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Studies on Soil Mycoflora in Coastal Area of Tuticorin Dt., Tamilnadu, India

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KEYWORDS

Soil Mycoflora, Coastal Area Tuticorin, India, *Aspergillus, Penicillium, Alternaria, Curvularia, Fusarium*

A B S T R A C T

A total of 39 isolates of mycoflora were isolated from soil samples collected from coastal area of Tuticorin Dt., Tamil Nadu, India. The soil mycoflora were isolated by using soil dilution technique. Based on morphological characteristics, fourteen genera of mycoflora were identified namely, *Aspergillus* (17 species), *Penicillium* (7 species), *Alternaria, Curvularia, Fusarium* (2 species each), *Acrophialophora, Botryotrichum, Choanephora, Helminthosporium, Mammaria, Trichocladium, Trichoderma, Trichurus and Verticillium (1 species each)*. The most common species isolated was *A. niger* followed by *P. javanicum, Alternaria humicola, A. sulphureus, Fusarium moniliforme, P. funiculosum, P. nigricans, P. spinulosum, Trichoderma polysporum* and *Trichurus spiralis*. From the present study, it appears that the coastal soils contain a mycoflora reservoir comprising of a variety of genera which contributes significantly to the ecological functioning of a marine ecosystem.

Introduction

In benthic marine environments, marine fungi represent ecologically important group amongst benthic organisms, acting as key intermediates of energy flow from detritus to higher trophic levels in marine ecosystems (Kohlmeyer and Kohlmeyer, 1979; Hyde *et al.*, 2000). The ecological importance of filamentous fungi in marine systems is underestimated; these organisms represent a diverse range of saprobes, pathogens and symbionts forming an integral part of coastal and deep-sea environments (Hyde *et al.*, 1998; Bass *et al.*, 2007).

Marine mycology has grown into a significant mycological subdiscipline during the last century with mycologists reporting the occurrence of marine fungi as early as 1849 (Jones *et al.*, 2009). By 1996, diversity estimates of marine fungi were placed at

around 1500 species, and by 2011, estimates projected the number of possible marine fungi as over 10,000 species (Jones, 2011). Marine fungi are considered important ecological components in marine environments due to their performance in biogeochemical processes (Tedersoo *et al.*, 2014; 2015).

A great diversity of fungi has been reported from along coastlines, such as mangrove, sand, beach and estuarine habitats (Morrison-Gardiner, 2002; Menezes *et al*., 2010; Behera *et al.*, 2012). Marine fungi are classified into obligate and facultative forms: obligate marine fungi are those that grow and sporulate exclusively in a marine or estuarine habitat, and facultative marine fungi are those that also occur in freshwater or terrestrial milieus yet are able to grow in, and frequently are isolated from marine habitats (Kohlmeyer and Kohlmeyer, 1979).

Fungi are particularly diverse and abundant in soils. Most of the studies on soil mycoflora in coastal areas have been conducted by researchers in Greece (Papadakis *et al*., 1997), Italy (Mancini *et al*., 2005), Spain (Larrondo and Calvo, 1989), Egypt (Fatma, 2003), Brazil (Gomes *et al*., 2008), Malaysia (Zakaria *et al*., 2011) and India (Behera *et al*., 2012; Anitha and Nayak, 2014; Ashok *et al.*, 2015). Nevertheless, in India, knowledge on soil fungi in coastal area is still lacking. Therefore, this study was carried out in order to observe the diversity of soil fungi in coastal area of three different locations of Tuticorin Dt.

Materials and Methods

Study Site

Tuticorin Coast is located in the south eastern part of coastal zone of Tamil Nadu State, India. It lies between 8°41’49” N and 9°22’20” N latitudes and 78°3’56” E and 79°26’6” E longitudes.

Collection of Soil Samples

The soil samples were collected seasonally from three different coastal areas such as Palayakayal, Punnakayal and Tuticorin. The soil samples were collected at a depth within 10 cm using a metal spatula. The spatula was sterilized every time with 70 per cent alcohol. At each station 5 to 7 samples were collected randomly and were pooled together. The samples were kept in sterilized polythene bags, sealed and transported to the laboratory.

