Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2015; 3(6): 160-163
© 2015 JEZS
Received: 11-08-2015
Accepted: 07-10-2015

Iqra Azam
Department of Zoology, Institute of Life Sciences, University of Gujrat.

Muhammad Kaleem Sarwar
Department of Zoology, Institute of Life Sciences, University of Gujrat.

Waheed Iqbal
Department of Zoology, Institute of Life Sciences, University of Gujrat.

Nadia Iram
Department of Zoology, Institute of Life Sciences, University of Gujrat.

Fareeha Azam
Department of Zoology, Institute of Life Sciences, University of Gujrat.

Correspondence:
Iqra Azam
Department of Zoology, Institute of Life Sciences, University of Gujrat.

Studies on population density and diversity of termites of district Gujranwala, Pakistan

Iqra Azam, Muhammad Kaleem Sarwar, Waheed Iqbal, Nadia Iram, Fareeha Azam

Abstract
A survey was conducted in District Gujranwala, Pakistan, for the evaluation of the population diversity of termite fauna of in garden trees of this region from January to June, 2012. Six species of termites *i.e*., *Coptotermes heimi, Microcerotermes championi*, *Odontotermes obesus, Microtermes obesi, Microtermes mycophagus* and *Odontotermes guptai* were recorded from houses and garden trees. Termites were found variably inhabiting different portions of garden trees. Maximum diversity of termites was 78% on Simpson's Index and 70% on Shannon scale from garden trees.

Keywords: Termites, Simpson's Index, Shannon scale, Gujranwala, Pakistan

1. Introduction
Termites cause tremendous losses to forest trees, agricultural crops and wood components in buildings (Ahmad, 1955a; Akhtar, 1987; Davies *et al.,* 2003) [1-3]. Out of 2500 described species throughout the world, about 300 species are considered as pests (Lee and Wood, 1971) [4]. Developing countries in Asia are mostly affected, as agricultural crops and local huts of poor subsistence farmers are destroyed by these insect pests (Akhtar, 1974) [5-7]. Termites cause extensive damage to trees, wooden structures, earthen dams, underground electrical cables, wooden buildings, wooden furnishings and items of paper. The pest species of termites that affect human habitations are recorded in number of countries, including Pakistan (Akhtar, 1975) [8, 9].

Termites attack had spoiled sugarcane crops in different areas of District Peshawar in 1985 and overall 90% damage was recorded in Nowshera District (Salihah *et al*., 1988) [10]. Sattar and Saliha (2001) [11] recorded 10 species of termites, which caused up to 90% of the damage to sugarcane, 43% to maize and 8-12% to wheat. Many of the orchards in Punjab were completely devastated by termites attack (Akhtar and Shahid, 1989) [12]. Three major seasons were observed: (i) hot season (April to July) when temperature rises above 45°C, (ii) rainy season (August to September) when average rainfall above 46 cm is recorded and (iii) mild season (October-March) when temperature decreases to 21°C (Akhtar and Sarwar, 1997) [13]. Agricultural farming here involves the production of rice, sugarcane, wheat, maize, pulses and vegetables (Akhtar, 1975) [14]. Garden trees produce oxygen and sequester carbon dioxide, they also provide homes for animals, recharge groundwater, replace soil nitrates, and prevent erosion and are preferably planted in lawns. These trees were attacked by a number of insect pests including termites resulting in notable reduction in yield. Based on the importance of termites as economic pests of trees, damage caused to household structures the present study was aimed to investigate its diversity and proportion in houses and garden trees.

2. Materials and Methods
This study was conducted in Gujranwala; the targeted areas of studies were People's colony, Model town and Satellite town (Figure 1). For garden trees, 200 trees were randomly selected from different sites in the District Gujranwala and termites were collected with camel hair brush from trunk, bark and wood debris of all the infested trees and counted. The specimens were preserved in 70% alcohol and brought to the laboratory for identification. These samples were identified by key based on the head shape and mandibles (Akhtar, 1974) [5]. All samples were sent to National Insect Museum, Islamabad for further confirmation. Diversity of different termite species was determined according to Simpson (1949) [14] and Shannon-Weiner function (Odum, 1975) [15] on the Simpson and Shannon indices.

