International Journal Of

Recent Scientific Research

ISSN: 0976-3031

Volume: 7(6) June -2016

SOIL CHARACTERISTICS AND MICROBIAL DIVERSITY OF THARANGAMPADI TALUK, NAGAPATTINUM DISTRICT, TAMIL NADU, INDIA

Ahilandeswari K., Ramya M and Dhivaharan V

THE OFFICIAL PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)
http://www.recentscientific.com/ recentscientific@gmail.com

ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 7, Issue, 6, pp. 12247-12250, June, 2016

International Journal of Recent Scientific Research

Research Article

SOIL CHARACTERISTICS AND MICROBIAL DIVERSITY OF THARANGAMPADI TALUK, NAGAPATTINUM DISTRICT, TAMIL NADU, INDIA

Ahilandeswari K*., Ramya M and Dhivaharan V

Department of Microbiology S.T.E.T Women's College, Sundarakkottai, Mannargudi, Thiruvarur (DT), Tamil Nadu, India

ARTICLE INFO

Article History:

Received 05th March, 2016
Received in revised form 21st April, 2016
Accepted 06th May, 2016
Published online 28th June, 2016

Key Words:

Microbial diversity, Tharangampadi Taluk, Fertility, Physico-Chemical parameter.

ABSTRACT

Soil characteristic and microbial diversity of Tharangampadi Taluk, Nagapattinam District have been investigated to study the seasonal changes in soil moisture, pH, Organic carbon, available nitrogen and micro nutrient like sodium, Potassium, Calcium and Magnesium during the period of one year (2015-2016). Physico - chemical analysis were performed to study the soil characteristic related to fertility and chemical nature. The study revealed the presence of 20 species of bacteria, among them 7 species were found in all the seasons and also study reveled the presence of 18 species of fungi, among them 7 species were found in all the season.

INTRODUCTION

Biodiversity define as simplest way is to count to the number of species in an ecosystem and the number of individual organisms of each species. But this is a challenge, because many species of soil organisms have never been identified – there are too many species and too few soil ecologists. The many species that live in the soil range in size from tiny one cells bacteria, algae, fungi and protozoa too more complex organisms like earthworms, insects, small vertebrates and plants.

Biodiversity in extreme habitats attracts great attention among researches because a study of the system can increase our understanding of the relationship between organism and their environment, and the unraveling is mechanism of their adaptation to extreme condition. However, the most fundamental meaning of biodiversity probably lies in the concept of species richness that is, the number of species occurring at a site, in a region or ecosystem.

Microbial diversity is a general term used to include genetic diversity, that is, the amount and distribution of genetic information, within microbial diversity of bacterial and fungal species in microbial communities; and ecological diversity, that is variation in community structure, complexity of interactions. Number of tropic levels, and number of guilds here we consider microbial diversity simply to include the number of different fungal bacterial species (richness) and there relative abundance (evenness) in soil microflora. Equations used to calculate species richness and evenness and diversity indices, which combine both richness and evenness, have been discussed by Smith 1998.

Soil structure can be defined as the arrangement of particles and associated pores in soil and the size range from nanometers to centimeters is demonstrated. Biological influences can be demonstrated in the formation and stabilization of the soil aggregates, but it is necessary to distinguish clearly between those forces or agencies which create aggressions of particles and those which stabilize or degrade such aggregations (Oades J.M 2010). Soils are complex systems in which physical soil structure is as important as chemical content. Soil pores which are maximized in a well structured soil allow oxygen and moisture to infiltrate to depths and plant roots to penetrate to obtain moisture and nutrients (Alpin. G 1998).

