Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(3): 1301-1303

Received: 28-03-2018
Accepted: 29-04-2018

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Termite (Isoptera) diversity in three distinct habitats of Western Ghats of Karnataka

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Abstract
A comparative study of termite diversity in different ecosystem (forest, pasture and Teak plantation) was carried out in Western Ghats of Karnataka to understand the influence of varied climate and human activities on the termite species richness and diversity. A standard belt transect method was used for sampling termites and was done at bi-monthly interval from July-2015 to May-2016. Totally 17 species were recorded which belongs to five sub families viz., Macrotermitinae, Heterotermitinae, Amitermitinae, Nasutitermitinae, Termitinae. Species richness varied across the habitats. A total of seven, 10 and 12 species were recorded in pasture, plantation and forest ecosystem respectively. The highest species richness was observed in forest area and least in pasture habitat. Shannon diversity index in pasture habitat, showed less values (1.66) compared to plantation (2.12) and forest (2.26). The influence of anthropogenic activities, Topography and bioclimatic factors is discussed.

Keywords: Termites, anthropogenic activities, diversity, forest, pasture, plantation

Introduction
Among insects, social insects are the world's most successful species invading new habitats [1]. Termites are amongst the most difficult insects to study because of their cryptic behaviour and natural nesting habitat [2]. The magnitude and dimension of ecological role played by termites is a function of their population density and biomass [3]. They contribute to gas exchange, nitrogen fixation, soil stability and quality [4].
Termite assemblage composition has a strong response to habitat disturbance and indicative of quantitative changes in the decomposition process [5]. The number of species and their biomass are especially large in tropics [6]. Indian termite fauna shares a very small portion of the global fauna *ie.*, approximately 300 species, 37 genera and 07 families [7]. 42 termite species identified along Western Ghats belonging to 13 genera and six sub-families under two families [8]. 12 termite species were redescribed using 16sRNA [9]. The anthropogenic threats are manifold in Western Ghats, large tracts of forest are being lost or converted to open/cultivated lands, coffee and areca plantations, or hydroelectric reservoirs [10]. The present study examines the effect of topography, land use pattern and human disturbance on the termite fauna in order to acquire accurate base line information for conservation decision making.

Materials and methods:
Study site: A representative location/habitats selected in each of the three habitats along the Western Ghats of Karnataka include (i) a pasture in Kalkodu, near Agumbe, Thirthahallitaluk, Shivamogga district (Long. 13^0 34' N, Lat. 75^0 07'E, altitude 631 m above mean sea level) (ii) A reserved forest in Balehonnur, Narasimharajapura taluka, Chikkamagluru district (Long. 13^0 24' N, Lat. 74^0 50'E, altitude. 791m above mean sea level) and iii) as a representative of a teak plantation in Ayanur, Shivamogga taluk and district (Long. 13^0 34' N, Lat. 75^0 07'E, altitude 683m above mean sea level).

Sampling for termites:
A standard belt transect method proposed by Davies [11] and Eggleton [12] was employed for sampling termites in three habitats. Sampling was done at bi-monthly interval from July 2015 to May-2016. The transect was 100m long, 2m wide and divided into 20 contiguous sections, each 5 x 2m in each habitat. In all sections, the habitats of termites were searched. The collected termites were counted, labelled and preserved in vials containing 75% ethyl alcohol.

The specimens were identified to species level using the keys provided by Roonwal and Chhotani [13], Chottani [14] and Kalleshwara swamy [7].

The number of species encountered in transect was used as an indicator of relative abundance of species. The species richness and diversity of termite fauna were calculated and compared using Shannon's Weiner index, Simpson's index, Margalef's diversity index, Menhinick's index and evenness.

Results and Discussion

Comparison of species composition in three habitats

The present study indicated differences in the species composition in the three different habitats. A total of 17 species in seven genera were recorded (Table 1) which belongs to five sub families (Macrotermitinae, Heterotermitinae, Amitermitinae, Nasutitermitinae, Termitinae). Twelve species (*Odontotermes obesus, O. feae, O. anamallensis, O. bellahunisensis, O. assmuthi, O. yadevi, Heterotermes malabaricus, Labriocapritermes distortus, Microcerotermes fletcheri, Microtermes obesi, Nasutitermes anamalaiensis, Dicuspiditermes gravelyi*) were recorded in forest ecosystem (Table 1), while seven species (*Odontotermes obesus, O. feae, O. bellahunisensis, O. assmuthi, O.vaishno, O. yadevi, Labriocapriterme sdistortus*) were recorded in pasture habitat and ten species (*O. obesus, O. feae, O. assmuthi, O. vaishno, O. bhagwatii, Microtermes obesi, Dicuspiditermes gravelyi, Dicuspiditermes obtusus, Eurytermes buddha, Odontotermes* spp) were in Teak Plantation. Among the habitats, *Odontotermes obesus, O. feae, O. bellahunisensis and O. assmuthi* were found common in all the habitats, whereas, *O. yadevi and Labriocapritermes distortus* were restricted to forest and pasture habitats only.

