Termite Transformations: Revealing Soil Secrets Through Comparative Analysis

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Abstract *— The study examines the physical, chemical, and biological properties of termite-affected and regular soil. It found that termite soil is slightly more acidic, loamy clay, and has higher water retention capacity than normal soil. Nitrogen content and microbial activity also differ between the two types. The study also found that termite soil has a pH of 8.7, indicating a more alkaline nature. However, soil and chloride tests did not show significant differences. The study provides insights into the ecological role of termites in soil modification and has implications for soil conservation and management practices.*

Keywords *— Termite soil, normal soil, soil analysis, physical properties, chemical properties.*

I. Introduction

Soil quality is a critical factor influencing agricultural productivity, ecosystem health, and sustainability. Various biological agents, including earthworms, ants, and termites, can modify soil properties significantly. Among these, termites (Order Isoptera) are particularly influential due to their nest-building and foraging activities [1]. Termites create extensive networks of tunnels that aerate the soil, enhance water infiltration, and redistribute organic matter and minerals [2].

Termite mounds often exhibit distinct soil characteristics compared to adjacent, non-termite soils. Such differences can manifest in parameters like pH, texture, nutrient availability (especially nitrogen and potassium), and microbial community composition [3]. While termite-modified soil may offer benefits such as improved water retention and enhanced nitrogen content, it may also exhibit nutrient imbalances, for instance in potassium [4]. Understanding these modifications can help farmers and land managers harness the positive effects of termite activity for soil improvement while addressing any deficiencies through targeted amendments [5]. In this study, we compare termite-affected soil (T) and nearby normal soil (N) to explore their physicochemical and microbial attributes. The results have implications for both sustainable agriculture and ecological conservation, providing insights into how termite activity can be integrated into soil management strategies.

Fig. 1: Kundum (M.P.) Map - Link for the map

II. Materials and Methods

Study Area and Sample Collection

- **Location: Fig. 1.** Soil samples were collected from a termite mound (Termite Soil, T) and an adjacent non-termite area (Normal Soil, N) in Kundum near Jabalpur (M.P.).
- **Depth**: Samples were taken from the top 10–15 cm to capture the root zone.
- **Storage**: The samples were air-dried before laboratory analysis.

Laboratory Analysis

- **pH Measurement:** A soil-water suspension (1:2 ratio) was prepared and left to stand for 30 minutes.
- **Soil Texture:** Determined via the feel method to classify samples as loamy clay, silt clay loam, etc.
- **Water Retention Capacity:** Each soil sample was saturated, drained to field capacity, and weighed to calculate the percentage of water retained relative to dry soil weight.

- **Nitrogen Content:** A qualitative Nessler's reagent test was used. Color changes (dark brown vs. brown) provided an indication of relative nitrogen levels.

- **Potassium Test:** Lower levels in termite soil highlight the need for supplementation if used for crop cultivation.

- **Microbial pH:** Soil slurries were incubated for 24–48 hours and then tested for any shift in pH, reflecting microbial metabolic activity.

- **Carbonate Presence:** A few drops of dilute acid were added to the soil. Bubble formation indicated the presence of carbonates.

- **Humus Test:** Hydrogen peroxide was added to assess organic matter decomposition. Bubble formation indicated active humus decomposition.

- **Chloride Test:** Silver nitrate solution was added to the soil extract; results were noted as either indicated or not indicated for chloride presence.

- **Yeast Test:** Soil was mixed with a yeast culture to observe fermentation (foam or gas formation), indicating available nutrients and microbial-favourable conditions.

- **Yogurt (Microbial) Test:** Soil samples were added to milk cultures. The rate and extent of curd formation suggested the overall microbial load.

- **Leaf Decay Test:** Dried leaves were partially buried in soil samples to observe decomposition rates over a set period, indicating microbial activity related to organic matter breakdown.