Isolation of Fungi

The soil mycoflora were isolated by the method of Warcup (1950). Soil sample weighed 1g was diluted in 10 ml of 50% seawater (1:1 v/v seawater (30 ppt): distilled water). One ml of the diluted sample (10^{-2} and 10^{-3}) was poured and spreaded on the petriplates containing sterilized PDA medium (Potato - 200 gms, dextrose -20 gms, agar -15 gms, distilled water -500 ml, sea water - 500ml, pH -6.5) supplemented with one percent streptomycin sulphate solution for preventing bacterial growth in replicates. The inoculated plates were kept in the aseptic conditions at the room temperature (24±2°C) for 3 - 5 days. The colonies growing on PDA plates with different morphology were counted separately. The fungal cultures were then transferred, subcultured and the pure cultures were maintained on PDA medium.

Fungal morphology were studied macroscopically by observing colour and texture and microscopically by staining with lactophenol cotton blue and observed under Nikon phase contrast microscope (Nikon, Japan) for the conidia, conidiophores and arrangement of spores.

Identification

The identification of the fungal taxa was done using the standard manuals of fungi such as A Manual of Penicillia (Raper and Thom, 1949), A Manual of Soil fungi (Gillman, 1957), The genus *Aspergillus* (Raper and Fennell, 1965), Hyphomycetes (Subramanian, 1971), Dematiaceous Hyphomycetes (Ellis, 1971, 1976), Marine Mycology The Higher fungi (Kohlmeyer and Kohlmeyer, 1979) and Compendium of soil fungi (Domsch *et al.*, 1980).

Presentation of Data

Percentage of contribution and percentage of frequency of fungal isolates were calculated by using the following formulas.

$$\% \text{ contribution} = \frac{\text{No. of colonies of fungus in a sample}}{\text{Total number all colonies of all the species in a sample}} \times 100$$

$$\% \text{ frequency} = \frac{\text{Number of samples in which a particular fungus occurred}}{\text{Total number of samples examined}} \times 100$$

Based on the frequency occurrences the fungi were grouped as rare (0-25% frequency), occasional (26-50% frequency), frequent (51-75% frequency) and common (76-100% frequency) species.

Physico-chemical Analysis of Soil

The physico-chemical parameters of collected soil samples were analyzed by APHA method (1989) in Soil Testing Laboratory, Department of Agriculture, Government of Tamil Nadu, Tiruchirappalli-20.

Statistical Analysis

The relationship between the physico-chemical parameters and total fungal colonies was studied by Pearson's correlation method. The data were computed and analyzed using Statistical Package for Social Sciences (SPSS) software.

Results and Discussion

The occurrence of marine fungi has been reported in different substrates such as sponges, algae, wood, tunicates, sediments, mollusks, corals, plants, fish and the ecology and phylogeny of this group were summarized (Jones, 2000; Jones *et al*., 2009 & 2011; Jones and Pang, 2012; Richards *et al*., 2012).

In the present study, a total of 39 marine fungal species were recorded (Table 1). Based on morphological characteristics, fourteen genera of mycoflora were identified namely, *Aspergillus* (17 species), *Penicillium* (7 species), *Alternaria, Curvularia*, *Fusarium* (2 species each), *Acrophialophora, Botryotrichum, Choanephora, Helminthosporium, Mammaria*, *Trichocladium*, *Trichoderma*, *Trichurus and Verticillium (1 species each).* In the same way, Raveendran and Manimohan (2007) reported maximum number of marine fungi (72) from Kerala and Prasannarai and Sridhar (1993) reported 32 taxa from Mangalore coast.

The maximum fungal species were isolated from Punnakayal station followed by Tuticorin and Palayakayal (Table 2-4).

Similarly, the taxonomic and ecological studies of marine fungi from Maharashtra (Patil and Borse, 1983), Karnataka (Prasannarai and Sridhar, 1993), Tamil Nadu (Ravikumar and Vittal, 1996), Goa (Borse *et al*., 1999), Gujarat (Borse *et al*., 2000), West Bengal (Borse and Pawar, 2001) and Andhra Pradesh (Sarma and Vittal, 2001) have been reported in various part of the India.

