



Analysis of Physicochemical Parameters and Fungal Diversity From Marine Soil and Water Samples Of Ramanathapuram District, Tamil Nadu, India

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ABSTRACT

Physico-chemical and mycofloral analysis of marine samples of Ramanathapuram district, Tamil Nadu, India. The investigation conducted to evaluate the physicochemical parameters and mycofloral survey were performed in soil and water samples of marine area of Ramanathapuram district, Tamil Nadu. The physicochemical parameters like pH, electrical conductivity, organic carbon, organic matter, available nitrogen, phosphorus, potassium, zinc, copper, iron and manganese, calcium, magnesium, sodium, potassium and cation exchange capacity proton in the Thirupullani, Melapudhukudi, Korakkarai and Sethukarai area were analysed from Ramanathapuram district. Among the soil samples, the Korakkarai sample showed maximum quantity of physicochemical parameters when compared with other places respectively. Determination of water physicochemical parameters like rainfall, atmospheric temperature, water temperature, pH, salinity, dissolved oxygen, Biochemical oxygen demand, chemical oxygen demand, nitrate, phosphate, iron, copper, zinc, potassium, calcium and sodium were analysed. The mycofloral investigation, on the basis of morphology were carried out. The investigation of mycofloral diversity like *Aspergillus awamori*, *A. luchuensis*, *A. candidus*, *A. chevalieri*, *A. flavipes*, *A. nidulans*, *A. niger*, *A. terreus*, *A. flavus*, *A. fumigatus*, *Curvularia lunata*, *Fusarium oxysporum*, *F. solani*, *Helminthosporium oryzae*, *Penicillium citrinum* and *P. janthinellam* of Thirupullani was maximum (107) colonies found to be recorded than that of other places of marine soil, whereas isolation of fungi like *Aspergillus sydowii*, *A. ochraceus*, *A. versicolor*, *A. ruber*, *A. niger*, *A. terreus*, *A. flavus*, *A. fumigatus*, *Fusarium moniliformae* and *Penicillium citrinum* of marine water samples were represented in maximum number of colonies (77) were observed in Thirupullani and Korakkarai. Fungal populations are an integral soil component and play a number of functions in the processes which are key to the energy in the environment.

Keywords: Marine soil, water, physicochemical, myco diversity

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INTRODUCTION

Soil microorganisms such as bacteria and fungi play an important role in soil fertility and protecting plant health. The soil ecosystem is supported by several interactions among its physical, chemical and biological components. Many biological processes take place in soil and determine functions that provide various summaries within the ecosystem. The soil mycoflora plays a pivotal role in evolution of soil condition and stimulating plant growth. Fungi are an important component of soil microbiota and more in abundance than bacteria depending on soil depth and nutrient conditions.

Marine fungi have been classified into three geographical groups [1]. Mangrove fungi incorporated in biogeographically [2]. Marine fungi have the ability to grow at certain marine water concentrations.

The physical and chemical breakdown of rocks to fine particles with large surface areas and the accompanying release of plant materials initiate the soil forming process [3]. The microorganisms such as bacteria, fungi, actinomycetes, viruses, protozoa and algae [4]. The soil microorganism with habitat especially the higher vegetation factors in soil formation [5].

The soil microbes, the plant and animal residues entering soil organic matter of physical, chemical and biological properties of soil were performed. The micro fungi regulating soil biological activity. The soil

fungus population in relation of Marine field were analysed. The organic matter is decomposed by the microbes is interrelated into the chemical composition of the substrates as well as environmental condition [6].

MATERIAL AND METHODS

Sample Collection

The marine samples of soil and water were collected from four different places of Thirupullani, Melapudhukkudi, Koraiarai and Sethukarai of Ramanathapuram district, Tamil Nadu, India for soil microfloral and physiochemical characters were analysed and preserved in refrigerator for further investigation.

Physicochemical parameters soil and water

The physico-chemical parameter of collected soil and water samples were analyzed by standard methods [7]. The analysis of physico - chemical parameter of the soil and water samples were done at soil and water testing laboratory, Department of Agriculture, Government of Tamil Nadu.