Biological activity helps in the maintenance of relatively open soil structure, as well as facilitating decomposition and the transportation and transformation of soil nutrients. Changing soil structure has been shown to lead to reduced accessibility by plants to necessary substances. It is now uncontested that microbial exudates have a dominant role in the aggregation of soil particles and the protection of carbon from further degradation (Six J; Frey, S.D 2006). It has been suggested that microorganisms within the soil "engineer" a superior habitat and provide a more sound soil structure, leading to more

*Corresponding author: *Ahilandeswari K*
Department of Microbiology S.T.E.T Women's College, Sundarakkottai, Mannargudi, Thiruvarur (DT), Tamil Nadu, India

productive soil systems. (Fanning, D.S and Fanning, M.C.B. 1989).

MATERIALS AND METHODS

Study Site and Location

Tharangampadi formerly Tranquebar, is a panchayat town in the Nagapattinum District of the Indian state of Tamil Nadu. It lies 15 kilometers (9.3 mi) north of Karaikal, near the mouth of a distributaries of the Kaveri River. Tharangampadi is the headquarters of Tharangampadi Taluk while its name means "place of the singing waves". It was a Danish colony from 1620 to 1845, and in Danish it still known as Trankebar. The area chosen for study is in and around Nagapattinam coastal region, which is situated on the eastern margin of Tamil Nadu.

Collection of Soil Samples

Soil sample were collected from three different villages (Kadakkam[S1], Kiliyanur[S2], Madapuram[S3]) from Tharangampadi taluk, Nagapattinam district, Tamil Nadu. The sample collection period is pre monsoon to monsoon (September to December). The physico – chemical parameter of such soils were analyzed.

Physicochemical Parameters

The soil samples were collected from three different areas at four seasons viz, monsoon, post monsoon, summer and pre monsoon and their physico chemical parameter were analyzed such as pH, Moisture content, Carbon, Nitrogen, Calcium, Phosphorus, Magnesium, Zinc, Copper, Iron and Manganese also estimated.

Isolation of Microbial Population

Serial dilution was performed by using the collected soil sample to isolate the fungal and bacterial population from the soil samples.

Isolation and Idedification of Bacteria

The bacterial species present in soil sample were isolated by nutrient agar plate. The bacterial population grown in plate were identified by morphological and biochemical analysis.

Morphological analysis were done by Performing Gram staining and motility test. Biochemical characters were analyzed by performing Indole test, Methyl- red test, Voges-proskauer test, Citrate utilization test, Catalase test, Oxidase test and Triple sugar Iorn test.

Table 1 Physico- chemical parameter of three soil sample of Tharangampadi (Kadakkam -S_1, Kiliyanur -S_2, Madapuram -S_3).

Season	pH	moisture (%)	Tempreture (°C)	O.C (kg/ac)	N (kg/ac)	P (kg/ac)	K (kg/ac)	Mg (kg/ac)	Ca (kg/ac)	Zn (ppm)	Fe+ (ppm)	Cu (ppm)	Mn (ppm)
Monsoon													
S_1	7.36	42.56	26	0.47	84.6	4.8	138	9.7	10.9	0.87	4.86	0.95	3.27
S_2	7.76	41.15	26	0.85	81.2	4.7	126	8.8	11.3	0.82	4.81	0.99	3.42
S_3	7.45	45.02	28	1.25	82.9	2.9	136	9.3	11.3	0.88	5.90	0.97	3.25
Post monsoon													
S_1	7.19	40.55	38	0.85	86.9	4.01	147	9.1	10.8	0.65	6.34	0.75	3.05
S_2	7.76	41.05	35	0.87	81.2	4.31	144	8.4	10.5	0.65	5.27	0.72	3.32
S_3	7.46	40.02	36	0.89	88.9	4.52	124	8.8	10.2	0.87	4.78	0.76	3.44
Summer													
S_1	7.36	36.01	42	0.80	90.20	2.85	129	9.6	10.6	0.89	4.65	0.92	3.49
S_2	7.65	37.08	48	0.77	85.6	2.87	137	8.1	11.7	0.88	4.52	0.86	3.45
S_3	7.12	39.08	47	0.55	82.33	2.34	139	8.3	10.9	0.72	4.52	0.88	3.25
Pre monsoon													
S1	7.75	40.30	33	1.25	82.3	2.05	141	8.6	10.4	0.83	4.23	0.88	3.78
S_2	7.34	42.01	34	1.52	87.8	2.84	139	9.3	11.4	0.82	4.27	0.77	3.48
S_3	7.08	40.30	37	0.65	87.9	2.06	147	8.8	11.5	0.80	5.37	0.74	3.28

