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A Detailed exploration on termites (Isopteran; Termitidae) Ecology of vegetative gradient in Gulbarga University Campus, Kalaburagi

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Abstract
Termites are social insects belonging to the order Isoptera; it exhibits polymorphism and showing various ecologically important activities along with some destructive activities as they usually feed upon wooden structures. The present investigation yielded in recording of 2 different species of termites belonging to the genus *Odontotermes* (Family: Termitidae) namely, *Odontotermes wallonensis* and *Odontotermes brunneus* from Gulbarga University campus, Kalaburagi. Soil samples collected from the mounds represented by *Odontotermes wallonensis* of different soil types were analyzed for Physio-chemical parameters such as elemental analysis and pH was also recorded. During the study, analysis of 40 termite mounds where done which showed the dominance of *Odontotermes wallonensis* in the taken study area.

Keywords: Ecology, Termites, Kalaburagi, Physio-Chemical characters, Mount soil sample

Introduction

Termites are small, white or brownish terrestrial social insects exhibiting very well-organized polymorphism, categorizing into fertile caste (workers, soldiers, king, and queen) and the sterile caste belonging to order isopteran originated nearly 100 million years ago. Termites are often known as 'kashtaharika' or wood-feeders as per the ancient Sanskrit literature, also termites are commonly named as white ants, 'Udai' or 'deemak'. A total of 3106 species of termites have been described (Sudipta *et al.*, 2017) [14] of which only 371(12.4%) have been reported as destructive and only 104 (3.5%) are considered as serious pests. Bose (1994) reported 95 species of termites belonging to 5 families from southern India. Termites are usually known for their destructive nature as they cause severe damage to the wooden structures but they play vital role in ecosystem by recycling of plant nutrients because of their detritivore's nature and consuming dead plant materials at any level of decomposition (Pooja *et al.*, 2017). Economically termites are not only the serious pests of agriculture and plantations but also, they cause enormous damage to structural wood in different types of houses in all tropical and subtropical countries (Bignell and Eggleton, 1998 & 2000; Qaseem 2015) [12]. Subterranean termites foremost harmful wood tormentor within the world, build their colonies within the soil and frequently work their means on top of the bottom to achieve wood or any other cellulose source.

Present investigations carried out in the campus of the Gulbarga University, Kalaburagi from Jan 2018 to May 2018 to determine the termite diversity and distribution which also involved the analysis of physio-chemical parameters of the mound.

Materials and methods

Study area

The Gulbarga University campus is situated on 860 acres of land 6 kilometers east of Kalaburagi city at an elevation of 1556ft., (17˚18˙46" N latitude and 76˚52˙32" E longitude). The study area exhibits dry deciduous type of vegetation were temperature ranges from 20˚C to 45˚C with average rainfall of about 750mm.The study area was divided into 5 blocks (Fig 1) such as:

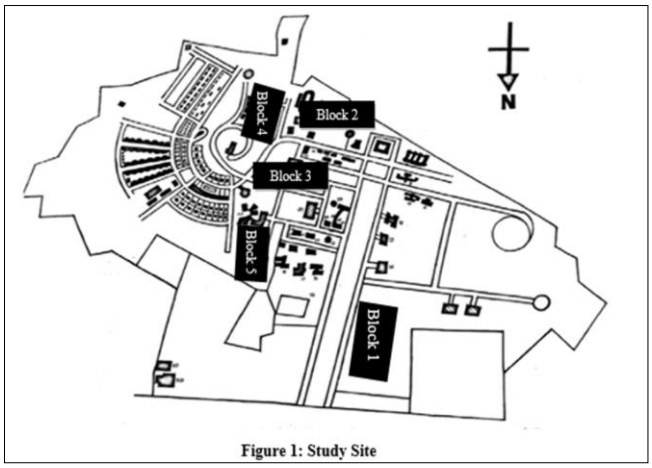


Fig 1: Study site

Block 1: University 1st gate to boy's hostel surrounding area.
Block 2: Administrative block to Arts department and Sports department surrounding
area.
Block 3: Girls Hostel front and back area.
Block 4: Guest House and quarters surrounding area.

