International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

Characteristics of Termite Mound Soils and its Adjoining Soils in and around Ippatla Asbestos Mineralized area, Kadapa District, Andhra Pradesh

L.Chandra Sekhar Reddy
Department of Geology, Loyola College, Pulivendla-516390, Kadapa District,A.P
*E Mail: chandrareddyloyola@gmail.com

ABSTRACT

An investigation on varied types of termite mounds relative to the nearby soils that are not inhabited by the termites in and around Ippatla asbestos mineralized area of Kadapa district show that the activity of the termites is increasing the contents of organic matter, electrical conductivity and pH in the termite mounds. The physical and physico-chemical properties of termite mound soils such as bulk density, organic matter, electrical conductivity and pH were studied and compared with its corresponding adjacent surface soils unaffected by termite activity. The termite mounds soil contains higher organic matter, pH and electrical conductivity than that of their adjacent surface soils, where as bulk density of termite mounds are lower than that of the surface soils. The variations in the physical and physico-chemical properties of termite soils and soils are attributed to the variations in associated vegetation types and the microbial activity of the mounds. Hence the physical and physico-chemical properties of these biologically reworked soils are different from the source material used for mound construction.

Keywords: *Termite mounds, surface soil, organic matter, bulk density, pH, electrical conductivity, Ippatla*

INTRODUCTION

Termites are common biological agents that produce significant physical and chemical modifications to tropical and subtropical soils (Lobry de Bruyn and Conacher, 1990 ; Mando *et al.*, 1996; Heikens *et al.*,2001). Termites commonly build earthen mounds of various shapes and sizes forming an important feature of the tropical landscape. Termites constitute an important component 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). They generally go through a sequence of actions, from fetching, carrying to cementing mineral particles into mounds by using their salivary secretion (Wood, 1988; Donovan *et al.*, 2001; Ndiaye *et al.*, 2004; Lopez-Hernandez *et al.*, 2006).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. The influence of termites on soils ranges from physical effects to changes in the chemical properties of soil organic matter, changes in soil texture and structural stability and C/N ratios (Lobry de Bruyn and Conacher, 1990). Biogeochemical studies have demonstrated that in tropical parts of India these mounds can be used as tool in mineral exploration (Prasad and Vijayasaradhi, 1985; Prasad and Sankaranna, 1987; Gopalakrishna,1993). The present study deals with the physical and physico-chemical properties such as bulk density, organic matter, pH and electrical conductivity of termite mounds and their adjacent surface soils in and around Ippatla asbestos mineralized area.

AREA OF THE STUDY

The study area Ippatla is located in Lingala mandal of Cuddapah district, Andhra Pradesh and lies between latitude 14° 25' 58"N, and longitude78° 10' 41"E. This area is included in the Survey of India toposheet No. 57J/3. This study area forms part of the Lower Cuddapah super group comprising Papagni and Chitravati groups (Nagaraja Rao *et al.,*1987).Geologically major part of the area is occupied by basalts,dolomites, limestones, dolomitic limestones and shales. The major minerals in this area are asbestos and serpentines. Earlier workers discussed the hydrochemical studies on this area (Chandra Sekhar Reddy and Ramana Reddy, 2011).

MATERIALS AND METHODS

Eighteen pairs of samples were collected in different localities from the study area. Each pair of samples represents a termite-affected material taken from different parts of the mound/nest and these spot samples were combined to form a composite sample. With reference to the termite mound, the corresponding soil sample taken 10-12 meters away from mound without significant termite activity and these spot samples also were combined to form a composite sample. Thus termite mound soils and their corresponding surface soils were collected. Samples of soils and termite soils were oven dried at 110^0 C and lightly disintegrated with mortar and pestle and then passed through 2mm sieve mesh and the physical (bulk density and organic matter) and physico-chemical (pH and electrical conductivity) properties were determined (Table 1). This study has been undertaken to know the termite activity on physical and physico-chemical properties of termite soils and surface soil

RESULTS AND DISCUSSIONS

Bulk Density

Bulk density was determined by Wax coating method (Blake, 1965). Bulk density of termite soils and their adjacent surface soils are given in Table 1. Bulk density of termite soils ranges from 0.35 to 1.36 gm/cc. and that of adjacent soils 0.95 to 1.72 gm/cc. From the data (Table 1.), it is clear that the bulk density is lower in termite soils than their adjacent surface soils. This may be attributed to the termite activity (Maldague, 1964) resulting increased porosity (Lee and Wood, 1971). In the study area, most of the termite mounds are colonized with vegetation.