Table 2 Morphological and Biochemical characters of the bacterial isolates

Name of the Organism	Gram staining	Motility	Indole	MR	VP	Citrate	Catalase	Oxidase	Urease	TSI
Enterobacter spp	_	+	+	_	_	+	+	_	+	_
Azospirillum spp	_	+	+	-	+	+	+	-	-	+
Azotobacter	-	+	+	-	+	+	+	-	-	+
B.cogulans	+	+	_	+	+	_	_	+	_	+
Bacillus subtilis	+	+	-	+	+	+	+	-	-	-
Bacillus cereus	+	+	_	_	+	_	_	+	+	+/_
Bacillus licheniformis	+	+	-	-	+	+	+	+	+	_
E.coli	-	+	+	+	-	-	+	-	-	-
Enterobacter spp	_		+	_	_	+	+	_	+	_
Micrococcus luteus	+	_	_	_	_	+	_	_	+	+
P.Alkaligens	-	+	-	-	-	+	+	+	+	+
Shigella	-	-	+/-	+	-	-	+	-	-	+
Pseudomonas aerugens	_	+	+	_	_	_	+	+	+	+
Pseudomonas striata	_	_	+	_	_	+	+	+	+	+
Rhizobium meliloti	_	+	_	+	-	+	_	+	_	_
Rhizobium spp	_	+	_	+	-	+	_	+	_	_
Staphylococcus epidermis	+	-	-	-	-	+	+	-	+	+
Staphylococcus spp	+	-	-	-	-	+	+	-	+	+/-
Streptococcus spp	+	+	-	+	_	_	_	_	_	+/-

Isolation of Fungi

Fungal population present in the soil sample were determined by plating the soil dilution of 10^{-2} to 10^{-5} dilution using solidified Rose Bengal Agar medium and Potato Dextrose Agar medium. The prepared medium was sterilized at 121°C for 5 minutes and it was supplemented with 1% streptomycin to prevent bacterial growth.

Conidial Population

The number of Colony Forming Units (CFU) present in 1 gram of the soil samples were determined by multiplying the number of colonies with dilution factors.

$$\text{Number of CFU's of fungi per gram dry weight of soil} = \frac{\text{Mean no.of colonies} \times \text{dilution factor}}{\text{Dry weight of the soil.}}$$

Identification of Fungi (Gillman, 1957)

The fungus was made by single spore culture methods. A portion of the growing edge of each colony was picked up with the help of a pair of needles and mounted on a clean slide with lacto phenol cotton blue.

The slide was gently heated over the flame so as to remove air bubbles. The excess stain was wiped off with the help of tissue paper and then the cover slip was sealed with transparent nail polish for semi permanent. The slide was observed under microscope to examine individual fungal species and identified by their morphology. The fungal culture was identified by using Manual of Soil Fungi (Gillman, 1957),

RESULT

Identification of Bacteria

The different species of soil bacteria were observed from soil samples. The bacterial species were identified by their morphological characters and Bergey's manual of determinative bacteriology. The predominant bacterial genus identified in the soil are *E.coli*, *Enterococcus, Streptococcus, Staphylococcus Proteus, Pseudomonas* and *Bacillus*.

In the monsoon season *Shigella, Bacillus plavifaciens, Micrococcus luteus, M.rosens, E. coli, B.cogulans, Enterobacter spp, P.alkaligens, Rhizobium* were noted predominantly.

