STUDY OF TERMITE SPECIES IN A DENSELY VEGETATED AREA, PUTHUPATTU, IN NORTHEASTERN PUDUCHERRY FOR POSSIBLE USE IN ERMIGRADATION

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Abstract: The termites are one of the most dominant invertebrate groups and it feeds on dead plant materials and hence they have an important role in nutrient and carbon cycling in soil. In addition they play an important function in soil formation, humification and breakdown of dead organic plant materials and nitrogen-fixation. In this study, the survey is conducted in a densely vegetated region of 55 acres, Puthupattu-Northeastern Puducherry is reported. Ten termite species were sampled. Ten species was identified of which eight belongs to family Termitidae, one to the Rhinotermitidae family and another to the family Kalotermitidae. Nine of these species are higher termites: *Hypotermes obscuriceps, Macrotermes convulsionarius, Odontotermes anamallensis, O.globicola, O.brunneus, Microtermes obesi, Microcerotermes flecteri, M.ganeshi* and *Trinervitermes nigrirostris* belonging to the family Termitidae. A lower termite belonging to family Kalotermitidae was also sampled (*Neotermes shimogensis*).

Keywords: Termites, Sampling, Transect, Quadrat, Termigradation and Termireactors.

Introduction: In tropical forests, the termites are one of the most dominant invertebrate group (Donovan *et al.,* 2001), and it feeds on dead plant materials and they have an important role in nutrient and carbon cycling in soil (Donovan *et al.,* 2001; Jones and Eggleton, 2000). In addition they play an important function in soil formation, humification and breakdown of dead organic plant materials and nitrogen-fixation (Eggleton *et al.,* 1996). The termites modify the permeation rates of water in soil (Lavelle *et al.,* 2006). Termites exhibit diverse feeding habit- they are wood eaters, grass eaters, and soil feeders, In this chapter, sampling of termites from a densely vegetation region, in northeastern Puducherry, Puthupattu, is reported.

Materials and Method: The survey of termites was carried out in Puthupattu village, located in Vaanur Taluk, Villupuram district (Tamil Nadu) near northeastern Pondicherry (U.T) border on East Coast Road (ECR) NH 45. The latitude is 12° 13' 02" N and longitude: 79° 58' 51" E. It is a dense forest covering 55 acres. The village map (1:5000) scale was obtained from the village officer (Figure.1.1a). Sampling of termite was done based on the standard protocol of Jones *et al* detailed in Leather, (2005). The map of the study area and the transect marked is illustrated in Figure 1.1

(a) Puthupattu Map

(b) Transect Marked in the Study Area

Figure 1.1

Termite Survey: The survey of termites in the area was carried out using transect and quadrat methods as elaborated by Jones *et al*., 2005.

Transect Method: Each transect was 100 m long and 2 m wide, divided into 20 contiguous sections (each 5m X 2m) and numbered sequentially. Samples were collected in each section for 30 minutes by two persons. In each section the following microhabitats were searched for termites: 12 samples of surface soil (each 12 cm X 12 cm, to 10 cm depth); accumulations of litter and humus at the base of trees and between buttress roots; the inside of dead tree stumps, logs, branches, and twigs; the soil within and beneath rotten logs; all mounds and subterranean nests encountered; arboreal nests, carton runways, and sheeting on vegetation up to a height of 2 m above ground level.

Quadrat Method: A 100 m x 100 m plot was randomly selected and marked. In it five sub-sections of 2 m x2 m were marked randomly and the termites were sampled as done in the transect based method. The termites were collected using a brush dipped in ethanol and preserved in 80% ethanol. The animals were separated from the debris with the help of the brush by placing them in a petri dish. Then the workers and soldiers (major and minor) were separated and preserved in 80% ethanol in 20 ml glass bottles. The preserved sample was labeled carefully with all required information.

From the quadrat, every single dead wood and litter was checked for the presence of termites. (Figure 1.2). From the trees, upto 2m, the termites, if present, was also sampled. A soil pit of 30 cm x 30 cm x 25 cm dimension was made in each quadrat and the termite samples were gathered.