Isolation

One gram of marine sediment soil samples was diluted serially in distilled water Potato Dextrose Agar medium (PDA) was prepared and sterilized in an autoclave at 121°C for 15 minutes. The medium was incorporated with streptomycin sulphate solution (1:1) and poured into the petriplates. After solidification 0.1mL of serially diluted soil sample were inoculated into the medium. The inoculum was spread uniformly and kept undisturbed in dust free chamber at room temperature for a period of 3-5 days. The fungal colonies were counted. The pure cultures were maintained in the conventional potato dextrose agar medium [8]. Similarly, followed isolation of fungi in water samples of marine.

Identification and Photomicrography

The identification of fungi were performed after 72 hrs of culture observed with microscopically using standard manual of soil fungi [9], Hyphomycetes [10]. More Dematiaceous Hyphomycetes [11].

RESULTS AND DISCUSSION

The marine soil and water samples has significant issues in the marine atmospheres that influence the growth, replica and metabolic actions of microbes [12]. The physico-chemical properties like calcium carbonate, electrical conductivity, macronutrients such as organic carbon, nitrogen, phosphorus and potassium were estimated. Micronutrients like iron, manganese, zinc, copper and other cations exchange capacity, sodium and magnesium of the marine soil samples were collected and estimated from different places of India.

In general, the occurrence and diversity of microfungi in sandy beach soils were similar with other study in different parts of the world. The differences in species composition may in the physico chemical factor including soil texture, pH due to different sampling strategies, different isolation techniques, and salinity of the seawater, temperature and nutrient status as indicated. Although many species of microfungi isolated from different types of soils are saprophytic, some species are biotrophic mutualists and parasites of plants, animals and other fungi [13].

In the present study that the physicochemical factors including soil texture the maximum physico-chemical parameters in Thirupullani such as pH, electrical conductivity, organic carbon, organic matter, nitrogen, phosphorus, potassium, iron, zinc, copper, manganese, calcium, magnesium, sodium, potassium and other cations exchange capacity was (7.91), (0.51 ds m^{-1}), (0.25%), (0.50%), (112.0mg/kg), (4.25mg/kg), (126.5 mg/kg), (4.13 ppm), (0.84ppm), (0.42ppm), (2.36 ppm), (12.6mg/kg), (7.6 mg/kg), (1.26 mg/kg), (0.13 mg/kg) and (23.0 mg/kg) found to be recorded respectively whereas minimum in (7.91), (0.26 ds m^{-1}), (0.16%), (0.32%), (97.8mg/kg), (4.00mg/kg), (125 mg/kg), (1.02 ppm), (0.52ppm), (4.62ppm), (1.84 ppm), (11.3mg/kg), (6.5 mg/kg), (1.29 mg/kg), (0.23 mg/kg) and (28.6 mg/kg) exhibited from soil sample in Sedhukarai. The maximum physico chemical parameters in Melapudhukkudi such as rainfall, atmospheric temperature, water temperature, pH, salinity, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, nitrate, Phosphate, iron, copper, zinc, potassium, calcium and sodium was (88 mm), (25.4°C), (31.1 °C), (6.8), (34%), (3.0ml/L), (1.1ml/L), (0.8ml/L), (0.28g/l), (0.30g/l), (0.3g/l), (1.5g/l), (07g/l), (0.10g/l), (0.08g/l) and (0.84g/l) found to be recorded respectively whereas minimum in (86.4mm), (27.5°C), (24.3 °C), (6.9), (32%), (2.3ml/L), (1.1ml/L), (0.8ml/L), (0.30g/l), (0.46g/l), (0.2g/l), (1.1g/l), (08g/l), (0.10g/l), (0.06g/l) and (0.74g/l) exhibited from water samples in Thirupullani. (Table 1 and 2).

The fungal organisms were isolated using PDA agar plate was incubated at room temperature (27°C) for five days. Forty four (44) fungi from soil samples had different morphological characteristics, different colony colors and different colony sizes. The average incubation time was five days for the full growth on

the agar plates. Totally 44 fungal organisms were isolated from different soil. The surface of the soil showed higher number of organisms when compared with 15 cm depth in the soil [14].