Block 5: Botanical Garden and surrounding departments Chemistry, Botany, Physics,
Microbiology, Biochemistry, Biotechnology, material science and USIC

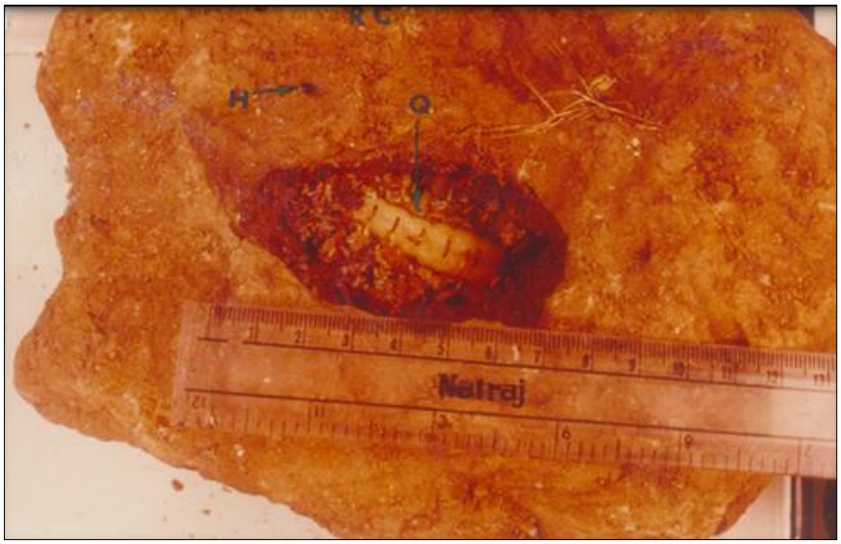
Department
Collections were carried out weekly from Jan 2018 to May 2018 by Quadrate method and Lines transect sampling method (Plate 1-3). Termites were collected and preserved in 70% alcohol for further identification. Later different casts from each species were photographed by stereo zoom microscope.

Analysis of Physio-chemical parameters of termite mounts soil
A total of 3 representative mounds were selected based on nesting soil type (Red, Black and Grey) of Block 1 and 2. Later pH of the soil samples from different mounds determined electrometrically using glass electrode pH meter. The elemental analysis of termite mound soil was carried out at USIC department, Gulbarga University, Kalaburagi.

Results
Survey and distribution of termites: There are 2 different species of termite's namely *Odontotermes wallonensis* and *Odontotermes brunneus* belonging to family Termitidae were dominantly found in different sites of the campus (Plate 4-8). During the present study worker, soldier and queen were observed and recorded. The percentage of occurrence was more with *Odontotermes wallonensis* (57.5%) followed by *Odontotermes brunneus* (42.5%) from the forty recorded nest. The measurements of termite mount were made to analyze variation in nest formation and species specificity (Table 1).

Analysis of Physio-chemical parameters of termite mounts soil: The physio-chemical parameters of different termite mound soil varied with respect to pH, K, Mg and Mn. Manganese was highest in all type of soil samples compared to potassium and magnesium. The pH of all the soil samples is towards basic ranging between7.92 to 8.23 (Table 2).

Plate 1: Vertical section of the mound of *O.wallonensis* showing scattered fungus Combs And royal chamber with queen in the base of the mound.



RC = Royal chamber; Q = Queen; H = Holes

Plate 2: Showing vertical section of the royal chamber with queen inside. Royal Chamber of the termite *O. wallonensis* shown with an arrow mark.

Plate 3: Showing nymphs of the reproductive caste of the termite *O. wallonensis*. Showing small wing pads to the nymph

Plate 4: Showing nursery vaults excavated from the established nests of the Termite *O. wallonensis*

Plate 5: Nest of *O. brunneus* with scattered turrets having open holes on the Turrets, Gulbarga University Campus, Gulbarga

Table 1: The height, diameter and temperature of the mound nest of the termites.

