



## Short Communication

# A Note on Diversity of Termites in Taxila, Rawalpindi, Pakistan

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### ABSTRACT

Four termite species, i.e. *Odontotermes horai*, *Odontotermes obesus*, *Coptotermes hemi* and *Microtermes unicolor* were recorded from soil cores and trees of Taxila, district Rawalpindi, Pakistan, examined. *Odontotermes horai* was the most abundant species, followed by *Coptotermes hemi*, *Microtermes unicolor* and *Odontotermes obesus*. The Simpson and Shannon's indexes of diversity reflected that diversity was 70% and 99%, respectively, in case of soil sampling and the diversity was 59% and 99% on the Simpson and Shannon scales, respectively, in tree sampling. Berger-Parker diversity index revealed that diversity was highest at Palar Top, followed by Khurram Paracha, Garhi Afghana whereas lowest diversity was estimated from Usman Khattar.

### Article Information

Received 1 December 2014  
Revised 20 October 2015  
Accepted 6 March 2016  
Available online 1 June 2016

### Authors' Contribution

MM conceived the idea, designed the experiments and wrote the article. KN conducted the experimental work. MN helped in the identification of termite species, while MFN analyzed the data.

### Key words

Termite, relative abundance, *Odontotermes* sp., *Microtermes* sp.

Termites are social insects that live in colonies; which may consist of several hundreds to over a million individual termites. Diversity of termite may provide a variety of ecosystem services; such as decomposition of different materials, cycling of carbon and nitrogen, soil structuring and stimulation of microbial activity at different levels (Lavelle *et al.*, 1997; Sugimoto *et al.*, 2000; Donovan *et al.*, 2002). They also help to promote biodiversity by creating suitable conditions for plants and other biota (Korb, 2008). In addition to the ecosystem services, a number of termite species are economically important pests of agricultural crops, forest plantations and the wood components in the buildings (Ahmed *et al.*, 2006).

Till today, some 2650 species of termites belonging to 280 genera and placed in seven families have been reported worldwide (Kambhampati and Eggleton, 2000). The highest diversity and abundance of termites has been found in African, South American and Southeast Asian rain forest ecosystems (Collins, 1988; Bignell and Eggleton, 1998). The termite fauna of Pakistan consists of four families (Kalotermitidae, Hodotermitidae, Rhinotermitidae and Termitidae), 16 genera and 53 species (Ahmad and Akhtar, 1994). Comprehensive studies about different species, relative abundance and distribution in different localities of Pakistan have not been properly carried out. Keeping in view the economic importance of termites, this research study was designed to investigate the diversity of termites in rural areas of

Taxila, Rawalpindi. The specific objectives of this research study were to explore the diversity, distribution and abundance of termites in the study area.

### Materials and methods

This research study was conducted in tehsil Taxila (33° 44' and 72° 49'), a historical and an important archeological site, situated about 30-kilometers North-West of Islamabad and Rawalpindi, Pakistan. Sampling of termites was carried out from soil and trees. For studying the termite diversity in the soil, 200 soil core samples (30 x 30 x 30 cm each) were taken from four localities (Palar Top, Usman Khattar, Garhi Afghana and Khurram Paracha; 50 samples from each locality) of the study area. Each soil core was minutely observed for presence of termites and, if present, all the termites were counted and preserved in 80% alcohol in a sampling vial. For studying the termite diversity in tree plantation, a plot of 200 x 200 m was selected at each of the four localities, mentioned above, and a thorough survey was conducted for all the trees (n = 168) in the sampling area. Each tree was examined for termite infestation. In case of infestation, the termite specimens were collected from trunk, bark and wood debris of all the infested trees with a camel hair brush and were counted and preserved for identification. The termites were identified following Akhtar (1983).

Diversity of different termite species on the Simpson and Shannon indices was worked out according to Simpson (1949) and Shannon-Weiner function (Odum, 1975). In order to calculate the locality effect on the diversity of termites, Berger-parker index (d) was calculated through equation:  $d = N(\max) / N$

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0030-9923/2016/0004-1213 \$ 8.00/0

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**Table I.- Diversity index of number of individuals of different termite species collected from 200 soil cores and different trees (n=168) from Taxila, Rawalpindi during the year, 2013.**

Species	Trees	Portion	No. of termites	Percentage	Pi	Simpson's index $\pi_2 \times X$	Shannon's index $Pi (\log \pi_i) \times S$
<b>Soil Cores</b>							
<i>Microtermes unicolor</i> (Termitidae)	<i>Dalbergia sissoo, Morus alba</i>	Wood debris, Trunk	95	17.14	0.1714	0.0294	0.1031
<i>Odontotermes obesus</i> (Termitidae)	<i>Dalbergia sissoo, Morus alba</i>	Trunk	94	16.96	0.1696	0.0287	0.1021
<i>Coptotermes heimi</i> (Rhinotermitidae)	<i>Dalbergia sissoo, Morus alba, Broussonetia papyrifera</i>	Trunk, wooden debris	125	22.56.	0.2256	0.0509	0.1358
<i>Odontotermes horai</i> (Termitidae)	<i>Dalbergia sissoo</i>	Dead portion of trunk, bark	240	43.32	0.4332	0.1876	0.2607
			554	100	1.0	D=0.2966, 1-D =0.7034	H= 0.6017
<b>Trees</b>							
<i>Microtermes unicolor</i> (Termitidae)	<i>Dalbergia sissoo, Morus alba</i>	Wood debris, Trunk	72	13.06	0.1306	0.0170	0.0786
<i>Odontotermes obesus</i> (Termitidae)	<i>Dalbergia sissoo, Morus alba</i>	Trunk	143	25.95	0.2595	0.0673	0.1562
<i>Coptotermes heimi</i> (Rhinotermitidae)	<i>Dalbergia sissoo, Morus alba, Broussonetia papyrifera</i>	Trunk, wooden debris	309	56.07	0.5607	0.3143	0.3375
<i>Odontotermes horai</i> (Termitidae)	<i>Dalbergia sissoo</i>	Dead portion of trunk, bark	27	4.90	0.0490	0.0024	0.0294
			551	100	1.0	D=0.4010, 1-D =0.5989	H= 0.6017