Table.1 List of Isolated Soil Mycoflora from Coastal Area of Tuticorin dt.
In the Year of 2013 -2014

S. No.	Name of the isolates
1.	*Acrophialophora fusispora*
2.	*Alternaria geophila*
3.	*A. humicola*
4.	*Aspergillus candidus*
5.	*A. conicus*
6.	*A. flavus*
7.	*A. fuscus*
8.	*A .granulosus*
9.	*A. niger*
10.	*A. ochraceus*
11.	*A. parvulus*
12.	*A. phoenicis*
13.	*A. repens*
14.	*A. rugulosus*
15.	*A. sulphureus*
16.	*A. terreus*
17.	*A. terricola*
18.	*A. ellipticus*
19.	*A. thomii*
20.	*A. unguis*
21.	*Botryotrichum atrogriseum*
22.	*Choanephora cucurbitarum*
23.	*Curvularia geniculata*
24.	*Curvularia* sp.
25.	*Helminthosporium oryzae*
26.	*Fusarium moniliforme*
27.	*F. equiseti*
28.	*Mammaria echinobotryoides*
29.	*Penicillium granulatum*
30.	*P. janthinellum*
31.	*P. funiculosum*
32.	*P. javanicum*
33.	*P. nigricans*
34.	*P. rubrum*
35.	*P. spinulosum*
36.	*Trichocladium opacum*
37.	*Trichoderma polysporum*
38.	*Trichurus spiralis*
39.	*Verticillium glaucum*

Table.2 Total Number of Colonies, Mean Density (Cfu/G) and Percentage Contribution of Fungi from Palayakayal in the Year of 2013-2014

S. No.	Name of the organisms	Post monsoon		Summer		Pre monsoon		Monsoon		Total no. of colonies	% of contribution
		TNC	MD	TNC	MD	TNC	MD	TNC	MD		
1	*Aspergillus fuscus*	1	0.33	1	0.33	2	0.67	-	-	4	3.17
2	*A. niger*	1	0.33	4	1.33	4	1.33	4	1.33	13	10.32
3	*A. parvulus*	-	-	4	1.33	2	0.67	-	-	6	4.76
4	*A. repens*	3	1.00	-	-	2	0.67	3	1.00	8	6.35
5	*A. sulphureus*	3	1.00	-	-	3	1.00	3	1.00	9	7.14
6	*Botryotrichum atrogriseum*	-	-	6	2.00	6	2.00	-	-	12	9.52
7	*Choanephora cucurbitarum*	4	1.33	-	-	-	-	-	-	4	3.17
8	*Curvularia geniculata*	-	-	3	1.00	3	1.00	-	-	6	4.76
9	*Fusarium moniliforme*	3	1.00	3	1.00	3	1.00	3	1.00	12	9.52
10	*Fusarium equiseti*	2	0.67	-	-	3	1.00	-	-	5	3.97
11	*Penicillium funiculosum*	3	1.00	-	-	-	-	2	0.67	5	3.97
12	*P. granulatum*	1	0.33	-	-	3	1.00	2	0.67	6	4.76
13	*P. javanicum*	4	1.33	2	0.67	2	0.67	2	0.67	10	7.94
14	*P. janthinellum*	4	1.33	-	-	2	0.67	-	-	6	4.76
15	*P. nigricans*	1	0.33	1	0.33	-	-	4	1.33	6	4.76
16	*P. rubrum*	1	0.33	1	0.33	4	1.33	-	-	6	4.76
17	*P. spinulosum*	-	-	-	-	4	1.33	4	1.33	8	6.35
		31.00	10.33	25.00	8.33	43.00	14.33	27.00	9.00	126.00	100

TNC – Total Number of Colonies; MD – Mean Density

Table.3 Total Number of Colonies, Mean Density (cfu/g) and Percentage Contribution of Fungi from Punnakayal in the Year of 2013-2014