In the post monsoon season *Pseudomonas aeruginosa, E.coli, Enterobacter spp, Pseudomonas striata, Bacillus cereus, B.subtilis, Shigella sp* were noted predominantly.
In the summer season *Pseudomonas, B.licheniformis, Pseudomonas aeruginosa, Micrococcus sp, Staphylococcus epidermidis, Azotobacter, B.cereus. B.subtilis* were noted predominantly.

In the pre monsoon season *Azotobacter*, *E.coli, Pseudoonas spp, E.aerogens, B. subtilis, Staphylococcus spp. Pseudomonas allkaligens, Shigella spp, E.aerogens* were noted predominantly (Table-3).

Identification of Fungi

Different species of fungi where observed from the soil samples collected from three different villages. The colonies showed a characteristic colour of black, green, white and brown, yellow and they were confirmed by identifying their morphological characters by Ellis manual. The fungal genus identified includes *Aspergillus, Trichoderma, Alternaria, Penicillium, Verticillium, Cladosporium, Rhizopus,* and *Absidia*. Among the fungal species identified A.niger, *A.oryzae, Fusarium, Trichoderma viridie, T.horizonum* were predominant in the soil samples.

In the monsoon season *Rhizopus oryzae, Penicillium conidia, Trichoderma harzianum, Aspergillus niger, Rhizopus, Mucor, Aspergillus ruber, Aspergillus fumigatious, Rhizopus stolnifer, Trichoderma viride, Aspergillus oryzae, Aspergillus ruber* were noted predominantly In the post monsoon season *Alternaria spp, Aspergillus spp, Cladosporium spp, Rhizopus spp, Trichoderma spp, Aspergillus oryzae, A.terreus, Fusarium oxysporrum, Trichoderma viride, T. harzianum* were noted predominantly In the summer season *Aspergillus niger, cladosporium, Aspergillus oryzae, Fusarium oxysporrum, Trichoderma harzianum, Aspergillus silvaticus, Aspergillus temicola, Aspergillus repens* were noted predominantly In the pre monsoon season *Aspergillus conicus*, *Rhhizopus stolnifer, Fusarium oxysporrum, Verticellum spp, P. Jethinellum, Aspergillus oryzae, Rhizopus oryzea* were noted predominantly (Table-4).

Table 3 Total population of bacterial species present in Tharangampadi taluk

Name of the Bacteria	Monsoon	Post Monsoon	Summer	Pre Monsoon
Shigella spp	+	+	-	-
Micrococcus luteus	+	-	-	-
Micrococcus rosens	+	+	+	+
E.coli	+	+	-	+
Enterobacter spp	+	+	+	+
Pseudomonas aerogens	+	+	-	+
Pseudomonas alkligens	+	-	+	-
Rhizobium spp	+	+	-	-
B.cogulans	+	-	-	-
Azospirillum spp	-	+	-	-
Azotobacter	-	-	+	+
Staphylococcus epidermis	+	+	-	-
Bacillus subtilis	+	+	+	+
Bacillus cereus	+	+	+	+
Staphylococcus spp	-	-	+	-
Streptococcus spp	+	+	+	+
Micrococcus serrataia	-	-	+	-
Bacillus licheniformis	-	+	-	+
Bacillus circulans	+	+	+	_
Bacillus mesentericus	-	+	_	_

Table 4 Total population of fungal species present in Tharangampadi taluk

Name of the Fungi	Monsoon	Post Monsoon	Summer	Pre Monsoon
Alternaria spp	+	+	+	+
Cladoporium spp	-	+	+	+
Aspergillus flavus	+	+	+	+
Aspergillus itaniconicus	-	+	-	+
Rhizopus spp	+	+	+	+
Trihoderma spp	+	+	+	+
Aspergillus oryzae	+	+	+	-
Fusarium oxysporrum	-	+	+	-
Trichoderma harizanum	+	+	+	-
Rhizopus stolinifer	+	-	-	+
Rhizopus oryzae	+	+	+	+
Trichoderma viride	+	+	+	+
Verticilum spp	-	-	-	+
Aspergillus repens	-	-	+	-
Penicillum spp	+	+	+	+
Aspergillus niger	+	-	+	+
Aspergillus ruber	+	-	+	_
Aspergillus fumigates	+	-	-	+

