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MICROBIAL ANALYSIS IN TERMITE MOUND SOIL AND NORMAL SOIL

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ABSTRACT

Soil macrofauna such as termites, ants and earthworms are considered to be species with a major influence on soil structure and biota. Soil contains different types of microbes such as bacteria, fungi, actinomycetes etc. The mound represents a specific habitat for soil microorganisms since the physical properties (water holding capacity, bulk density, structural stability) and the chemical properties (cation exchange capacity, organic matter content and quality) are very different from those of the surrounding soil. Termite mound soil and normal soil are different in their properties. Termites affect the ability of soil to support microbes. The influence of termites on soil microbes were determined by microbial analysis. The number of colonies of bacteria, fungi and actinomycetes were analysed in termite mound soil and normal soil. Termite soil were rich in bacterial and fungal populations. Actinomycetes colonies were rich in normal soil. Among total microbes, bacterial count were higher than fungi and actinomycetes in termite soil.

KEYWORDS: Macrofauna, Termite mound soil, Normal soil, Microbes, Physical properties, Chemical properties.

INTRODUCTION

Termites are often the dominant macrobiota in many areas, especially in the tropics with a major role in ecological processes.[1] Along with ants and earthworms, termites are one of the three main groups of soil ecosystem engineers.[2]

Soil harbours diverse group of microorganisms including actinomycetes, bacteria, fungi and microfauna that constitute an important component of ecosystem, especially aiding in nutrient recycling.[3] These microorganisms are important because they affect the physical, chemical and biological properties of soil where several common groups of bacteria are especially important to ensure health of the soil.[4] Microbial diversity depends on available nutrients and their varied concentrations.[5] Termites are known to influence the physical and chemical properties of soil in tropical and subtropical forest ecosystems, which in turn affect the microbial density in soil.[6,7,8]

The main objective of the study is to analyse the microbial colonies in termite mound soil and normal soil.

MATERIALS AND METHODS

Study area

The study was conducted in Puthukkodu of Peringottukurussi panchayath of Palakkad district, Kerala.

Sample collection

The termite mounds of the study site were destructed and the termite soil was collected in a plastic bag. Normal soil was collected from the same place a few meters away from the termite mounds in another plastic bag. Both samples were brought and kept in room temperature and are then analysed for microbial study.

Number of bacterial colonies

Serial dilution and further spread plating was performed for the microbial analysis of the given soil samples. Serial dilution is the dilution of a sample in 10 fold dilution. It begins with the addition of 1g of sample to 99ml of sterile distilled water and was mixed together (10^0 dilution). 1ml from that mixture is added to 9ml of sterile distilled water and mixed together (10^{-1}). Repeated the same procedure for up to 10^{-6} dilution.

After performing serial dilution, spread plating was done on nutrient agar plates from 4 dilutions (10^0, 10^{-2}, 10^{-4} and 10^{-6}). For spread plating, 100µl samples from the above mentioned dilutions were spread on sterile Nutrient agar plates using sterile L-rod and incubated the plates at 37^{0}C for 24 hours. The colonies grown on the plates were then counted and expressed in colony forming unit per millilitre (CFU/ml).

Number of colonies (CFU/ml)
= number of colonies counted × dilution factor /volume of culture plated

Number of fungal colonies

The procedure is similar to that of bacteria. After performing serial dilution, spread plating was done on Rose Bengal agar plates by taking 100µl samples from 4 dilutions (10^0, 10^{-2}, 10^{-4} and 10^{-6}) and spread using sterile L-rod and incubated the plates at room temperature for 48 hours. The colonies grown on the plates were then counted and expressed in CFU/ml.

Number of actinomycetes colonies

For counting actinomycetes present in the samples, the given samples were pre-treated before serial dilution by heating it at 100^0C for 1 hour to kill the other microbes present. The serial dilution procedure is similar to that of bacteria and fungi. After serial dilution, 100µl samples from the dilutions 10^0, 10^{-1}, 10^{-2}, 10^{-4} were placed on Starch- casein agar medium using sterile L-rod and incubated at room temperature for 7 days. The colonies grown on the plates were then counted and expressed in CFU/ml.