(a) Hypotermes Obscuriceps

(b) Macrotermes Convulsionarius

Figure 1.2 Termites Sampled from Litter

Identification: The sampled termites were separated from the soil debris with the help of the brush in petridish and then the workers and soldiers (major and minor) were separated, and preserved in 80% of ethanol in sample bottles. Then the preserved samples was labelled carefully distinguishing workers, soldiers (major and minor) with the transect and quadrat details, sub-site details, date and time of sampling.

The sampled termite species were identified primarily on the basis of morphological characters and then finally their measurements of different parts. The characters were matched with the keys from Zoological Survey of India source books (Bose, 1986; Roonwal and Chhotani, 1989 and Chhotani, 1997) and other compendia (Kumar and Thakur, 2013). The different parts of the body was dissected and mounted on different slides (like head, eyes, antenna, pronotum, mesonotum, metanotum, legs, rostrum (in nasute), cerci, whole body, postmentum, labrum and mandible) for noting the structure and measurements.

Results and Discussion: All the sampled termites were identified into ten species of termites. Nine of these species belonged to higher termites: *Hypotermes obscuriceps, Macrotermes convulsionarius, Odontotermes anamallensis, O.globicola, O.brunneus, Microtermes obesi, Microcerotermes flecteri, M.ganeshi* and *Trinervitermes nigrirostris.* The lone species of lower termite was *Neotermes shimogensis.*

Table 1.1 Taxa and the Feeding Groups of the Termites Recorded from Puthupattu

Family	Sub Family	Name of the Species	Foraging/Feeding Substrate	Type of Nesting
Termitidae	Macrotermitinae	*Hypotermes obscuriceps*	Leaf litter	Sep
		Macrotermes convulsionarius	Leaf litter/soil	Sep
		Odontotermes anamallensis	Dead wood and leaf litter	Int
		O.brunneus	Dead wood and leaf litter	Int
		O.globicola	Dead wood and leaf litter	Int
		Microtermes obesi	Wood and litter feeder	Int
	Amitermitinae	*Microcerotermes fletcheri*	Dead/live wood	Int
		Microcerotermes ganeshi	Dead/live wood	Int
	Nasutitermitinae	*Trinervitermes nigrirostris*	Soil and grass	Int
Kalotermitidae	-	*Neotermes shimogensis*	Dead wood	Int

Based on the feeding behavior of termites as described by Donovan *et al.,* 2001, we have grouped the termite species sampled from the study area (Table 1.1). Out of ten species identified, three species (*O. anamallensis, O. brunneus* and *O. globicola*) are dead wood and leaf litter feeders. *Microtermes obesi* is wood and litter feeder. *N. shimogensis* is dead wood feeders. *T. nigrirostris* is soil and grass feeder. *M. convulsionarius* is leaf litter and soil feeder. *H. obscuriceps* is leaf litter feeder whereas *Microcerotermes fletcheri* and *M. ganeshi* are dead / live wood feeder.

Eight of the species – *O. anamallensis, O. brunneus, O. globicola, N. shimogensis, Microtermes obesi, Microcerotermes fletcheri, M. ganeshi* and *T. nigrirostris* – belong to intermediate nesting type. Two species *M. convulsionarius* and *H.obscuriceps* belong to separate-piece nesters (Table 1.1).
The termites were sampled to compare the species richness and diversity in the sampled area and present study was compared with that of others who have also followed the same sampling method illustrated in Table 1.2.

The abundance of termites, species wise, is given in Figure 1.3 and family-wise in Figure 1.4. It can be seen from Figure.1.3 that *Hypotermes obscuriceps* is the most abundant species and *Neotermes shimogensis* is the rare species.