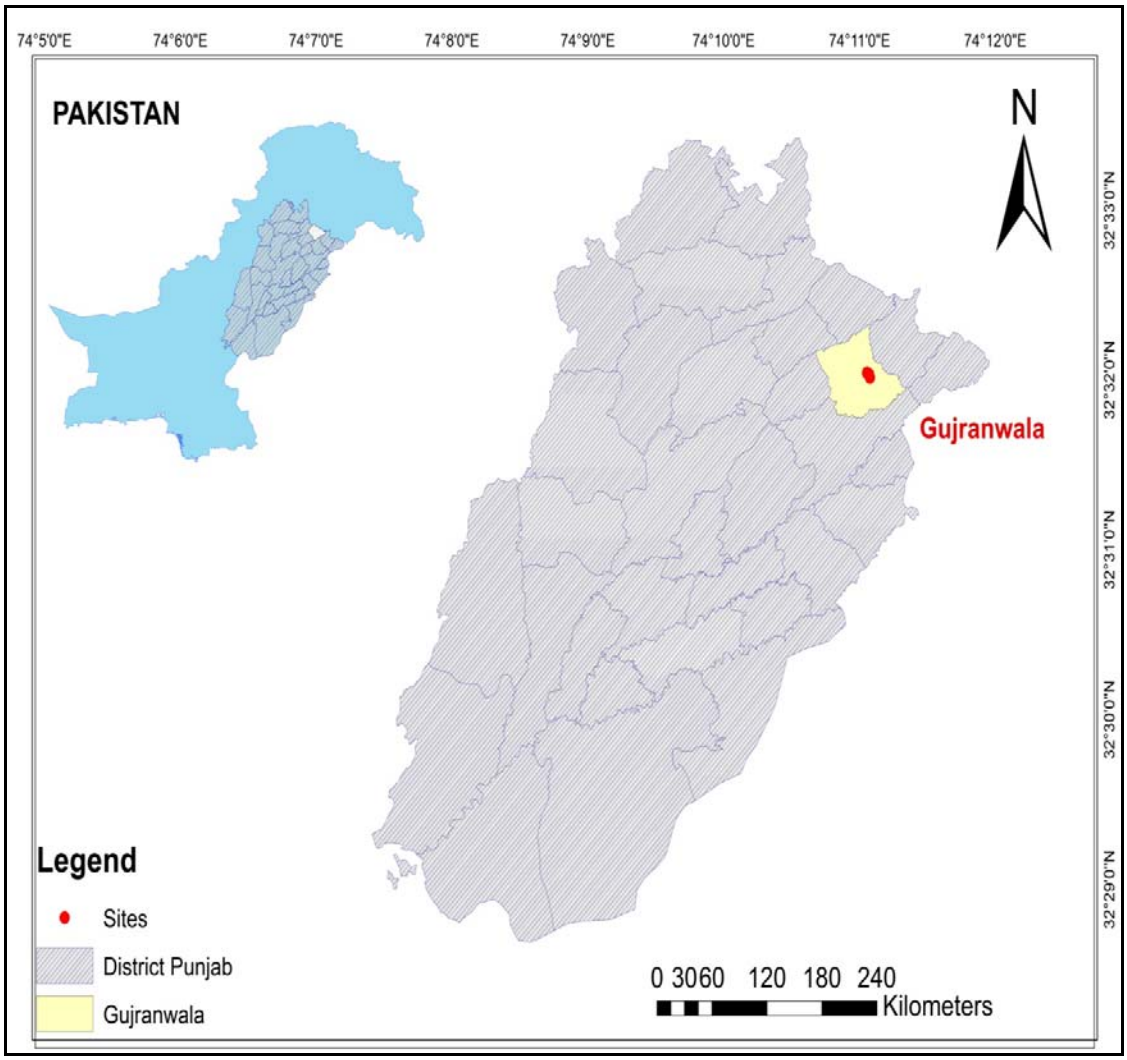

Fig 1: Sampling sites at Gujranwala (Punjab), Pakistan

Results and Discussion

From samples collected from 200 garden trees six species belonging to three subfamilies and two families were identified, *Microcerotermes championi*, *Odontotermes obesus, Coptotermes heimi, Microtermes mycophagus, Microtermes obesi,* and *Odontotermes guptai* (Table 1). *M. mycophagus* was the most frequently found species, which was followed by *C. heimi* and *M. obesi* and *M. championi* was the least observed.