S. No.	Name of the organisms	Post monsoon		Summer		Pre monsoon		Monsoon		Total no. of colonies	% of contribution
		TNC	MD	TNC	MD	TNC	MD	TNC	MD		
1	*Alternaria humicola*	1	0.33	2	0.67	2	0.67	1	0.33	6	4.23
2	*Aspergillus candidus*	-	-	2	0.67	-	-	2	0.67	4	2.82
3	*A. conicus*	4	1.33	-	-	-	-	6	2.00	10	7.04
4	*A .granulosus*	-	-	-	-	3	1.00	1	0.33	4	2.82
5	*A. niger*	4	1.33	4	1.33	4	1.33	1	0.33	13	9.15
6	*A. rugulosus*	3	1.00	-	-	3	1.00	-	-	6	4.23
7	*A. terricola*	-	-	-	-	4	1.33	4	1.33	8	5.63
8	*A. thomii*	2	0.67	-	-	2	0.67	2	0.67	6	4.23
9	*A. unguis*	1	0.33	1	0.33	-	-	3	1.00	5	3.52
10	*Curvularia* sp.	-	-	1	0.33	1	0.33	1	0.33	3	2.11
11	*Helminthosporium oryzae*	4	1.33	-	-	3	1.00	-	-	7	4.93
12	*Mammaria echinobotryoides*	4	1.33	-	-	4	1.33	4	1.33	12	8.45
13	*P. granulatum*	-	-	-	-	1	0.33	4	1.33	5	3.52
14	*Penicillium janthinellum*	-	-	3	1.00	3	1.00	3	1.00	9	6.34
15	*P. javanicum*	4	1.33	-	-	-	-	4	1.33	8	5.63
16	*P .funiculosum*	2	0.67	-	-	2	0.67	2	0.67	6	4.23
17	*P. nigricans*	2	0.67	2	0.67	2	0.67	2	0.67	8	5.63
18	*P. rubrum*	1	0.33	1	0.33	2	0.67	-	-	4	2.82
19	*P. spinulosum*	2	0.67	2	0.67	2	0.67	2	0.67	8	5.63
20	*Trichoderma polysporum*	2	0.67	2	0.67	4	1.33	2	0.67	10	7.04
		36	12	20	6.67	42	14	44	14.67	142	100

TNC – Total Number of Colonies; MD – Mean Density

Table.4 Total Number of Colonies, Mean Density (CFU/g) and Percentage Contribution of Fungi from Tuticorin in the Year of 2013 -2014

S. No.	Name of the organisms	Post monsoon		Summer		Pre monsoon		Monsoon		Total no. of colonies	% of contribution
		TNC	MD	TNC	MD	TNC	MD	TNC	MD		
1	*Acrophialophora fusispora*	-	-	2	0.67	-	-	-	-	2	1.87
2	*Alternaria geophila*	-	-	1	0.33	1	0.33	-	-	2	1.87
3	*Aspergillus ellipticus*	-	-	2	0.67	-	-	2	0.67	4	3.74
4	*A. flavus*	3	1.00	-	-	2	0.67	-	-	5	4.67
5	*A. niger*	1	0.33	4	1.33	1	0.33	1	0.33	7	6.54
6	*A. ochraceus*	2	0.67	-	-	2	0.67	3	1.00	7	6.54
7	*A. phoenicis*	2	0.67	-	-	2	0.67	2	0.67	6	5.61
8	*A. terreus*	1	0.33	-	-	1	0.33	1	0.33	3	2.80
9	*Penicillium funiculosum*	3	1.00	1	0.33	2	0.67	2	0.67	8	7.48
10	*P. granulatum*	4	1.33	-	-	4	1.33	2	0.67	10	9.35
11	*P. janthinellum*	2	0.67	-	-	2	0.67	2	0.67	6	5.61
12	*P. javanicum*	2	0.67	1	0.33	2	0.67	3	1.00	8	7.48
13	*P. nigricans*	-	-	3	1.00	-	-	3	1.00	6	5.61
14	*P. rubrum*	-	-	3	1.00	-	-	4	1.33	7	6.54
15	*P. spinulosum*	1	0.33	1	0.33	2	0.67	-	-	4	3.74
16	*Trichoderma opacum*	4	1.33	-	-	4	1.33	-	-	8	7.48
17	*Trichurus spiralis*	3	1.00	3	1.00	3	1.00	1	0.33	10	9.35
18	*Verticillium glaucum*	-	-	-	-	-	-	4	1.33	4	3.74
		28	9.33	21	7	28	9.33	30	10	107	100

TNC – Total Number of Colonies; MD – Mean Density

Table.5 Percentage Frequency and Frequency Class of Different Species of Fungi Recorded at Three Stations (N=24) in the Year of 2013-2014