Table: 1.2 Gist of the Studies Reported by Other Authors and the Present Study

S.No	Author(s)	Study area	Methodology	No. of Termite Species Identified	Indices values
1	Primanda *et al.,* (2003)	University of Indonesia campus covering an area of 16.000m$^{2.}$	Not mentioned	6	Not mentioned

2	Carrijo *et al.,* (2009),	The Parque Estadual da Serra de Jaragua (State Park), Jaragua, Goias, Brazil.	Jones and Eggleton's (2000)	29	Shannon diversity H' 2.55
3	Hemachandra *et al.,* (2010)	Hantane forest range, Sri Lanka; secondary forests comprising 432 ha	Eggleton *et al.,* (1996) and Leather (2005)	11	Shannon diversity H'1.630 (in secondary forest) and (0.683 in undisturbed natural forest
4	Palin *et al.,* (2010)	Plots from lowland Amazonia (Tambopata National Reserve, Madre de Dios) to the Kosnipata valley district of Manu National Park, Cuzco at five 1 hectare in Peru	Jones and Eggleton (2000)	59	Not mentioned
5	Dosso *et al.,* (2010)	Lamto reserve in central Cote d'Ivoire in four different habitats in Guinean savanna	Jones & Eggleton (2000)	31	Simpson index of four different areas; 0.84, 0.80, 0.88 and 0.90
6	Dambros *et al.,* (2012)	Terra firme forest in Balbina Hydroelectric plant Presidente figueiredo, central Amazonia in approximately 1,000000 ha.	Not mentioned	26	Not mentioned
7	Ali *et al.,* (2013)	Islamia University of Bahawalpur, Pakistan	Not mentioned	6	Shannon index (H') 1.178
8	Tenon *et al.,* (2013)	Savannas of Northern of Cote d'Ivoire	Jones & Eggleton (2000)	27	Shannon index (H') 2.88; and Simpson index 0.94.
9	Shanbhag and Sundararaj (2013)	Two different territory in Western Ghat, India	Jones & Eggleton (2000)	14	Simpson's diversity index from (forest areas and plantations are 7.3 and 5.5 Shannon Wiener's index (H') in two areas is 2.2 and 1.56 and Pielou's evenness index is 0.85 and 0.76
10.	Kaur *et al.,*(2014)	Pondicherry University campus, Puducherry (780 acres)	Jones *et al.,* described in Leather (2005)	13	Pielou's eveness value 0.57, Simpson's index 0.34 and Shannon diversity index 1.45
11	Anantharaju, *et al.,*(2014)	Pondicherry Engineering college, Northeastern Puducherry, India (210 acres)	Jones *et al.,* described in Leather (2005)	10	Simpson's diversity index 0.20; Shannon Wiener's index (H'1.83) value and Pielou's evenness index is 0.79
12	Kaur *et al.,*(2014)	Four different forests (Aurodam, Gaia, Newland and Revelation) in Auroville international city, Puducherry, India.	Jones *et al.,* described in Leather (2005)	10	Simpson's index 0.17 to 0.21 and Shannon diversity index (1.74-1.82)
13	Present study	Puthupattu (55acres) Puducherry, India	Jones *et al.,* described in Leather (2005)	10	Shannon index H' 1.94, Simpson index 0.19 and Pielou's index 0.84

The termite species diversity and abundance of the surveyed areas in 55 acres the species diversity index was calculated using Shannon Diversity index value of H' 1.94 its denote the relatively diverse community. The Simpson index 0.19 represent relatively even community and Pielou's index 0.84, this value nominate below high diversity in the area.