E-H /Log S=0.6017/0.6020 =0.9962

**Table II.- Berger-Parker Index for diversity index of the termite species recorded in the soil samples of different localities in the Taxila, Rawalpindi during 2013.**

Locality	Total number of termites (N)	Max. abundant termite species ( $N_{max}$ )	Berger Parker Index $D=N_{max}/N$	1/d
Khuram Paracha (n=50)	152	66	0.43	2.32
Palar Top (n=50)	205	63	0.30	3.33
Usman Khattar (n=50)	89	70	0.78	1.28
Garhi Afghana (n=50)	77	42	0.54	1.85

Where N is total number of termites of all the species and  $N_{max}$  is number of termites of the most abundant species in the area.

### Results

The results on the diversity of termites in different areas of Taxila, District Rawalpindi indicated that four species of termites i.e., *Odontotermes horai*, *Odontotermes obesus*, *Microtermes unicolor* (Family Termitidae) and *Coptotermes heimi* (Family Rhinotermitidae) were recorded from the soil cores (n =

200) and different trees examined (n = 168; Table I). Relative abundance of different termite species revealed that *Odontotermes horai* (45.88%) was the most abundant termite species in the current study area, followed by *Coptotermes heimi* (19.5%), *Microtermes unicolor* (18.16%) and *Odontotermes obesus* was the least recorded species (17.97%). In case of the termite diversity from the soil, out of 200 soil cores, 18 were found to be infested with termites (9%). Out of 168 trees, which were examined for termite infestation, 23 (13.69%) were found infested. The highest infested tree

species was *Dilbergia sissoo* (32.5%), followed by *Morus alba* (21.62%) and the least infested tree was the *Broussonetia papyrifera* (6.66%); remaining tree species (*Acacia modesta*: n=5, *Callistemon lanceolatus*: n=6, *Eucalyptus comadulensis*: n=24, *Melia azedarach*: n=7, *Populus* spp.: n = 13, *Acacia Arabica*: n=6) were having no infestation by the termites.

In case of the soil cores, a total of 554 individuals of the four termite species were collected (Table I). Simpson and Shannon's diversity indices reflected that on Simpson's index, the overall diversity (1-D=0.7034) was 70.34% and it was 99% in case of the Shannon scale. *Odontotermes horai* was the most dominant species with a value of 0.4332 on Simpson's index. As regards the diversity of termites from the examined trees, same four species were recorded (Table I). A total 551 individuals were collected from nine different types of trees. *Coptotermes hemi* was the most dominant species with value of 0.3143 on Simpson's index. The overall diversity on the Simpson scale was (1-D=0.598) was 59%, while it was 99% on the Shannon scale (H/Log S=0.99).

A comparison of the termite species recorded from four locations of the study area was evaluated by applying the Berger-Parker diversity index and it was revealed that the highest diversity was recorded from the Palar Top (3.33), followed by Khurram Paracha (2.32), Garhi Afghana (1.85) and the lowest diversity was estimated from Usman Khattar (1.58) (Table II).

### Discussion

Termite is economically important insect group, because of their extensive damage to the woodwork in buildings, agricultural and forest plantations in many countries of the world, including Pakistan (Akhtar and Shahid, 1989; Manzoor *et al.*, 2010; Rao *et al.*, 2012). Limited information is available on the diversity of termite fauna in Pakistan. Akhtar and Shahid (1989) reported four termite species, *viz.*, *Microtermes mycophagus*, *Microtermes obesi*, *Microtermes unicolor* and *Eremotermes paradoxalis* from cotton fields in Multan district. Akhtar and Sarwar (1997) reported four termite species (*Microtermes mycophagus*, *Microtermes obesi*, *Odontotermes guptai* and *Eremotermes paradoxalis*) from wheat field of Bahawalpur area. Akhtar and Shahid (1993) described nine termite species from various areas of Punjab district. Nasir (2006) explored termite fauna of Mianwali district and reported 16 species, including three species of the present study, except, *O. horai*, which was the most dominant species in the current study. Similarly Manzoor and Mir (2010) reported 13 termite species from infested houses of

Punjab (except *Microtermes unicolor*, three species of present study were present). The present results provided basic information on the diversity patterns of termites in the soil and the tree species of the Taxila area. The study suggested a detailed survey of the *Dilbergia sissoo* and *Morus alba* (both are more dominant and useful tree species of the area), for their infestation by the termites.

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