Table 1: Termite species collected from different portion of trees from January to June, 2012

Species (Subfamily: Family)	Trees	Portion
*Coptotermes heimi (*Coptotermitinae: Rhinotermitidae)	*Mangifera indica*	Trunk portions
Microcerotermes championi (Termitinae: Termitidae)	*Dalbergia sissoo*	Dead portion of trunk
Odontotermes obesus (Macrotermitinae: Termitidae)	*Dalbergia sissoo, Populus alba*	Trunk, fallen twigs
Microtermes obesi (Macrotermitinae: Termitidae)	*Dalbergia sissoo*, *Acacia nilotica*	Wood debris, Trunk of tree
Microtermes mycophagus (Macrotermitinae: Termitidae)	*Dalbergia sissoo*	Dead portion of bark, trunk portions
Odontotermes guptai (Macrotermitinae: Termitidae)	*Mangifera indica, Dalbergia sissoo*	Bark of tree, dead portion of trunk

Termite collection from different parts of trees showed that *C. heimi* and *M. mycophagus* (dead portion) inhabited bark of trees of *Dalbergia sissoo,* while *O. guptai* (dead portion) occupied bark and trunk of *M. indica; M. mycophagus, O. obesus, M. obesi* and *M. championi* were recovered from the trunk of *D. sissoo*. *C. heimi* and *M. obesi* were collected from the wood debris of *D. sissoo,* while *O. obesus* from the fallen twigs.

The Shannon's Index value of 0.698 and Simpson's Index 0.7891 was obtained. *Microtermes obesi* with a value of 0.0846 (Simpson's Index) and 0.1559 (Shannon's Index) was the dominant species followed by *M. mycophagus* with a value of 0.0171 (Simpson's Index) and 0.1151 (Shannon's Index). The lowest value for *Odontotermes obesus* was recorded with 0.0020 (Simpson's Index) and 0.0559 (Shannon's Index) (Table 2).

Using Simpson's (1949) equation of C (Index of dominance), a value 1.0 was obtained for the termite communities in the district. In January, *M. mycophagus, M. obesi* and *C. heimi* were the three species present with (D=0.3440, 1-D=0.656) and H=0.4695 (Table 3). In February, *O. obesi, O. guptai and M. championi* with (D=0.3581, 1-D=0.642) and H=0.4539. In March similar trend was observed for *M. mycophagus, M. obesi* and *O. guptai with* D=0.37, 1-D=0.63 and H=0.452. The

lowest value on Simpson's Index was observed in April, *M. mycophagus, M. obesus* and *C. heimi* presented D=0.4687, 1-D=0.5313 and H=0.3896. Whereas in May *C. heimi, M. championi, M. obesi* showed (D=0.552, 1-D=0.448) and H=0.4040. In June, *M. mycophagus, M. obesus* and *C. heimi* were prevalent with D=0.37, 1-D=0.633 and H=0.4515 (Table 3).

The overall termite diversity (1-D= 0.7891) on the Simpson scale was 78% and on Shannon scale (H=0.698) is 70%. On the Simpson's Index highest diversity value was recorded for January 65% followed by May 44%.On the Shannon Wiener function, the highest value of diversity was recorded in January (H=0.4695) followed by February (H=0.4539).

Table 2: Diversity index of number of individuals of different termite species collected from garden trees from January to June, 2012

Species	No. of termites	Percentage	*Pi*	Simpson's index D = $\sum Pi^2$	Shannon's index H=$\sum Pi\ln(Pi)$
Microtermes mycophagus	36	13.0909	0.1309	0.0171	-0.1151
Microtermes obesi	80	29.0909	0.2909	0.0846	-0.1559
Odontotermes guptai	42	15.2727	0.1527	0.0233	-0.1235
Coptotermes heimi	75	27.2727	0.2727	0.0743	-0.1535
Microcerotermes championi	27	9.8181	0.0981	0.0096	-0.0941
Odontotermes obesus	15	5.4545	0.0454	0.0020	-0.0559
	275	100	1.0	D=0.2109,1-D= 0.7891	H=0.698

Table 3: Diversity index showing diversity of number of individuals of different termite species collected from garden trees from January to June, 2012

2012	Name of species	No. of termites	*Pi*	D = $\sum Pi^2$	H=-$\sum Pi\ln(Pi)$
January	*Microtermes mycophagus*	16	0.2622	0.0687	-0.1521
	Microtermes obesi	20	0.3278	0.1074	-0.1583
	Coptotermes heimi	25	0.4098	0.1679	-0.1591
				D=0.3440, 1-D=0.656	H=0.4695
February	*Microtermes obesi*	20	0.2985	0.0891	-0.1559
	Odontotermes guptai	32	0.4776	0.2281	-0.1541
	Microcerotermes championi	15	0.2238	0.0501	-0.1446
				D=0.3581, 1-D=0.642	H=0.4539
March	*Microtermes mycophagus*	10	0.25	0.0625	-0.1506
	Microtermes obesi	20	0.50	0.25	-0.1505
	Odontotermes guptai	10	0.25	0.0625	-0.1506
				D=0.37, 1-D=0.63	H=0.452
April	*Microtermes mycophagus*	5	0.125	0.0156	-0.1104
	Coptotermes heimi	25	0.625	0.3906	-0.1287
	Odontotermes obesus	10	0.25	0.0625	-0.1505
				D=0.4687, 1-D=0.5313	H=0.3896
May	*Coptotermes heimi*	15	0.4054	0.1601	-0.1591
	Microcerotermes championi	12	0.3243	0.1021	-0.1011
	Microtermes obesi	20	0.5405	0.2921	-0.1445
				D=0.552, 1-D=0.448	H=0.4040
June	*Coptotermes heimi*	10	0.5	0.25	-0.1505
	Microtermes mycophagus	5	0.25	0.0625	-0.1500
	Odontotermes obesus	5	0.25	0.0625	-0.1500
				D=0.37, 1-D=0.633	H=0.4515