Sl.no.	Height (FT)	Diameter(FT)	Temperature(^{0}c)
1	5.5	20	31
2	4	15.5	29
3	3.5	25.5	30
4	4	17	32
5	3.6	15	30
6	6	30.5	31
7	1	33	30
8	2	12.5	32
9	2	22	33
10	1.5	11	34
11	6.6	21.6	34
12	5	17	27
13	3	6.7	26
14	4	8	29
15	3	6.8	29
16	1.5	3.5	31
17	3	7.6	32
18	4.5	15	28
19	3.5	8	29
20	4.6	10	31
21	4	9	30
22	3.5	7	31
23	4	7	31
24	5	11.7	33
25	6	13	30
26	5.5	18	31
27	5	11	32
28	3	7.6	33
29	4.9	28.5	33
30	0.5	11.6	34
31	7	35	33
32	5	27.6	33
33	4.5	27	31
34	2	14	31
35	1.5	10	30
36	5	18	30
37	7	31	29
38	7	20	31
39	5	16	31
40	4	18	30

Table 2: Analysis of Physio-chemical parameters of different termite species soil samples.

Sl. No	Termite species	Soil type	pH	K(mg/l)	Mn(mg/l)	Mg(mg/l)
1.	*Odontotermes wollenses*	Red soil	7.92	8.772	23.539	4.134
		Black soil	8.11	8.427	23.539	4.173
		Grey soil	8.23	8.768	23.539	4.202

Discussion

In Gulbarga university campus there are several types of termite mound were identified such as dry and moist mounds. Termites act both beneficial and harmful to the environment. The harmful effects are they damage crops, properties, and trees; they are beneficial to the ecosystem which enriches the soil fertility. The study area is one of the best places for the termites as it provides a good habitat for the termites. It provides food and shelter for the termites. It is because the atmospheric moisture throughout the year is around 60-80%, additionally plenty of food in terms of cellulolytic material is available. Only 2 species were identified. Observations made on the physicochemical characters of the mounds nest and graphical representation is shown as Graph No. 1- 7. Difference in the height and diameter of mound also depends on the disturbance caused by human beings, rainy winds, foraging domestic and wild herbivore, which destroys these mounds, consequently they reproduce again and again by the workers. As the termite queen grows year by year in length and weight, her fecundity is also enhanced. Thus, the growth of the queen and the enhancement of the fecundity year by year are the root cause of the increase in the population and resultant changes in the dimensions of mound nest and weight of the fungus comb. The mother queen during copulation stores a large number of sperms in her sperm theca and uses them whenever required.

In the present study area, a total of 5 transects were surveyed for the termite mound. The mounds belong to *Odentotermes wallonensis* are constructed largely on the earth surface among these nests maximum mounds were witnessed in botanical garden and minimum at guest house. It may be because botanical garden is a fully vegetative area with loose soil and undisturbed. It protected by fencing hence number of mounds were recorded in contrast. Whereas the guest house area is hilly terrain with disturbance by the devotees, staff, and guest hence a smaller number of mounds was recorded in the entire study. A single wood-boring mound was noticed. A future study on the species of the termites in the study area is required.

Conclusion

In the Gulbarga university campus, the habitat changes have led to the strong modifications of the termite community in terms of the species richness, species composition, biomass, and density. As the sampling in this study was restricted to the soil, the species richness in this report is probably underestimated to a certain extent. Sampling from various niches within the habitats like logs, busy landmass, and etc. anthropoid disturbance strongly affects the functioning of the natural ecosystem through modifications of vegetation, soil properties, and soil fauna communities.

Our synthesis is intended to identify knowledge gaps regarding the controls on termite abundances and distributions and to put into perspective why an understanding of their abundances is needed to project vegetation and function accurately. The *Odontotermes wallonensis* is dominant and distributed throughout the campus. The Physio-Chemical parameters of various termite mound nest soil varied with respect to the different soil type. Mn is comparatively higher than other constituents K and Mg. pH was basic and Potassium content was in normal range with respect to soil fertility. A key conclusion is that the lack of data on the ecology of termites in dry regions is a barrier to generalized, major conceptual advances for this insect guild. Thus, we must emphasize the critical need for further study of these species in non-urban, intact ecosystems, with a particular focus on their assistance identifying termites.

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