The fungi isolated from four marine soil and water samples with their frequency of occurrences were recorded (Tables 3 and 4). The isolated soil fungi in Sedhukarai such as *Aspergillus awamori*, *A. luchuensis*, *A. candidus*, *A. chevalieri*, *A. flavipes*, *A. nidulans*, *A. niger*, *A. terreus*, *A. flavus*, *A. fumigatus*, *Curvularia lunata*, *Fusarium oxysporum*, *F. solani*, *Helminthosporium oryzae*, *Penicillium citrinum*, and *P. janthinellum* found to be recorded respectively whereas minimum in Melapudukudi recorded due to the fluctuation of physico-chemical parameters exhibited respectively. The isolated fungi in water are maximum in Thirupullani such as *Aspergillus sydowii*, *A. ochraceus*, *A. versicolor*, *A. ruber*, *A. niger*, *A. terreus*, *A. flavus*, *A. fumigatus*, *Fusarium moniliformae* and *Penicillium citrinum* found to be recorded respectively whereas minimum in Sedhukarai due to the fluctuation of physico-chemical parameters exhibited respectively.

Sea water samples were collected from three different stations in Tuticorin coastal to study the physico-chemical characteristics. The analysis of different parameters such as temperature, pH, salinity, TDS, nitrite, nitrate, silicate, inorganic phosphate and total phosphate were carried out and reveal that the physico-chemical composition of all water samples were collected mainly depends on seasonal variations and discharge of solid waste fly ash from thermal power plant [15].

Isolation, screening and genotyping of pigmented filamentous fungi isolated from tropical marine environments around La Réunion Island, Indian Ocean. About 150 micromycetes were revived and isolated from 14 marine samples (sediments, living corals, coral rubble, sea water and hard substrates) collected in four different locations. Forty-two colored fungal isolates belonging to 16 families, 25 genera and 31 species were further studied depending on their ability to produce pigments and thus subjected to molecular identification [16].

Totally 30 fungal organisms were recorded and morphologically 10 different the fungal genera such as *Fusarium*, *Aspergillus*, *Mucor* and *Penicillium* were also screened [17].

The isolated genera were *Aspergillus*, *Penicillium*, *Trichoderma*, *Absidia*, and *Fusarium*, *Aspergillus* is the fungal genus of greater dominance in the soil of the Jansen Lagoon State Park. *Aspergillus niger* was the dominant species (37%), followed by *A. tamarii* (21.6%) [18]. Fourteen fungal strains were isolated from the Eastern coast of Alexandria and do further research on *Penicillium crustosum* [19].

Totally 56 fungal species belonging to 24 genera were isolated from Karankadu mangrove soil. Besides the above, maximum number of species diversity was encountered with the fungal species belonging to the class Deuteromycetes. The maximum percentage contribution of 3.72% *Aspergillus wentii*, (3.08%) was found with *Aspergillus niger* and *A. ochraceus*. It was followed by *Aspergillus versicolor* (2.99%), *Aspergillus flavus*, *A. quercinus*, *Rhizopus stolonifer*, and *Trichoderma harzianum* (2,81%).

Chitinase producing fungal strains were isolated from the soil samples from different sites of Shimla and Kinnaur district of Himachal Pradesh. Totally, 9 different fungal strains viz., SCF1.1, SCF2.1, SKF3.1, SNF1.1, SNF1.2, SNF3.1, KSF1.1, KSF1.2 and KRF3.1 were isolated. These isolates were characterized morphologically and microscopically. Out of 9 fungal isolates, 3 isolates were found to produce clear zone when incubated in colloidal chitin containing media [20].

Table 1: Analysis of physico-chemical properties of marine soil samples

S.No.	Parameters	Different places			
		Thirupullani	Melapudhukudi	Korakkurai	Sedhukarai
1.	pH	7.91	7.88	7.95	7.91
2.	Electrical conductivity (dsm ⁻¹)	0.51	0.43	0.40	0.26
3.	Organic Carbon (%)	0.25	0.22	0.30	0.16
4.	Organic Matter (%)	0.50	0.65	0.44	0.32
5.	Available Nitrogen (mg/kg)	112.0	114.6	117.6	97.8
6.	Available Phosphorus (mg/kg)	4.25	3.65	2.82	4.00
7.	Available Potassium(mg/kg)	126.5	114.6	112.4	125
8.	Available Zinc (ppm)	0.84	0.87	0.79	1.02
9.	Available Copper (ppm)	0.42	0.45	0.59	0.52
10.	Available Iron (ppm)	4.13	4.23	4.23	4.62
11.	Available Manganese (ppm)	2.36	2.84	2.86	1.84
12.	Calcium (mg/kg)	12.6	12.1	13.3	11.3
13.	Magnesium (mg/kg)	7.6	7.6	7.2	6.5
14.	Sodium (mg/kg)	1.26	1.20	1.20	1.29
15.	Potassium (mg/kg)	0.13	0.15	0.16	0.23
16.	Cat ion Exchange Capacity (C. Mole Proton ⁺ /kg)	23.0	22.8	20.6	28.6