S. No.	Name of the organisms	Palayakayal			Punnakayal			Tuticorin		
		No. of season in which the fungus occurred	Percentage frequency	Frequency class	No. of season in which the fungus occurred	Percentage frequency	Frequency class	No. of season in which the fungus occurred	Percentage frequency	Frequency class
1.	*Acrophialophora fusispora*							1	25	R
2.	*Alternaria geophila*							2	50	O
3.	*A. humicola*				4	100	C			
4.	*Aspergillus candidus*				2	50	O			
5.	*A. conicus*				2	50	O			
6.	*A. ellipticus*							2	50	O
7.	*A. flavus*							2	50	O
8.	*A. fuscus*	3	75	F						
9.	*A .granulosus*				2	50	O			
10.	*A. niger*	4	100	C	4	100	C	4	100	C
11.	*A. ochraceus*							3	75	F
12.	*A. parvulus*	2	50	O						
13.	*A. phoenicis*							3	75	F
14.	*A. repens*	3	75	F						
15.	*A. rugulosus*				2	50	O			
16.	*A. sulphureus*	3	75	C						
17.	*A. terreus*							3	75	F
18.	*A. terricola*				2	50	O			
19.	*A. thomii*				3	75	F			
20.	*A. unguis*				3	75	F			
21.	*Botryotrichum atrogriseum*	2	50	O						
22.	*Choanephora cucurbitarum*	1	25	R						
23.	*Curvularia.* sp				3	75	F			

24.	*Curvularia geniculata*	2	50	O						
25.	*Helminthosporium oryzae*				2	50	0			
26.	*Fusarium moniliforme*	4	100	C						
27.	*F. equiseti*	2	50	O						
28.	*Mammaria echinobotryoides*				3	75	F			
29.	*Penicillium granulatum*	3	75	F	2	50	O	3	75	F
30.	*P. janthinellum*	2	50	O	3	75	F	3	75	F
31.	*P. funiculosum*	2	50	O	3	75	F	4	100	C
32.	*P. javanicum*	4	100	C	3	75	F	4	100	C
33	*P. nigricans*	3	75	F	4	100	C	2	50	O
34	*P. rubrum*	3	75	F	3	75	F	2	50	O
35	*P. spinulosum*	2	50	O	4	100	C	2	50	O
36	*Trichocladium opacum*							2	50	O
37	*Trichoderma polysporum*				4	100	C			
38	*Trichurus spiralis*							4	100	C
39	*Verticillium glaucum*							1	25	R

R – Rare (0-25%); O – Occasional (26-50%); F – Frequent (51-75%); C – Common (76-100%)

Table.6 Physico – Chemical Characteristics of the Soil Samples Collected from Palayakayal

S. No.	Name of the parameters	Palayakayal (2013-2014)			
		Post monsoon	Summer	Pre monsoon	Monsoon
1	pH	8.51	8.63	8.22	8.33
2	Salinity	31	33	30	29
3	EC (dsm^{-1})	2.33	2.47	2.39	2.47
4	Organic Carbon (%)	0.34	0.33	0.39	0.40
5	Organic Matter (%)	0.59	0.52	0.61	0.60
6	Available Nitrogen (%)	0.968	0.701	0.833	0.779
7	Available Phosphorus (%)	0.294	0.268	0.213	0.233
8	Available Potassium (%)	0.950	0.991	0.913	0.901
9	Available Zinc (ppm)	0.91	0.95	1.51	1.99
10	Available Copper (ppm)	0.98	0.90	0.70	0.88
11	Available Iron (ppm)	4.99	4.71	4.63	4.73
12	Available Manganese (ppm)	2.15	2.19	2.54	2.58
13	Cat ion exchange capacity (C. Mole $Proton^{+}$ / kg)	21.12	22.6	21.7	22.3
14	Calcium (C. Mole $Proton^{+}$ / kg)	19.1	20.3	17.5	14.6
15	Magnesium (C. Mole $Proton^{+}$ / kg)	8.1	8.6	7.9	8.2
16	Sodium (C. Mole $Proton^{+}$ / kg)	1.99	2.01	1.51	1.63
17	Potassium (C. Mole $Proton^{+}$ / kg)	0.21	0.25	0.24	0.23
	Total fungal colonies	31	25	43	27

Table.7 Physico – Chemical Characteristics of the Soil Samples Collected from Punnakayal

