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Termite Soil as Bio-Indicator of Soil Fertility

R. Nithyatharani[1], U.S. Kavitha[2]
[1]*Assistant Professor, Cauvery College for Women, Trichy, Tamil Nadu, India-620 018*
[2]*Cauvery College for Women, Trichy, Tamil Nadu, India-620 018*

Abstract: ***Termites are a common group of insects which acts as bio indicator of soil fertility. Termites play a major role in nitrogen fixation, acetogenesis, methanogenesis, soil transportation and nutrient movement. The objective of the study is to determine the physiochemical parameters of soil in comparison with termite mound soil and chemically fertilized soil and this study also deals with the isolation and identification of microorganisms from termite soil. This study also involves the action of termites in soil fertility by pot culture technique. The physical parameters such as pH, moisture, texture, electrical conductivity and chemical parameters such as carbon, nitrogen, calcium, magnesium, phosphorus and potassium showed increased value when compared with chemically fertilized soil. Organisms such as Citrobacter fruendii, Paenibacillus sp, Enterobacter sp, Lactococcus sp were isolated successfully. Pot culture technique showed that the plant grown in termite soil shows more growth compared with chemically fertilized soil. The results suggested that termite soil has more significant factors responsible for plant growth in comparison with chemically fertilized soil.***

Keywords: Micro organisms, Physiochemical parameters, Pot culture technique, Soil Fertility, Termites.

I. INTRODUCTION

Soil is the loose covering of fine particles which makes up the surface of the earth. Soil is the natural medium in which plants grow. From the soil plant absorbs water and solutes which are necessary for the growth. Soil is a complex system which includes minerals, organic matter, water, air and organisms. Soil is used by the microorganisms as habit, habitat, food, shelter, support etc. But in the current scenario, the physical parameters of the soil are highly altered due to pollution. According to the survey of 2016, India occupies sixth place in soil pollution with 78%. Of which, 34% pollution is due to the addition of chemical fertilizers, plastics and other contaminants to the soil. An earthworm is the dominant member for the soil formation processes. The termites and ants also play the major role in the nutrient recycling, movement and transportation of soil material. Termites are ecological engineers in building mounds which enhances the content of organic carbon, clay and nutrients [1, 2, and 3]. The mound soil is redistributed by erosion, affecting soil microstructure and fertility [4, 5]. Termites are social insects belonging to the group Isoptera having almost 3000 species, in which 75% are soil feeding. The termites feed mostly on plant debris as they are decomposers. The gut of termite is modified and adapted for rising of pH, oxygen and hydrogen which are important for soil chemical and physical modifications [6, 7].

The present study involves with the determination of physio chemical parameters of termite soil and to isolate and identify the micro organisms present in the termite soil. This study also deals with action of gut microbiota of termites in improving soil fertility by performing pot culture technique in comparison with chemically fertilized soil.

II. MATERIALS AND METHODS

A. Collection Of Sample

The termite mound soil was collected from the village Veeramanipatti, Musiri, Tiruchirapalli. This area is abundant with termite mounds. The sample was collected at the height of 10 cm to 25 cm.

B. Physical Parameters

Physical parameters such as pH, moisture, salinity and texture were determined [8]. pH was measured by using pH meter. Salinity is determined by electrical conductivity meter. Moisture content is measured by using touch method.

C. Chemical Parameters

Chemical parameters such as total carbon, total nitrogen, potassium, phosphorus, magnesium and calcium were estimated [8]. Nitrogen and carbon were estimated by kjeldahl method. Calcium and magnesium were estimated by atomic absorption spectrometry method. Phosphorus was estimated by spectrophotometric method and potassium was estimated by flame photometric method.

D. Isolation Of Micro Organisms

The microorganisms from soil sample were isolated by pure culture method [9]. The samples were serially diluted upto 10^{-7} dilution. The serially diluted samples were plated by using spread plate technique and incubated at 37ºC for 24 hours. After 24 hrs, the samples were plated by using streak plate technique and kept for incubation.

E. Identification Of Micro Organisms

After incubation, the organisms were identified by biochemical tests and using staining method [10].

F. Pot Culture Technique

Three pots A, B and C was taken. Pot A contains 3 kg of sterile soil. Pot B contains 2 kg of sterile soil and 1 kg of chemically fertilized soil. Pot C contains 2 kg of sterile soil and 1 kg of termite soil. Fenugreek seeds were sown and kept undisturbed for 7 days. After 7 days, the lengths of the plants were measured and compared statistically.

III. RESULTS AND DISCUSSION

The physical and chemical parameters of the termite soil are more when compared with fertilized soil which is evident from table 1. Carbon and nitrogen content are the main components in improving soil fertility and are comparatively more in termite soil than fertilized soil. The organisms such as Citrobacter fruendii, Lactococcus sp, Enterobacter sp, Paenibacillus sp were isolated successfully and their role in soil fertility is tabulated in table 2. Citrobacter sp acts as nitrogen fixing organism in fixing atmospheric nitrogen into the soil [11] and as methanogenic organism in the production of methane [12]. Lactococcus sp acts as fermentative bacteria which help in extra molecular digestion [13]. Paenibacillus sp acts as sulphur reducing organism which play a major role in the conversion of sulphur molecules into sulphur oxide form [14]. Sulphur oxide is used by the plants for their growth and metabolism. Enterobacter sp acts as methanogenic bacteria and as acidogenic bacteria which play a major role in acetogenesis [15]. Pot culture technique shows that the length of the Pot C shows more growth when compared with Pot A and Pot B and tabulated in table 3.