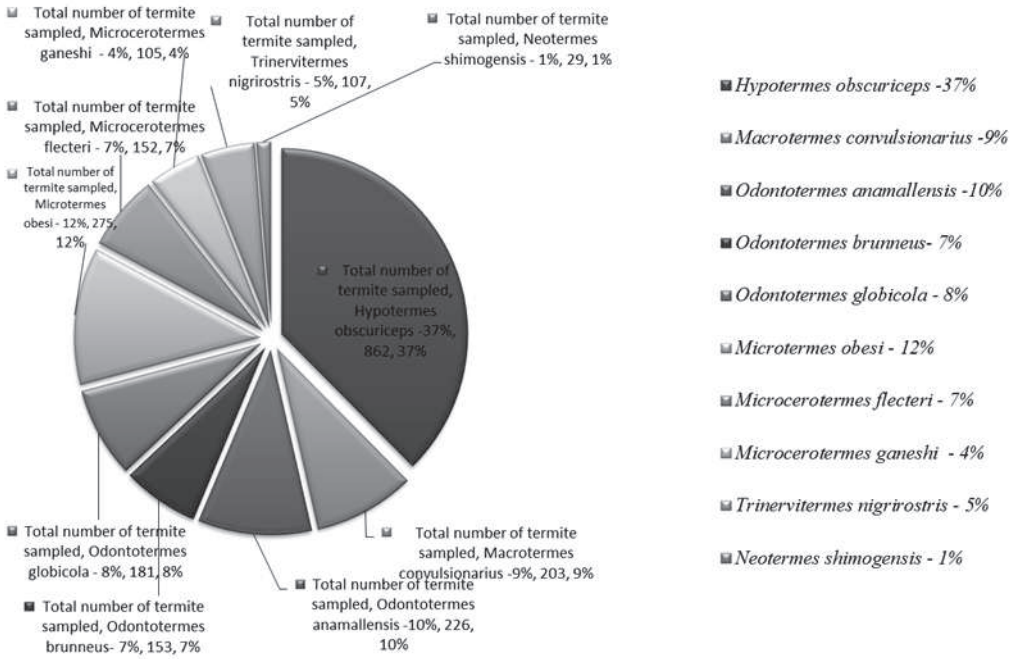

Figure 1.3 Termite Abundance, %, Species-Wise, Sampled from Puthupattu

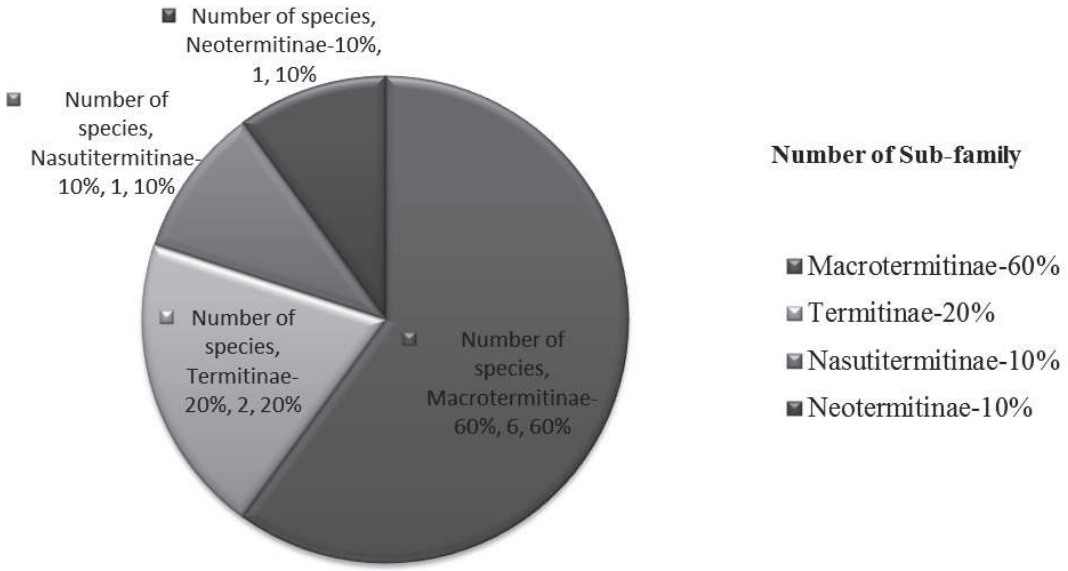

Figure 1.4 Sub-Family Distribution of Termites (%) Sampled from Puthupattu

Conclusion: From Puthupattu, ten termite species were sampled and identified. Out of ten identified species, nine termite species (*H.obscuriceps, M. convulsionarius, O.anamallensis, O.globicola, O.brunneus, Microtermes obesi, Microcerotermes flecteri, M. ganeshi* and *T. nigrirostris)* belonged to higher termites and one species (*Neotermes shimogensis*) belonged to lower termite. They belonged to two families: Termitidae comprising representatives from the sub-family: Macrotermitinae, Nasutitermitinae and Termitinae) and Kalotermitidae (Sub-family: Neotermitinae). *H. obscuriceps* was the most abundant (37%) and *N. shimogensis* was the rare species (1%) sampled in the study area.

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