features that can dramatically affect fungal biodiversity.

The species richness and diversity of fungi at five sampling stations were determined using Shannon and Simpson indices. Both Shannon and Simpson indices were highest at two stations i.e. S3 (3.075 and 0.9527) and S4 (3.044 and 0.9525). The Shannon evenness was highest at S4 and S2 (1.000) and least at S1 and S5 (0.9545) (Table 3). Species richness and diversity of fungi in all the five sampling stations during the four seasons is in conformity with the studies of Maria and Sridhar [10].

Ecological studies of marine fungi have mainly focused on those sporulating on the incubated substratum. This may lead to an underestimated diversity, because the fungi are present only as mycelium and sporulation may be inhibited by the presence of other fungi [11].The needs for the diversity and development of new classes of antimicrobial compounds are increasing, due to trends in antibiotic resistance among different strains of fungi and other microorganism. Which are causing serious problems in the containment of infectious diseases [12].Improvement of microbial strains for over-production of industrial products has been the hallmark of all commercial fermentation process [13] especially for marine fungi and mangrove fungi, from which the bioactive compounds isolated are often available in minute amounts only. Filamentous fungi, the principle commercial sources of xylanolytic enzymes, have many industrial uses, such as in paper manufacturing, animal feed, bread-making, juice and wine industries and xylitol production [14, 15].

Table 1: Water quality parameters in all the stations.

Parameters	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug
Salinity(ppt)	33.0	32.5	28.5	25.5	31.5	33.0	34.5	35.5	33.5	34.5	32.0	32.5
Temp(0^oC)	28.5	29.5	27.0	27.5	30.5	32.0	31.5	32.5	33	32.5	32.0	31.5
pH	8.0	8.1	8.0	8.2	8.3	8.0	8.1	8.2	7.9	8.1	8.2	7.8
Do(mg/l)	4.1	4.0	4.3	4.5	4.0	4.2	3.8	3.9	3.5	3.7	3.9	3.8

Table 2: Bio- diversity of fungi in all stations during September- 2007 to August- 2008.

S.No	Fungi	SS1	SS2	SS3	SS4	SS5
1	*Mucor sp.*	+	-	+	+	-
2	*Rhizopus rigricans*	-	-	+	-	+
3	*R. oryzae*	-	+	-	+	+
4	*Rhizopus sp*	+	-	-	-	+
5	*Neurospora crassa*	-	+	-	+	-
6	*Emerichella nidulans*	-	-	-	+	+
7	*Sacharamyces sp.*	-	+	+	-	-
8	*Aspergillus clavatus*	-	-		+	-
9	*A. flavus*	+	+	+	+	+
10	*A. funiculosis*	+	-	-	-	-
11	*A. fumigatus*	+	+	+	+	+
12	*A. luchensis*	+	+	+	-	+
13	*A. nidulans*	+	+	+	+	-
14	*A. niger*	+	+	+	+	+
15	*A. ochraceous*	+	+	+	+	+
16	*A. oryzae*	+	+	+	+	+
17	*A. quercinus*	+	+	+	+	-
18	*A. sachari*	-	+	-	-	-
19	*A. sulphureus*	+	+	+	-	+
20	*A. terreus*	+	+	+	+	+
21	*A. terricola*	-	-	-	+	-
22	*Aspergillus sp*	-	--	+	+	+
23	*Pencillium citrinum*	-	-	+	-	+
24	*P. frequentans*	+	-	-	-	-
25	*P. janthinellum*	-	+	-	+	-
26	*Pencillium sp*	+	-	-	+	+
27	*Verticillium sp*	+	-	+	+	-
28	*Alternatia alternata*	-	-	+	-	-
29	*A. brassicola*	+	-	-	-	-
30	*Alternaria sp*	-	-	-	+	-
31	*Cephalosporium sp*	-	-	+	-	-
32	*Cladosporium apicale*	+	+	-	-	-
33	*C. britanicum*	-	-	+	-	+
34	*Cladosporium sp*	+	+	-	+	+
35	*Curvularia lunata*	+	-	+	-	-
36	*Drechslera sp*	+	-	+	+	+
37	*Nigrospora sp*	-	-	+	-	+
38	*Fusarrium sp*	-	+	-	+	+
39	*Ascochyta sp*	-	+	-	-	-
	Total number of fungi	21	19	21	22	20

Those species mentioned about (- Absent) (+ Present).

SS1- Pazhaiyar; SS2 - Poombugar; SS3- Karaikal; SS4- Nagapattinam beach; SS5- Velankanni.

In the present study, it seemed that the field of marine mycology is necessary to investigate diversity of fungi in the oceans before we can understand their ecological significance and their distinct characters. The mycoflora of the oceans has not been studied in enough detail to identify marine-isolated fungi as specific halophiles, salt-adapted species, or non-marine fungi capable of survival in sea water. Large numbers of fungi have been isolated from the sea [16].We do not know if all these fungi grow actively in the sea, or if the isolates simply reflect survival of these fungi in the form of spores. Particular reference is made to the effects of habitats, availability of substrata for colonization, geographical distribution and temperature, salinity, inhibition competition and microhabitats on marine fungal diversity. However, these are only a few of the factors that have an effect on the occurrence and distribution of marine fungi. Others include dissolved organic nutrients, hydrogen ion concentration, osmotic effects, oxygen availability, pollutants, abundance of propagules in the water, ability to impact on to and attach to suitable substrata, hydrostatic pressure, substrate specificity, temperature and tidal amplitude and perhaps even light [9]. Lack of coastal vegetation, higher amount of human activities and also oil pillage from the motorized vessels used for fishing activities as well as washout from the catamaran might be the possible reason for the lower species richness and diversity of these above stations with the noted abiotic factors existing in the coastal environment. The presence in soil of micro-organisms capable of killing non-indigenous fungi by lysing their cell walls is well documented [17].

In conclusion, in the present investigation a number of factors that can affect the diversity of fungi in the marine environment. No single factor can account for the diversity we observe, the marine environment being a complex ecosystem with great variation in many parameters from ocean to ocean, from mangrove to mangrove and from shore to shore and sometimes over a

Table 3: Species richness, diversity and evenness of fungi recorded from five stations.

	Species richness	Diversity indices		
Sampling Stations	Species Recovered	Simpson (D')	Shannon (H'	Shannon Evenness (J')
Pazhayar	21	0.9566	2.9505	0.9545
Poombukar	19	0.9444	2.8904	1.000
Karaikal	21	0.9527	3.0752	0.9945
Nagapattinam	22	0.9524	3.0445	1.000
Velankanni	20	0.9566	0.9566	0.9545
Mean ± S.D	56±3.03	0.041±0.02	13.037±1.123	0.232±0.009

narrow range. Therefore it could be concluded that there is no uniformity in the diversity of marine fungi and their distribution pattern in different geographical regions. Several factors of salinity, origin and nature of substrata, pH and oceanic region affect the occurrence and diversity of marine fungi. They are reliant on the nature of the substrate and temporal regions that favour the colonization, growth and substrate possession of the fungi.

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