III. RESULTS

Table 1: Presents a summary of the comparative results for termite soil (T) and normal soil (N).

Parameter	Termite Soil (T)	Normal Soil (N)
pH	~7	~7.5
Soil Texture	Loamy clay	Silt clay loam
Water Retention	~40%	~37.5%
Nitrogen (Coloration)	Dark Brown	Brown
Potassium	Low	High
Microbial pH	~8.7	~6.5–6.9
Carbonate Presence	Bubbles observed	No bubbles
Humus Test	No significant change	Bubbles (indicative of decomposition)
Chloride Test	Not indicated	Not indicated
Yeast Test	High	Low
Yogurt (Microbial) Test	Suggests higher microbial load	Suggests lower microbial load
Leaf Decay Test	Lower microbial load	Higher microbial load

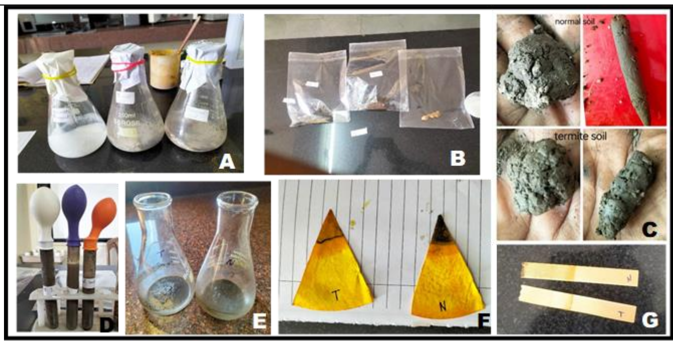

Fig.2: Images of Tests - A: Yogurt (Microbial) Test; B: Leaf Decay Test; C: Soil Texture; D: Yeast Test; E: Microbial pH; F: Potassium Test; G: pH Measurement

IV. DISCUSSION

In the results significant differences between termite soil and normal soil is seen. Termite soil (T) exhibited a near-neutral pH (~7) but a higher microbial pH (~8.7), suggesting that termite-driven processes create alkaline microenvironments favourable for certain microbes [6]. Normal soil (N) was slightly more alkaline in general pH (~7.5) but showed a lower microbial pH (~6.5–6.9). Termite soil had a loamy clay texture, retaining approximately 40% water, beneficial for water-scarce regions [7]. Normal soil, classified as silt clay loam, held slightly less water (~37.5%). Dark brown coloration in termite soil indicates higher nitrogen availability [8]. Lower levels in termite soil highlight the need for supplementation if used for crop cultivation. Termite soil showed bubble formation when acid was added, indicating carbonate presence, possibly from termite mound materials or biochemical processes [9]. Normal soil exhibited stronger bubbling with hydrogen peroxide, suggesting more active humus decomposition. The yogurt and yeast tests pointed to a higher microbial load in termite soil. This can be advantageous for nutrient cycling, but the leaf decay test showed faster decomposition in normal soil, suggesting different functional microbial communities in each soil type [10]. Overall, termite soil appears to offer enhanced moisture retention and potentially better nitrogen status but may require targeted potassium amendments. Its distinct microbial ecology, indicated by the alkaline environment and diverse microbial load, can influence plant–microbe interactions, potentially affecting crop productivity in both positive and negative ways.

V. CONCLUSION

Termite-affected soil displays unique physicochemical and microbial properties compared to nearby normal soil. Key advantages include improved water retention and favorable nitrogen indicators, while lower potassium content necessitates appropriate fertilization strategies. The higher microbial load in termite soil could be leveraged for sustainable agricultural practices, although variations in microbial functions (e.g., leaf decay) imply that soil management must be crop- and site-specific. These findings underscore the ecological significance of termites as soil engineers. Future research should explore long-term field trials, the specific microbial communities in termite mounds, and practical ways to integrate termite soil properties into broader soil management frameworks for enhanced productivity and ecosystem health [1; 3].

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