Table 2: Analysis of Physico-chemical properties of marine water samples

S.No	Parameters	Different Places			
		Thirupullani	Melapudhukudi	Korakkarai	Sedhukarai
1.	Rainfall (mm)	86.4	88	99	1.5
2.	Atmospheric Temperature (°C)	27.5	25.4	23.2	27
3.	Water Temperature (°C)	24.3	31.1	30.1	28
4.	pH	6.9	6.8	7.3	6.7
5.	Salinity (%)	32	34	29	35
6.	Dissolved Oxygen (ml/L)	2.3	3.0	3.0	3.3
7.	Biochemical Oxygen demand (ml/L)	1.1	1.5	1.6	2.7
8.	Chemical Oxygen demand (ml/L)	0.8	0.7	0.8	1.4
9.	Nitrate (g/l)	0.30	0.28	0.29	0.34
10.	Phosphate (g/l)	0.46	0.30	0.34	0.33
11.	Iron (g/l)	0.2	0.3	0.2	0.4
12.	Copper (g/l)	1.1	1.5	1.1	1.2
13.	Zinc (g/l)	08	07	09	08
14.	Potassium (g/l)	0.10	0.10	0.22	0.27
15.	Calcium (g/l)	0.06	0.08	0.07	0.09
16.	Sodium (g/l)	0.74	0.84	0.90	1.00