RESULTS

The number of colonies of bacteria were found to be higher in termite mound soil than normal soil. 10^{-6} dilution of termite soil showed 11×10^7 CFU/ml of bacteria whereas the number of bacterial colonies for 10^0, 10^{-2}, 10^{-4} dilutions of termite soil were too numerous to count. In normal soil, the number of bacterial colonies were 90×10^2 CFU/ml for 10^{-2} dilution and it was too numerous to count in 10^0 dilution. No colonies were observed for 10^{-4} and 10^{-6} dilutions. (Table 1).

The study showed that the number of colonies of fungi were maximum in termite mound soil compared to normal soil. Of the four dilutions, 10^0 dilution of termite soil showed 6.8×10^2 CFU/ml and normal soil showed 1.4×10^2 CFU/ml. The number of fungal colonies for 10^{-2} dilution of both soil samples were too few to count. No fungal colonies was observed for 10^{-4} and 10^{-6} dilution in both samples. (Table 2).

In the present study, the number of colonies of actinomycetes were found to be higher in normal soil than termite soil. The number of colonies of actinomycetes in 10^0 dilution for both soil samples were too numerous to count. 10^{-1} dilution of normal soil showed 18×10^2 CFU/ml whereas termite mound soil showed 8×10^2 CFU/ml. The number of colonies for 10^{-2} and 10^{-4} dilutions of both soil samples were too few to count. (Table 3).

The result also showed that total bacterial count were higher than fungi and actinomycetes in termite soil.

Table 1: Number of bacterial colonies present in termite mound soil and normal soil in different dilutions.

Sample	Dilution	Number of colonies (CFU/ml)
Normal soil	10^0	TNTC
	10^{-2}	90×10^2
	10^{-4}	0
	10^{-6}	0
Termite soil	10^0	TNTC
	10^{-2}	TNTC
	10^{-4}	TNTC
	10^{-6}	11×10^7

TNTC= Too Numerous To Count

Table 2: Number of fungal colonies present in termite mound soil and normal soil in different dilutions.

Sample	Dilution	Number of colonies (CFU/ml)
Normal soil	10^0	1.4×10^2
	10^{-2}	TFTC
	10^{-4}	0
	10^{-6}	0
Termite soil	10^0	6.8×10^2
	10^{-2}	TFTC
	10^{-4}	0
	10^{-6}	0

TFTC= Too Few To Count

Table 3: Number of actinomycetes colonies present in termite mound soil and normal soil in different dilutions.

Sample	Dilution	Number of colonies (CFU/ml)
Normal soil	10^0	TNTC
	10^{-1}	18×10^2
	10^{-2}	TFTC
	10^{-4}	TFTC
Termite soil	10^0	TNTC
	10^{-1}	8×10^2
	10^{-2}	TFTC
	10^{-4}	TFTC

DISCUSSION

Some of the earlier workers have shown a high diversity of bacteria and fungi found in termite mounds[9,10,11] and it has been attributed to higher moisture levels and substrate availability.[12] A similar result was obtained in the present study that the bacterial and fungal population were found to be higher in termite mound soil. The microbial biomass is inevitably transported from termite gut to termite nest with the flow of their faeces that causes a distinct pattern in the community structure.[13] The bacteria and fungi when found in soil play an essential role in nutrient transformations.[14]

Microbial population of termite mound soil was less when compared to surface soil near the mound and the microorganisms studied were bacteria, fungi and actinomycetes.[15] This was similar to the present study in the case of actinomycetes. Number of colonies of actinomycetes were less in termite soil than normal soil.

The high quantity of nutrients accumulated in termite mound soils have placed termite mound as a 'gold mine' for bacteria concentrations.[16] In the present study, bacterial population were maximum in termite mound soil when compared to fungal and actinomycetes population.

CONCLUSION

Termite mound soil were rich in bacteria and fungi and it may be due to the high moisture content. These microorganisms are important for nutrient transformations which in turn is required for plant growth and productivity.

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