Organic matter

Organic matter content was determined for both termite mound soils and adjoining surface soils followed by loss on ignition method (Davies, 1974). The organic matter percentage of termite soils ranges from 0.75 to 4.10 and that of adjacent soils 0.48 to 2.86. The termite soils have higher organic matter than their adjacent surface soils. This is due to the vegetative diet of termites and the use of their saliva and excreta in mound construction (Mermut *et al.,*

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

1984). Earlier studies have also revealed higher organic matter in termite soils than their adjacent soils (Lobry de Bruyn and Conacher, 1995). Anderson and Wood (1984) stated that the selection of large, defined food sources by termites, such as leaf litter or rotten wood, can result in a higher proportion of organic matter in the mounds. Termite activity increases the content of organic matter in the soils that they use for the construction of their nests and also modifies the clay mineral composition of these soil materials (Jouquet *et al.*, 2002; Roose Amsaleg *et al.*, 2004).

Table 1. Physical and physico-chemical characteristics of Termite soils (Ts) and Surface soils (Ss) of Ippatla area

S.No	Bulkdensity (gm/cc)		Organic matter %		Ph		Electrical conductivity (EC) (micromhos/cm)	
	Termite soils	Surface soils	Termite soils	Surface soils	Termite soils	Surface soils	Termite soils	Surface soils
1	0.35	0.95	1.88	0.85	8.6	8.0	275	215
2	1.14	1.24	3.18	2.26	7.8	7.2	300	250
3	1.22	1.37	4.60	2.71	7.9	7.1	86	65
4	1.36	1.68	3.75	2.58	6.8	6.0	256	195
5	1.32	1.54	2.15	1.94	6.5	6.4	320	290
6	1.25	1.70	3.29	2.00	8.6	7.2	85	78
7	1.15	1.72	1.92	1.20	6.6	6.1	120	98
8	1.12	1.42	2.66	1.09	7.5	7.1	74	39
9	1.35	1.59	1.90	1.52	6.8	6.2	285	170
10	1.19	1.56	2.98	2.04	6.6	6.4	98	75
11	1.21	1.42	4.55	2.62	7.3	6.2	400	260
12	1.23	1.38	3.15	2.20	7.9	6.4	86	54
13	1.30	1.12	2.70	1.56	8.2	7.9	53	40
14	1.33	1.60	4.10	2.86	7.5	7.3	162	95
15	1.27	1.48	2.75	1.15	7.6	7.4	225	196
16	1.06	1.52	0.75	0.49	8.9	7.8	320	270
17	1.12	1.70	2.75	0.48	7.8	6.7	130	105
18	1.14	1.66	1.90	1.02	6.9	6.7	85	72
Min	0.35	0.95	0.75	0.48	6.5	6.0	53	39
Max	1.36	1.72	4.10	2.86	8.9	8.0	400	290

pH

pH of termite soils and their adjacent surface soils are represented in Table 1. pH of termite soils ranges from 6.5 to 8.9 and that of adjacent soils 6.00 to 8.00. In general termite soils have higher pH values than surface soils. Earlier workers (Boyer, 1955; Watson, 1970; Mermut *et al.,* 1984) have reported that the termite soils have higher pH than the adjacent soil. In most cases, the termite soils are weakly acidic to slightly alkaline, whereas most of the corresponding surface soils are weakly acidic.

Electrical conductivity (EC)

Generally, the electrical conductivity (EC) of termite soils (53-400 micromhos/cm) is significantly higher than those of surface soils (39-290 micromhos/cm). This may be due to weathering of minerals, and mineralization of organic matter in this study area. The nature of the salts present in the soil depends upon the composition of the rock weathered, nature of weathering process and the subsequent reactions that occur as the salts are moved from the site of weathering to place of deposition. Watson (1975) has reported higher EC in termite soils than their corresponding surface soils.

CONCLUSIONS

This study revealed that the bulk density of termite soils is generally lower than that of their adjacent soils. The organic matter content, electrical conductivity and pH of termite soils is higher than that of adjacent soils. The variations in the physical and physico-chemical properties of termite soils and soils are attributed to the variations in associated vegetation types and the microbial activity of the mounds. 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 the physical and physico-chemical properties of these biologically reworked soils are different from the source material used for mound construction. Data presented in this study indicate that the presence of ants modifies the physical and physico-chemical properties of soils.

REFERENCES

Anderson, J.M. and Wood, T.G., (1984). Mound composition and soil modification by two soil feeding termites (Termitinae, Termitidae) in a riparian Nigerian forest. Pedobiologia., Vol. 26, pp 77-82.

Blake, G.R., (1965). Bulk density. In: Methods of soil analysis. Part-1 (Ed.C,R,Black) American Soc., Agron,Madison, WI, pp.375-390.

Boyer, P., (1955). Premierers etuds pedologiques et bacteriologiques des termitieres C.r. hebd. Scanc. London, 216p.