The variation could be due to anthropogenic activities hence increased disturbance had negative effect on species diversity and less decomposed matter or leaf litter in pasture habitat. Present findings are also in accordance with the reports of Sathish [15]. Forest and plantation habitats had more diversity of termite species. Here most termite assemblages have the diverse range of feeding (wood, soil, leaf litter, *etc.*) and nesting strategies like mound, arborial nest, nest of wood. These findings are corroborated with the reports of Dawes [16]. *Odontotermes obesus* was widely distributed in all the three regions due to its adaption to diverse ecological conditions and habits (wood, live crops, cow dung, tree species, pest to several crops, *etc.*). Next most widely adapted species was *O. feae* which had wide host range (wood, pest of number of crops, orchard and forest species).

Diversity three different habitats of study area

Species diversity and richness varied across three habitats.Shannon's wiener index shows that the values ranged from 1.66 to 2.26 (Table 2) in the study area. The index shows that forest had more species diversity (2.26) followed by plantation (2.12) and lowest in pasture (1.66) habitats. Simpson's index also revealed a similar trend. The dominance value ranged from 0.77 to 0.88. The highest dominance value was recorded at 0.88 in forest habitat followed by plantation (0.87), while lower species dominance was recorded at pasture (0.77). The evenness value reveals that the species are distributed evenly in the habitat. Evenness value was ranged from 0.85 to 0.92 (Table 2). Evenness was highest (0.92) in Forest followed by plantation (0.91) and least in pasture habitat (0.85). Margalef's diversity index is directly proportional to the diversity of species distributed in the habitat. This value was ranged from 0.82 to 1.28 in study area (Table 2). Highest value of Margalef's diversity index was observed in forest (1.28) followed by plantation (1.10) and lowest in pasture (0.82) and Menhinick's index also highest in forest (0.18) followed by plantation (0.17) and lowest in pasture (0.16). This indicated that forest habitat was more species rich than plantation and pasture land. These results are closely in confirmation with findings of Shanbhag and Sundararaj [17] who reported higher Simpson index in forest compared to plantation. A closed and very dense canopy in forest provides favourable environmental condition for termite fauna. Soil parameters, vegetation and microclimate strongly modify the termite communities opined by Basu [18]. It is well known fact that forest is rich in organic matter compared to disturbed lands. This must be the reason for higher number of species presence compared to disturbed regions.

Table 1: Termite fauna collected in three different ecosystem (July 2015 to May 2016)

Sl. No	Species	Subfamily	Forest	Pasture	Plantation
1	*Odontotermes obesus* (Rambur)	Macrotermitinae	+	+	+
2	*O. feae* (Wasmann)	Macrotermitinae	+	+	+
3	*O. anamallensis* Holmgren and Holmgren	Macrotermitinae	+	-	-
4	*O. bellahunisensis* Holmgren and Holmgren)	Macrotermitinae	+	+	+
5	*O. assmuthi* (Holmgren)	Macrotermitinae	+	+	+
6	*O. vaishno* Bose	Macrotermitinae	-	+	-
7	*O. bhagwatii* Chatterjee and Thakur	Macrotermitinae	-	-	+
8	*O. yadevi* Thakur	Macrotermitinae	+	+	-
9	*Labriocapritermes distortus* (Silvestri)	Termitinae	+	+	-
10	*Microtermes obesi* Holmgren	Macrotermitinae	+	-	+
11	*Microcerotermes fletcheri* Holmgren and Holmgren	Macrotermitinae	+	-	-
12	*Odontotermes* spp	Macrotermitinae	-	-	+
13	*Heterotemes malabaricus* Synder	Heterotermitinae	+	-	-
14	*Nasutitermes anamalaiensis* Synder	Nasutitermitinae	+	-	-
15	*Dicuspiditermes gravely* (Silvestri)	Termitinae	+	-	+
16	*Dicuspiditermes obtusus* (Silvestri)	Termitinae	-	-	+
17	*Eurytermes Buddha* Bose and Maiti	Amitermitinae	-	-	+
18	Unidentified workers		+	+	-
	Alpha diversity		12	7	10
	Beta diversity		F/Pa-7	Pa/Pl-10	F/Pl-11
	Gamma diversity		17		

