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PROPERTIES OF TERMITE MOUNDS AND THEIR ADJACENT SURFACE SOILS: A CASE STUDY FROM VELIDANDLA AREA, CUDDAPAH DISTRICT, ANDHRA PRADESH

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Abstract

The physical and physicochemical properties of soils of termite mounds from the Velidandla area of Andhra Pradesh were studied and compared with the corresponding adjacent surface soils. It was found that the termite mounds soil contains significantly higher organic matter content, pH, electrical conductivity and lower bulk density than that of their adjacent surface soils. The scatter diagrams illustrating various combinations of physical and physicochemical properties are sensitive enough to differentiate the termite soils and soils. The variations in the physical and physicochemical properties of termite soils and soils are attributed to the variations in associated vegetation types. The termites with necessary adaptations control and continuously modify the physical and physicochemical characteristics to maintain homeostatic equilibrium with their habitat.

Keywords: Termite mounds, organic matter, bulk density, electrical conductivity, pH.

Introduction

Termites constitute an important of soil fauna in tropical and sub-tropical regions. These insects are extremely susceptible to desiccation and maintain constant high humidity (Prasad, 1980). During the construction of their mounds, termites descend through rock fractures and carry mineral particles to the surface for their mound construction, and ground water to maintain a high relative humidity (Watson, 1972). The termites transport, repack and cement the soil particles together with their saliva and excreta during the source of mound construction. Hence the physical and chemical properties of these biologically reworked soils are different from their surrounding areas from where the materials are derived for mound construction. Varahamihira’s Brihat Samhita describes termite mound as one of the important bioindicators in exploration for ground water (Prasad, 1980) and mineral resources (Prasad and Vijayasaradhi, 1985; Prasad *et al.*, 1987). In Russia, geochemical features of termite mounds have been studied (Glazovshaya, 1984). Biogeochemical studies have demonstrated that in tropical parts of India these mounds can be used as tool in the exploration for copper (Prasad and Vijayasaradhi,1984), lead (Prasad and Sankaranna, 1987), and gold (Gopalakrishna,1993).Earlier studies have shown that the mound-building termites have a considerable influence on many soil properties (Lee and Wood, 1971). This study has been undertaken to understand the termite activity on physical and physicochemical properties of termite soils and their adjacent surface soils of barite mining area of Velidandla.

Area of the Study

Velidandla area is located in Cuddapah District, Andhra Pradesh. This study area forms part of the Lower Cuddapah super group comprising Papaghni and Chitravati Groups (Nagaraja Rao *et al.*, 1987).This area primarily consists of conglomerates, shales, basalts, dolomites and dolomitic limestones. The region falls under semi-arid or even arid belt with associated high temperatures and hence is classified as drought prone area. The average annual rainfall is 560- 600 mm. The area also experiences the effect of S-W and N-E monsoons. Termite mounds in the study area, generally found in association with different types of vegetation, soil and rock. They have varied shapes as conical, elongated, bald, and rounded even irregular. The size of the termite mounds vary from 0.5m to 2.7m in height and 1.75m to 3.72m in base diameter with different shapes

Methodology

For each termite mound, samples were collected from different parts of the exterior mound and these spot samples were combined to form a composite sample. With reference to the termite mound, the adjoining surface soils occurring in a radius of 8-10 m, unaffected by termites were collected and combined to represent a composite sample. Thus 23 termite soils occurring on basalts and their corresponding surface soils were collected. These sampled mounds include barren, monophytic and ployphytic types. Samples of soils and termite soils were oven dried at 110^o c and lightly disintegrated with mortar and pestle and then sieved to pass through 2mm sieve mesh and physical and physicochemical properties were determined (Table 1). The bulk density was determined by Wax coating method (Blake, 1965) and organic matter was estimated by loss on ignition method (Davies, 1974)

Results and Discussions

The bulk density values ranged from 1.25 to 1.65 gm/cc in termite soils and it ranged from 1.50 to 1.70 gm/cc in the adjacent surface soils. Bulk density of termite soils is generally lower than that of their adjacent surface soils, with polyphytic mounds having higher values than monophytic and barren mounds. This may be attributed to the termite activity (Ghilarov, 1962) resulting in increased porosity (Lee and Wood, 1971). Generally soils contain less than 1 to 20 percent organic matter with many types of organic compounds and their study is very complex (Rose *et al.,* 1979). The organic matter percentage ranged from 4.60 to 7.25 % in termite soils and it ranged from 2.65 to 3.24 % in the adjacent surface soils. Organic matter is generally higher in termite soils than their adjacent soils, with barren mounds having higher organic matter than monophytic and polyphytic mounds. It is attributed to the vegetative diet of termites (Bouillon, 1970) and the presence of organic materials which are used in mound construction (Arshad, 1981). The elevated amounts of carbon found in termite mound wall and foraging galleries compared with the adjacent surface soils are probably the result of faecal material and saliva being incorporated in the mound as a cementing agent (Gillman *et al.*, 1973).

Generally termite soils have higher pH than that of their adjacent surface soils. Several workers (Gokhale *et al.,* 1958; Watson, 1962; and Omo Malaka, 1977) have reported that termite soils have higher pH than the soils. The electrical conductivity (EC) of termite soils (50-150 micromhos/cm) is higher than those of

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surface soils (20-90 micromhos/cm) with monophytic mounds having higher values of EC than barren and polyphytic mounds. This may be due to weathering of minerals, and mineralization of organic matter

in the mining area. Watson (1975) has reported higher electrical conductivity in termite soils than the surface soils. Scatter diagrams were prepared among various physical and physicochemical parameters of termite soils and soils in the study area to see if any combination between two parameters would differentiate the termite soils and soils. The following combinations of scatter diagrams have been made. Bulk density Vs. organic matter; pH Vs. organic matter; and Electrical conductivity Vs. Organic are highly sensitive enough to differentiate the soils and termite soils. Similarly the Bulk density Vs. Electrical conductivity; and pH Vs. electrical conductivity is also enough to differentiate the soils and termite soils. But Bulk density Vs.pH is not of any utility in differentiating the soils and termite soils in the Vemula barite mining area. Lee and Wood (1971) have attempted to differentiate the termite soils from their adjacent surface soils by means of their chemical properties. Termites continuously modify the pedological properties of their environment by creating favourable conditions and to attain equilibrium with necessary adaptations.

Conclusions

This study reveals that generally the bulk density of termite soils is lower than that of their adjacent surface soils. Whereas the organic matter content, pH and electrical conductivity of termite soils is higher than that of their adjacent surface soils. During the course of construction of termite mounds, soil particles are selected, transported, repacked and cemented together with saliva and/or excreta (Mermat *et al.*,1984). Hence physical and physicochemical properties of these biologically reworked termite soils are different from their surrounding areas from where the soil material is derived for mound construction. The different combinations of scatter plots of physical and physicochemical properties are sensitive enough to show segregation of plots into two different groups separating soils from termite soils in Velidandla area. The variations in the physical and physicochemical properties of termite soils and adjoining surface soils are attributed to the variations in associated vegetation types and the microbial activity of the mounds. The termites with necessary adaptations control and continuously modify the physical and physicochemical characteristics in the study area.

Table 1.Physical and physic-chemical properties of Termite Soils and Surface Soils

Type of soil	Bulk density	Organic Matter	Electrical Conductivity	pH
Termite soil	1.25 to 1.65 gm/cc	4.60 to 7.25 %	50-150 micromhos/cm)	7.25- 8.15
Surface soil	1.50 to 1.70 gm/cc	2.65 to 3.24 %	20-90 micromhos/cm)	6.17-7.30

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