Parameters	Fertilized soil	Termite soil
Salinity (ds/m)	0.27	0.31
pH	7.67	7.17
Moisture content (%)	43	45
Calcium (mgg^{-1})	0.51	0.57
Magnesium (mgg^{-1})	22.09	23.01
Phosphorus (mgg^{-1})	17.03	20.13
Potassium (mgg^{-1})	36.96	39.1
Carbon (%)	48.81	51.51
Nitrogen (mgg^{-1})	11.35	14.22

Table 1 Shows the results of physical and chemical parameters of termite soil and fertilized soil.

Activity	Fertilized soil	Termite soil
Nitrogen fixing organisms	Green sulphur bacteria Azotabacter	Citrobacter fruendii
Sulphur reducing organisms	Desulfobacter sp	Paenibacillus sp
Fermentative bacteria	Lactobacillus sp	Enterobacter sp Lactococcus sp
Methanogenic bacteria	Serratia sp Acinetobacter sp	Citrobacter sp Enterobacter sp
Acidogenic bacteria	Bacillus sp	Enterobacter sp

Table 2 shows the isolated organisms from fertilized soil and termite soil.

POTS	SOIL	LENGTH (cm)
POT A	Sterile soil	8.0
POT B	Sterile soil + fertilized soil (2:1)	8.7
POT C	Sterile soil + termite soil (2:1)	8.9

Table 3 shows the results of pot culture technique.

IV. CONCLUSION

This study concludes that the microbes present in the soil in general prevents soil erosion, maintains soil quality and thus conserves more biological resources. Moreover the microbial mass creates living soil as it enhances the nutrients and organic matter. Comparing the physical and chemical parameters as well as the results of the pot experiment, this study also suggests that 2:1 ratio of sterile soil with termite soil yields higher results.

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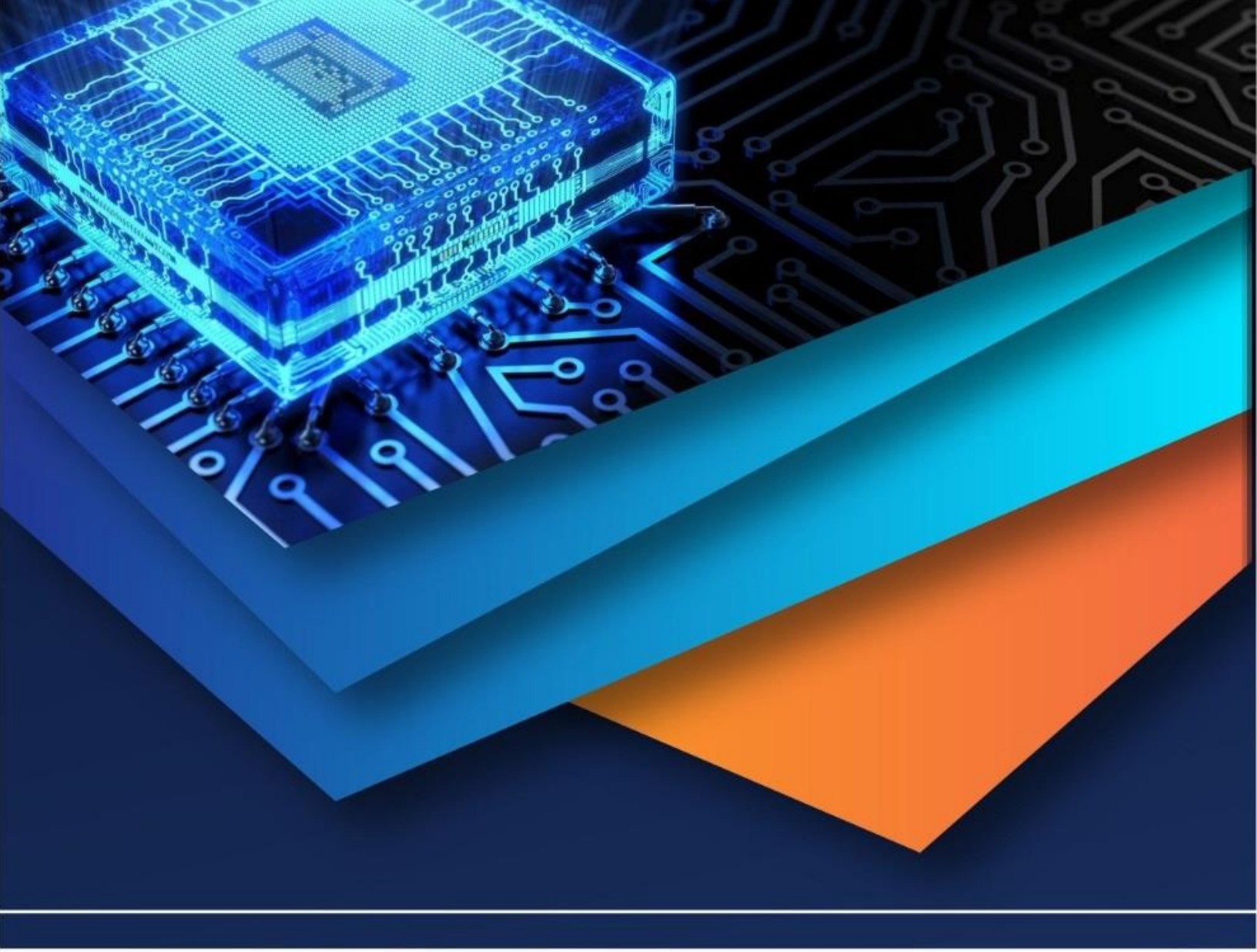

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