Figure 1: Microphotography of the identified fungal colonies

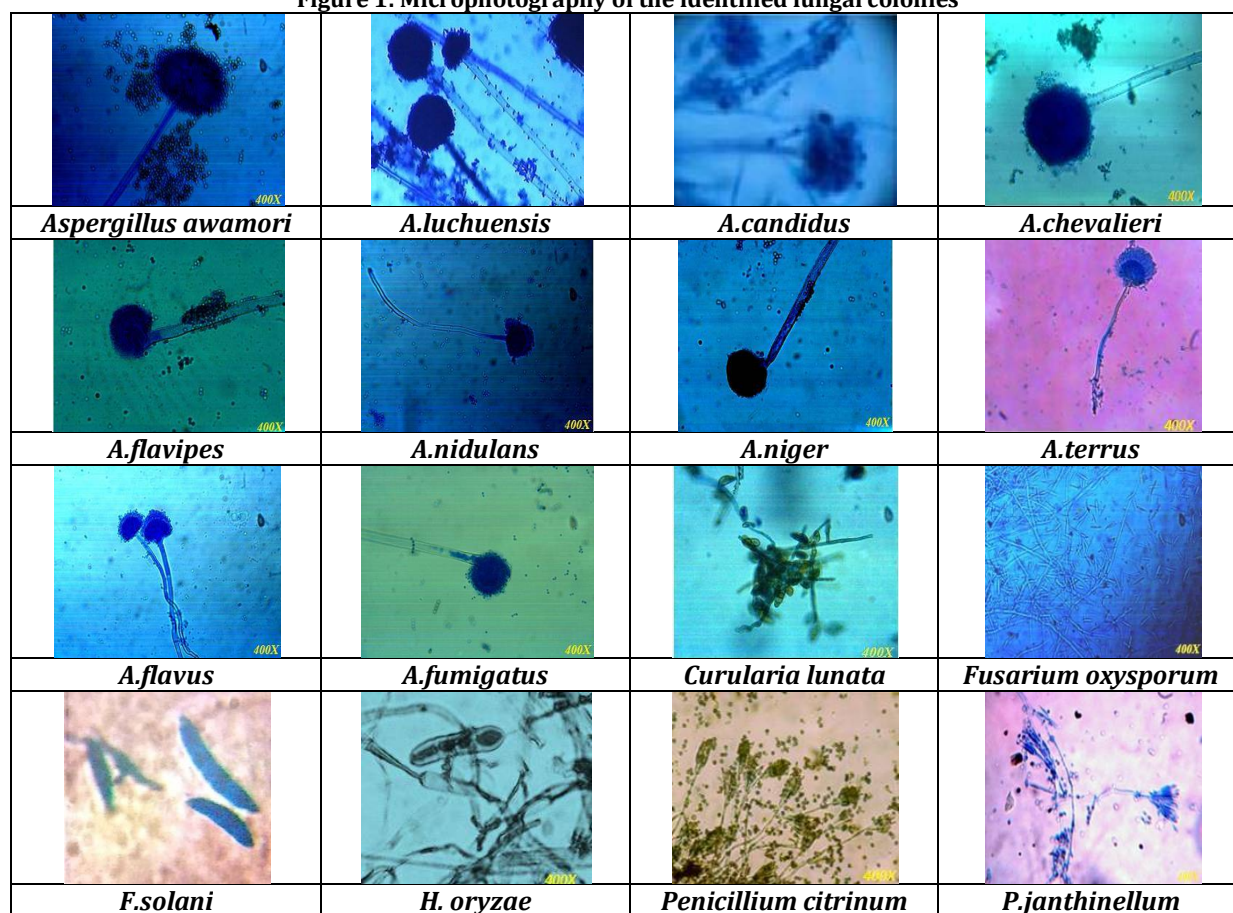


Table 3: Isolation and identification of fungi from marine soil samples

S. No	Name of the fungi	Different places			
		Thirupullani	Melapudhukudi	Korakkarai	Sedhukarai
1	<i>Aspergillus awamori</i>	03	06	-	07
2	<i>A.luchuensis</i>	02	-	01	-
3	<i>A.candidus</i>	04	-	08	02
4	<i>A.chevalieri</i>	05	03	-	06
5	<i>A.flavipes</i>	03	08	09	04
6	<i>A.nidulans</i>	07	-	06	07
7	<i>A.niger</i>	12	11	14	13
8	<i>A.terreus</i>	10	13	12	14
9	<i>A.flavus</i>	13	10	11	15
10	<i>A.fumigatus</i>	09	12	14	13
11	<i>Curvularia lunata</i>	03	02	-	04
12	<i>Fusarium oxysporum</i>	10	09	12	14
13	<i>F.solani</i>	09	08	10	13
14	<i>Helminthosporium oryzae</i>	02	-	03	-
15	<i>Penicillium citrinum</i>	11	09	07	06
16	<i>P.janthinellum</i>	04	06	05	08
Total number of colonies		107	91	112	126
Total number of species		16	11	13	14

Table 4: Isolation and identification of fungi from marine water samples

S.No.	Name of the fungi	Different places			
		Thirupullani	Melapudhukudi	Korakkarai	Sedhukarai
1.	<i>Aspergillus sydowii</i>	08	-	07	06
2.	<i>A.ochraceus</i>	-	02	03	-
3.	<i>A.versicolor</i>	02	04	-	-
4.	<i>A.ruber</i>	-	-	-	02
5.	<i>A.niger</i>	12	11	10	13
6.	<i>A.terreus</i>	13	12	11	10
7.	<i>A.flavus</i>	14	10	12	13
8.	<i>A.fumigatus</i>	10	11	13	09
9.	<i>Fusarium moniliformae</i>	09	14	11	06
10.	<i>Penicillium citrinum</i>	09	12	10	04
Total number of colonies		77	76	77	63
Total number of species		07	08	08	08

CONCLUSION

It can be concluded that the soil health condition have a tremendous impact on environmental sustainability for Agriculture. Moreover, soil diversity concentered with the production of health food which impacts public and animal health. More research is required to find the best way to maintain fungal diversity in soil, taking in to consideration of fungal role with physicochemical parameter were performed. The ability to compare functional structure between ecosystem and predict responses in soil conservation. Soil physic-chemical parameters play a key relevance and stability although it is uncertain for deterioration of soil properties and changes in fungal commonly affect the functional stability of soil.

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CONFLICT OF INTEREST

The authour's declared that they have no conflict of interest.

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