Chandra Sekhar Reddy, L. and Ramana Reddy, K.V. (2011). Hydrochemistry and groundwater quality with special reference to nitrate: A case study from Ippatla, Kadapa district, Andhra Pradesh. Vol.1 (9), pp.149-151.

Davis, B.E.(1970).Termites of Ethiopain region. In: Biology of termites (Eds: K.Krishna and F.M. Weesner), Academic press, New York., Vol.2, pp.153-280.

Donovan, S. E.; Eggleton, P.; Dubbin, W. E.; Batchelder, M.; Dibog, L. (2001). The effect of a soil feeding termite, *Cubitermes fungifaber* (Isoptera: Termitidae) on soil properties: Termites may be an important source of soil microhabitat heterogeneity in tropical forests. Pedobiologia, Vol.45 (1), pp 1-11

Gopalakrishnan, R., (1993). Exploration for gold using termitaria. Current Science.Vol.65, No.2, pp. 168-169.

Heikens, A.; Peijenburg, W. J. G. M.; Hendriks, A. J., (2001). Bioaccumulation of heavy metals in terrestrial invertebrates. Environ. Pollut., Vol.113 (3), pp 385-393.

Jouquet, P.; Mamou, L.; Lepage, M.; Velde, B., (2002). Effect of termites on clay minerals in tropical soils; fungus-growing termites as weathering agents. Eur. J. Soil Sci., Vol.53 (4), pp 521-527.

Lee, K.E. and Wood, T.G., (1971). Termites and Soils. Academic Press, London, 251p.

Lobry de Bruyn, L.A. and Conacher, A.J. (1995). Soil modification by termites in the central wheat belt of Western Australia. Aust. Jour. Soil Res, Vol.33, pp.179-193.

Lobry de Bruyn, L.A.and Conacher, A.J., (1990). The role of termite and ants in soil modification: a review. Aust. Jour. Soi Res., Vol.28, pp.55-93.

Lopez-Hernandez, D.; Brossard, M.; Fardeau, J. C.; Lepage, M., (2006). Effect of different termite feeding groups on P sorption and P availability in African and south American savannas. Biol. Fert. Soils, Vol.42 (3), pp 207-214.

Maldague, M.E., (1964). Importance des populations de termites dans les sols equatoriaux. Trans. 8th Int. Congr. Soil Sci, Buchatest, Vol.3, pp.743-751.

Mando, A.; Stroosnijder, L.; Brussard, L., (1996). Effects of termites on infiltration into crusted soil. Geoderma, Vol,74 (1- 2), pp 107-113.

Mermut, A.R., Arshad, M.A. and Arnand, R.J., (1984). Micropedological study of termite mounds of three species of Macrotermes in Kenya. Soil .Sci. Soc. American Jour., Vol. 48, pp. 613-620.

Nagaraja Rao, B.K., Rajurkar, S.T., Ramalingaswamy, G. and Ravindra Babu, B. (1987). Stratigraphy, structure and evolution of the Cuddapah Basin. Geol. Soc. India, Mim., Vol.6, pp.- 33-86.

Ndiaye, D.; Lepage, M.; Sall Cire, E.; Brauman, A., (2004). Nitrogen transformations associated with termite biogenic structures in a dry savanna ecosystem. Plant. Soils, Vol.265 (1-2), pp 189-196.

Prasad, E.A.V. and Sankaranna, G., (1987). A biogeochemical aspect of the termite mounds from base metal mineralization of Agnigundala, Andhra Pradesh. Geobios, Vol.14 pp. 80-83.

Prasad, E.A.V. and Vijayasaradhi, D., (1985). Biogeochemistry of chromium and vanadium from mineralized zones of Kondapalli and Putrela, Krishna District, Andhra Pradesh. Jour. Geol. Soc. India.,Vol.26, pp.133-136.

Prasad, E.A.V., (1980). Ground water in Varahamihira's Brihat Samhita. Department of Geology, S.V.University, Tirupati, A.P, 351p.

Roose Amsaleg, C.; Brygoo, Y.; Harry, M., (2004). Ascomycete diversity in soil-feeding termite nests and soils from a tropical rainforest. Environ. Microbiol., Vol.6 (5), pp 462- 469.

Watson, J.P., (1970). Contribution of termites to development of zinc anomalies in Kalahari sand. Trans. Inst. Min. Metall.,Vol.79, pp.53-59.

Watson, J.P., (1972). The distribution of gold in termite mounds and soils at a gold amomaly in Kalahari sand. Soil Sci., Vol.113, pp.317-321.

Watson, J.P., (1975). The composition of termite (Macrotermes SPP) mounds on soil derived from basic rock in three rain fall zones of Rhodesia, Geodera, Vol.14, pp. 147-158.

Wood, T. G., (1988). Termites and the soil environment. Biol. Fert. Soils, Vol.6 (3), pp 228-236.