S. No.	Name of the parameters	Punnakayal (2013-2014)			
		Post monsoon	Summer	Pre monsoon	Monsoon
1	pH	8.57	8.63	8.39	8.42
2	Salinity	30	31	30	29
3	EC (dsm^{-1})	1.91	1.99	1.89	1.95
4	Organic Carbon (%)	0.44	0.51	0.64	0.63
5	Organic Matter (%)	0.32	0.31	0.39	0.37
6	Available Nitrogen (%)	0.913	0.859	0.989	0.769
7	Available Phosphorus (%)	0.251	0.261	0.226	0.262
8	Available Potassium (%)	0.852	0.896	0.801	0.788
9	Available Zinc (ppm)	1.33	1.59	1.51	1.71
10	Available Copper (ppm)	0.97	0.82	0.72	0.95
11	Available Iron (ppm)	4.61	4.88	4.67	4.51
12	Available Manganese (ppm)	2.96	2.88	2.99	2.76
13	Cat ion exchange capacity (C. Mole $Proton^{+}$ / kg)	21.7	24.1	25.1	26.1
14	Calcium (C. Mole $Proton^{+}$ / kg)	17.1	19.1	16.5	17.7
15	Magnesium(C. Mole $Proton^{+}$ / kg)	8.2	8.8	8.0	9.0
16	Sodium (C. Mole $Proton^{+}$ / kg)	1.89	1.98	1.33	1.61
17	Potassium (C. Mole $Proton^{+}$ / kg)	0.25	0.29	0.24	0.25
	Total fungal colonies	36	20	42	44

Table.8 Physico – Chemical Characteristics of the Soil Samples Collected from Tuticorin

S. No.	Name of the parameters	Tuticorin (2013-2014)			
		Post monsoon	Summer	Pre monsoon	Monsoon
1	pH	8.46	8.72	8.23	8.32
2	Salinity	32	36	30	31
3	EC (dsm^{-1})	2.43	2.79	2.27	2.15
4	Organic Carbon (%)	0.39	0.27	0.45	0.29
5	Organic Matter (%)	0.52	0.45	0.63	0.71
6	Available Nitrogen (%)	0.894	0.869	0.915	0.745
7	Available Phosphorus (%)	0.257	0.227	0.295	0.256
8	Available Potassium (%)	0.999	0.993	0.818	0.869
9	Available Zinc (ppm)	1.09	1.32	1.65	1.72
10	Available Copper (ppm)	0.62	0.80	0.94	0.63
11	Available Iron (ppm)	4.26	5.01	5.26	4.96
12	Available Manganese (ppm)	3.52	2.62	2.74	1.85
13	Cat ion exchange capacity (C. Mole $Proton^{+}$ / kg)	29.9	26.1	23.9	27.7
14	Calcium(C. Mole $Proton^{+}$ / kg)	15.7	17.6	15.3	15.9
15	Magnesium(C. Mole $Proton^{+}$ / kg)	8.1	8.5	7.9	7.6
16	Sodium(C. Mole $Proton^{+}$ / kg)	1.33	1.44	1.33	1.33
17	Potassium(C. Mole $Proton^{+}$ / kg)	0.23	0.33	0.27	0.24
	Total fungal colonies	28	21	28	30

Table.9 Correlation of Physico – Chemical and Total Number of Colony Characteristics of the Soil Samples of Palayakayal in the Year of 2013 -2014