DISCUSSION

Advance in microbial methods have demonstrated that microorganisms globally are the dominating organism both concerning biomass and diversity. Their functional and genetic potential may exceed that of higher organisms. Studied of bacterial diversity have been hampered by their dependence on phenotypic characterization of bacterial isolates (Torsvik 2002). An increasing interest has emerged with respect to the importance of microbial diversity in soil habitat. The extent of the diversity of microorganisms in soil is seen to be critical to the maintenance of soil health and quality, as a wide range of microorganisms is involved in important of soil functions.

In this study, the physico chemical parameters of soil were estimated. Through the parameters we will analyze the correlation of microbial species and chemical nature of soil. Microorganism is mainly based on nutritional condition of soil. According to the physico chemical parameter, the soil species and nutritional status may vary. The biodiversity studies helpful to analyze the impact of physico chemical parameter of soil on species variation and it will help to former to select the suitable crop and to improve their knowledge about crop rotation.

Determination of bacterial diversity by culture method showed the predominance of bacterial genera such as *E.coli, Pseudomonas aeroginosa, Bacillus subtilis, Bacillus cereus, Streptococcus spp, Staphylococcus spp, Shigella spp.* Determination of fungal species showed the predominance of *Aspergillus flavus, Aspergillus niger, Rhizopus spp, Trichoderma spp, Rhizopus oryzae, Trichoderma viride, Penicillium spp.*

CONCLUSION

The present study revealed that the microbial community varied at different seasons as well as area, and were both positively and negatively correlated with physic- chemical and available micro and macro nutrients accounted for a significant amount of variability in bacterial community composition. This indicates that the organic matter content, pH and available soil nutrients could influence the structure of the community in soil. The predominant bacterial and fungal species were identified in different season and the variations of species in different season were analyzed to find out the effect of seasonal variation in species diversity. By this way we will find out the suitable or most adopted biofertilizer for particular season.

References

Aplin, G (1998). Australians and Their Environment: An Introduction to Environmental Studies. Oxford University Press, Melbourne.

Gilman J.C., A Manual of soil fungi, 2nd Indian edition, Biotech Books, Delhi Fanning, D.S and Fanning, M.C.B. (1989). Soil morphology, Genesis and Classification. Willey & Sons. Chicnester, U.K.

Oades, J.M. (2010). "The role of b iology in the formation, stabilization and degradation of soil structure". Geoderma **56**(1): 377-400. doi :10.1016/0016-7061(93)90123-3.

Six, J; Frey, SD; Theiet, RK; Betten, K.M. (2006). "Bacterial and Fungal Contributions to Carbon Sequestration In Agroecosystem." Soil sci. soc 70 (2): 555-569.doi:10.2136/sssaj2004.0347.

Smith, M.L., Bruhn, J.N. and Anderson, J.B. (1998). Soil fungi in fieid, *J. Nature* **356**:428.

Torsvik, V., and Overeas, L. (2002). Microbial diversity and function in soil; from genes to ecosystem. Curr. Opin. Microbial. 5:240-45

Warcup J.H. (1995), on the origin of colonies of fungi developing on soil dilution plates, *Trans, Brit. Mycol*. Soc, **38**, 298-301.

****

How to cite this article:
Ahilandeswari K., Ramya M and Dhivaharan V.2016, Soil Characteristics and Microbial Diversity of Tharangampadi Taluk, Nagapattinum District, Tamil Nadu, India. *Int J Recent Sci Res.* 7(6), pp. 12247-12250.

TSSN 0976-3031