Note: +: Present; - : Absent; F-Forest, Pa-Pasture, Pl-Plantation

Table 2: Diversity indices of termite fauna in different habitats

Diversity index	Forest	Pasture	Plantation
Total number of individuals (N)	5476	1451	3670
Number of species (S)	12	7	10
Shannon-weiner index ('H)	2.26	1.66	2.12
Simpson dominance index	0.88	0.77	0.87
Evenness (J)	0.92	0.85	0.91
Margalef's index	1.28	0.82	1.10
Menhinick's index	0.16	0.18	0.17

Conclusion

The forest and plantation habitats had more diversity of termite species compared to pasture. The effect of anthropogenic activities continuously leading to decrease in forest area and increase in plantation and agricultural crops. This is affecting the biodiversity of insects including termites. Transect sampling performed at bi-monthly interval and variation in recorded species in three different ecosystems, because these species are not abundant and are not distributed throughout the sections/habitats. They are subjected to biodiversity loss and may become extinct if not protected. The study conclusively demonstrated that there is a need of conservation efforts to be taken up in the Western Ghats.

References

1. Pardeshi M, Prusty BAK. Termites as ecosystem engineers and potentials for soil restoration. Current Science. 2010; 99:11-15.
2. Ahmed BM, Nkunika P, Sileshi WG, French JR, Nyeko P, Jain S. Potential impact of climate change on termite distribution in Africa. British Journal of Environment and Climate Change. 2011; 1:172-189.
3. Lee KE, Wood TG. Termite and Soils. Academic Press, New York, 1971.
4. Bignell DE. Termites in ecosystems. In: Abe, T, Bignell, D. E, Higashi, M (eds) Termites: evolution, sociality, symbioses, ecology. Kluwer Academic Publishers, 2000, 363-387.
5. Jones DT, Eggleton P. Sampling termite assemblages in tropical forests: Testing a rapid biodiversity assessment protocol. Journal of Applied Ecology. 2000; 37:191-203.
6. Pearce MJ. Termites: Biology and pest Management. CAB International, London, 1999, 172-175.
7. Kalleshwaraswamy CM, Nagaraju DK, Viraktamath CA. Illustrated key to common termite (Isoptera) genera of South India. Biosystematica. 2013; 7(1):11-21.
8. Vidyashree AS, Kalleshwaraswamy CM, Shanarabasappa. Termites (Isoptera) fauna in Western Ghats, India. Agric International. 2018; 5(1):20-23.
9. Vidyashree AS, Kalleshwaraswamy CM, Mahadeva Swamy HM, Asokan R, Adarsha SK. Morphological, molecular identification and phylogenetic analysis of termites from Western Ghats of Karnataka, India. Journal of Asia-Pacific Entomology. 2018; 21(1):140-149.
10. Menon S, Bawa KS. Applications of Geographic Information Systems (GIS), remote-sensing, and a landscape ecology approach to biodiversity conservation in the Western Ghats. Current Science. 1997; 73(2):134-145.
11. Davies RG, Hernandez LM, Eggleton P, Didham RK, Fagan LL, Winchester NN. Environmental and spatial influences upon species composition of a termite assemblage across neotropical forest islands. Journal of Tropical Ecology. 2003; 9:509-524.
12. Eggleton P, Homathevi R, Jeeva D, Jones DT, Davies RG, Maruati M. The species richness and composition of termites (Isoptera) in primary and regenerating lowland dipterocarp forest in Sabah, East Malaysia. Ecotropica. 1997; 3:119-128.
13. Roonwal ML, Chhotani OB. Fauna of India and adjacent countries-Isoptera (Termites). Zoological Survey of India, Calcutta. 1989; I:1-671.
14. Chhotani OB. The fauna of India and adjacent countries-Isoptera (termites). Zoological Survey of India, Calcutta. 1997; II:801-810.
15. Sathish GS. Faunistic studies on termites (Isoptera) of Shivamogga and evaluation of new insecticides. M.Sc (Agri) Thesis, University of Agricultural and Horticultural Sciences, Karnataka (India). 2015, 105-108.
16. Dawes TZ. Impacts of habitat disturbance on termites and soil water storage in the tropical Austalian Savanna. Pedobiologia. 2010; 53:241-246.
17. Shanbhag RR. Sundararaj R. Assemblages and species diversity of wood destroying termites in different land use systems in Western Ghat, India. Journal of Forest Research. 2013; 24(2):361-364.
18. Basu P, Blachart E, Lepage M. Termites (Isoptera) community in the Western Ghats, South India: influence of anthropogenic disturbance of natural vegetation. European Journal of Soil Biology. 1996; 32(3):113-121.