	PH	SA	EC	OC	OM	AN	AP	AK	AZ	AC	AI	AM	CEC	CA	MG	NA	K	TNC
PH	1																	
SA	0.989*	1																
EC	0.939	0.939	1															
OC	-0.651	-0.687	-0.396	1														
OM	-0.863	-0.822	-0.950*	0.177	1													
AN	0.109	0.075	0.414	0.672	-0.586	1												
AP	-0.906	-0.894	-0.708	0.882	0.590	0.308	1											
AK	0.854	0.766	0.753	-0.426	-0.829	0.174	-0.794	1										
AZ	-0.627	-0.511	-0.631	-0.003	0.822	-0.499	0.458	-0.903	1									
AC	-0.145	-0.048	0.165	0.438	-0.091	0.580	0.459	-0.480	0.341	1								
AI	-0.239	-0.092	-0.103	-0.018	0.335	-0.085	0.293	-0.707	0.803	0.762	1							
AM	0.199	0.087	0.353	0.541	-0.624	0.812	0.086	0.529	-0.840	-0.004	-0.650	1						
CEC	0.228	0.100	-0.015	-0.254	-0.139	-0.280	-0.428	0.645	-0.608	-0.944	-0.932	0.332	1					
CA	0.930	0.971*	0.858	-0.790	-0.675	-0.089	-0.888	0.616	-0.296	-0.002	0.095	-0.148	-0.021	1				
MG	0.875	0.865	0.984*	-0.229	-0.978*	0.566	-0.588	0.732	-0.686	0.239	-0.136	0.491	-0.042	0.755	1			
NA	0.897	0.951*	0.911	-0.629	-0.737	0.116	-0.759	0.540	-0.283	0.229	0.214	-0.061	-0.210	0.969*	0.839	1		
K	0.677	0.768	0.794	-0.402	-0.599	0.252	-0.466	0.225	-0.039	0.572	0.520	-0.133	-0.561	0.820	0.751	0.926	1	
TNC	-0.884	-0.923	-0.966*	0.438	0.848	-0.348	0.656	-0.573	0.409	-0.333	-0.155	-0.152	0.240	-0.897	-0.934	-0.971*	-0.924	1

TFC - Total Fungal Colony, SA - Salinity, EC - Electrical Conductivity, OC - Organic Carbon, OM - Organic Matter, AN - Available Nitrogen, AP - Available Phosphorus, AK - Available Potassium, AZ - Available Zinc, AC - Available Copper, AI - Available Iron, AM - Available Manganese, CEC - Cat ion exchange capacity, CA - Calcium, MG - Magnesium, NA - Sodium, K – Potassium

**** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level**

Table.10 Correlation of Physico – Chemical and Total Number of Colony Characteristics of the Soil Samples of Punnakayal in the Year of 2013 -2014

	PH	SA	EC	OC	OM	AN	AP	AK	AZ	AC	AI	AM	CEC	CA	MG	NA	K	TNC
PH	1																	
SA	0.857	1																
EC	0.106	0.072	1															
OC	-0.922	-0.917	0.209	1														
OM	-0.871	-0.908	-0.456	0.767	1													
AN	-0.172	-0.293	-0.945	-0.054	0.595	1												
AP	0.842	0.590	-0.375	-0.855	-0.473	0.377	1											
AK	0.922	0.989*	0.059	-0.953*	-0.915	-0.244	0.690	1										
AZ	-0.758	-0.857	0.445	0.952*	0.592	-0.241	-0.780	-0.867	1									
AC	0.761	0.339	-0.120	-0.618	-0.387	0.253	0.903	0.473	-0.448	1								
AI	0.454	0.119	-0.649	-0.505	0.042	0.751	0.859	0.234	-0.504	0.826	1							
AM	-0.890	-0.823	0.348	0.981*	0.646	-0.230	-0.929	-0.877	0.949	-0.704	-0.659	1						
CEC	0.223	0.247	0.982*	0.058	-0.594	-0.983*	-0.301	0.223	0.285	-0.112	-0.653	0.216	1					
CA	0.731	0.932	-0.281	-0.922	-0.695	0.027	0.626	0.911	-0.966*	0.273	0.266	-0.870	-0.101	1				
MG	0.836	0.729	0.632	-0.613	-0.943	-0.668	0.436	0.767	-0.362	0.498	-0.029	-0.505	0.720	0.441	1			
NA	0.970*	0.798	-0.130	-0.948	-0.735	0.074	0.945	0.875	-0.831	0.830	0.644	-0.959*	-0.019	0.751	0.680	1		
K	0.040	0.371	0.731	0.028	-0.526	-0.905	-0.492	0.270	0.095	-0.537	-0.869	0.220	0.811	0.160	0.464	-0.181	1	
TNC	-0.856	-0.531	-0.440	0.591	0.749	0.353	-0.660	-0.629	0.318	-0.815	-0.351	0.566	-0.475	-0.279	-0.890	-0.775	-0.032	1

TFC - Total Fungal Colony, SA - Salinity, EC - Electrical Conductivity, OC - Organic Carbon, OM - Organic Matter, AN - Available Nitrogen, AP - Available Phosphorus, AK - Available Potassium, AZ - Available Zinc, AC - Available Copper, AI - Available Iron, AM - Available Manganese, CEC - Cat ion exchange capacity, CA - Calcium, MG - Magnesium, NA - Sodium, K – Potassium

**** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level**

Table.11 Correlation of Physico – Chemical and Total Number of Colony Characteristics of the Soil Samples of Tuticorin in the Year of 2013 -2014

	PH	SA	EC	OC	OM	AN	AP	AK	AZ	AC	AI	AM	CEC	CA	MG	NA	K	TNC
PH	1																	
SA	0.740	1																
EC	0.594	0.368	1															
OC	-0.869	-0.506	-0.179	1														
OM	-0.989*	-0.634	-0.574	0.905	1													
AN	-0.110	0.397	-0.694	-0.071	0.188	1												
AP	0.546	-0.024	0.826	-0.360	-0.613	-0.891	1											
AK	0.965*	0.889	0.569	-0.772	-0.915	0.058	0.377	1										
AZ	-0.333	-0.307	0.561	0.693	0.349	-0.679	0.387	-0.316	1									
AC	0.261	-0.452	0.173	-0.470	-0.401	-0.639	0.697	-0.001	-0.098	1								
AI	0.661	0.967*	0.512	-0.321	-0.543	0.263	0.042	0.830	-0.056	-0.534	1							
AM	0.082	0.477	-0.640	-0.297	-0.019	0.973*	-0.775	0.217	-0.817	-0.491	0.303	1						
CEC	-0.670	-0.433	0.179	0.933	0.702	-0.370	-0.025	-0.600	0.905	-0.342	-0.197	-0.572	1					
CA	0.705	0.513	0.985*	-0.297	-0.674	-0.579	0.779	0.699	0.432	0.122	0.630	-0.504	0.048	1				
MG	0.199	-0.171	0.853	0.116	-0.236	-0.955*	0.878	0.095	0.781	0.418	0.004	-0.947	0.453	0.754	1			
NA	0.954*	0.514	0.663	-0.851	-0.982*	-0.367	0.749	0.849	-0.214	0.515	0.448	-0.164	-0.606	0.736	0.398	1		
K	0.808	0.736	0.898	-0.412	-0.749	-0.326	0.610	0.850	0.231	-0.045	0.815	-0.238	-0.116	0.958*	0.537	0.758	1	
TNC	-0.893	-0.901	-0.712	0.579	0.821	0.035	-0.410	-0.963*	0.071	0.138	-0.911	-0.079	0.362	-0.820	-0.245	-0.773	-0.947	1

TFC - Total Fungal Colony, SA - Salinity, EC - Electrical Conductivity, OC - Organic Carbon, OM - Organic Matter, AN - Available Nitrogen, AP - Available Phosphorus, AK - Available Potassium, AZ - Available Zinc, AC - Available Copper, AI - Available Iron, AM - Available Manganese, CEC - Cat ion exchange capacity, CA - Calcium, MG - Magnesium, NA - Sodium, K – Potassium

**** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.**

The results of the present study demonstrated that the genus *Aspergillus* (17 species) and *Penicillium* (7 species) were dominantly isolated. This is in agreement with the previous finding of Thennarasu *et al*. (2011) and Anitha and Nayak (2014) who reported that *Aspergillus* and *Penicillium* were dominant genera in coastal area of Andaman Islands and Puducherry and Karaikal region.

Percentage frequency and frequency class of different species of fungi were evaluated (Table 5). *A. niger* was commonly isolated from all the three stations. The pH of soil was ranged from 8.22 to 8.72. The major and minor elements were showed variations in the study stations (Table 6-8). The relationship between various physico-chemical parameters of soil and total fungal colonies were statistically analyzed (9-11).

Many factors can influence the activity, abundance and distribution of fungi in the marine environment. Salinity and temperature are the major factors affecting the diversity of marine fungi as is well illustrated by the data of Booth and Kenkel (1986). In the present study, Sodium ($r=-0.971$; $P<0.05$), and electrical conductivity ($r=-0.966$; $P<0.05$) showed negative correlation at Palayakayal station and available potassium ($r=-0.963$; $P<0.05$) exhibited negative correlation at Tuticorin station. From the present study, it appears that the coastal soils contain a mycoflora reservoir comprising of a variety of genera. Tuticorin coast provides a unique opportunity for mycologist to explore fungal diversity and exploit their ecological, medicinal and industrial potential.

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