In past very little work has been done on diversity indices regarding proportion of termites in Pakistan. The only study conducted was by Akhtar and Sarwar (1993) [16, 17, 18] reported that termite diversity in wheat fields was 56% on the Simpson scale and 67% on the Shannon scale. Different species of termite species inhabited different portions of shisham, mango, poplar and acacia trees like their fallen leaves and debris. The present study provided some useful information about biodiversity of termite in the Gujranwala district.

References

1. Ahmad M. Termites of West Pakistan, Biologia. 1955a; 1:202-264.
2. Akhtar MS. About a white aunt. *Microtermes obesi* Holmgern as agricultural pest. Punjab University Journal of Zoology. 1987; 2:11-45.
3. Davies RG, Eggleton P, Jones DT. Evolution of termite functional diversity: analysis and synthesis of local ecological and regional influences on local species richness. Journal of Biogeography. 2003; 30:847-877.
4. Azam I, Afsheen S, Zia A, Sarwar MK, Iqbal I. Surface Water Contamination in Halsi Nala; an Assessment and Spatial Distribution Survey Using GIS Approach. Journal of environmental chemistry and ecotoxicology. 2015; 7:37-48.
5. Akhtar MS. Zoogeography of termites of Pakistan. Pakistan Journal of Zoology. 1974; 6:85-106.
6. Sarwar MK, Azam I, Iram N, Iqbal W, Rashda A, Anwer F *et al.* Cotton aphid *Aphis gossypii* l. (Homoptera; Aphididae); A challenging pest; Biology and control strategies: A review. International Journal of Applied Biology and Pharmaceutical Technology. 2014; 5(1):288-294.
7. Azam I, Afsheen S, Zia A, Javed M, Saeed R, Sarwar MK *et al.* Evaluating insects as bio-indicators of heavy metal contamination and accumulation near industrial area of Gujrat, Pakistan. Bio Med Research International, 2015, Article ID 942751, 11 pages, 2015.

doi:10.1155/2015/942751.
8. Iqbal W, Malik MF, Sarwar MK, Azam I, Iram N, Rashda A. Role of housefly (*Musca domestica,* Diptera; Muscidae) as a disease vector; a review, Journal of Entomology and Zoology Studies. 2014; 2(2):159-163.
9. Akhtar MS. Taxonomy and Zoogeography of termites of Bangladesh. Bull. Department of Zoology, University of the Punjab (N.S). Art 1975; 7:1-199.
10. Salihah Z, Sattar A, Khatoon. A survey of Sugarcane termites of Nowshehra and Charsada Thesil. Proceedings of Pakistan Congress of Zoology 1988; 8:189-197.
11. Sattar A, Saliha Z. Detection and control of subterranean termites. In: Technologies for sustainable Agric. Proc. National Workshop, NIAB, Faisalabad, Pakistan. 2001; (24-26):195-198.
12. Akhtar MS, Shahid AS. Termites population and damage in cotton fields at Qadirpur. Multan, Pakistan. Sociobiology 1989; 15:349-359.
13. Akhtar MS, Sarwar M. Termite population diversity and damage in wheat fields of Bahawalnagar Division. Proceedings of Pakistan Congress of Zoology 1997; 17:153-163.
14. Simpson FH. Measurement of diversity. Nature 1949; 163:688-695.
15. Odum EP. Ecology. Holt Rinehart and Winston, London, UK, 1975.
16. Lenz. Termite problem species and management of termite problems in Australia. Sociobiology 2002; 40:11-12.
17. Lee CY, Yap J, Ngee PS, Jaal Z. Foraging colonies of a higher mound-building subterranean termite, *Globitermes sulphureus* (Havilland) in Malaysia. Japanese Journal of Environmental Entomology and Zoology 2003; 14:105-112.
18. Akhtar MS, Sarwar M. Comparison of toxicity and repellency of Dieldrin with other insecticides used against *Bifiditermes beesoni* (Gardner) (Isoptera), Pakistan Journal of Zoology. 1993; 23:269-271.