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Research Article

INTENSITY OF FORAGING ACTIVITY IN SUBTERRANEAN TERMITES AT MULAKALAPALLY FOREST REGION, KHAMMAM DISTRICT, ANDHRAPRADESH INDIA

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ABSTRACT

Seasonal foraging activity of subterranean termites on forest plants were observed Mulakalapally forest region, Khammam (A.P). Two distinct foraging patterns were identified in the species of termites. *Microtermes Sp* and *Coptotermes Sp* have strong forging activity high peak in wet season. Whereas *Odontotermes Sp* and *Macrotermes Sp* have strong foraging activity peak in the dry season. The foraging activity depends upon Environmental factors. The foraging activity was observed in the galleries at the temperature to 17°-25°C.

KEY WORDS

Mulakalapally forest region, Temperature, Odontotermes obesus foraging activity

STUDY AREA:

The present investigation was carried out in Mulakalapally forest region, Khammam district in Andhra Pradesh, India; It lies in between latitude 17º36' and 18º38', North and 80º21' East of Greenwich longitudes. The annual average temperature was recorded 25ºC and annual precipitation was 990mm. Soil are typically acidic (pH 4.0-7.5) the soil are high in organic matter.

INTRODUTION:

Termites play a key role in tropical and subtropical forest ecosystems as decomposers of the largest part of dead organic matter, playing a significant role in soil formation. At the same time, termites are dangerous pests to agricultural crops and forestry. Studies of termites ecology have been carried out mainly in rain forests (Abe 1978, Abe Matsumoto 1979, Eggleton et al., 1999) .In semi deciduous forests the population has been studied (Sing, Singh 1981, Inoue et al., 2006, Anichkin et al., 2007, Vu et al 2007). Termites in forest ecosystem of national Park in Vietnam, Belyaeva, A.V. Tiunov (2010). Termites feed on plants in almost every form living, freshly dead in various stages of decomposition and humus. Their feeding habits are reviewed in Adamson (1943) (Lee & Wood 1971).The pattern of damage varies with species, climate and area, it is widely assumed that rarely damage indigenous trees (Harris, 1955; Lee& Wood 1971; Tho 1992).

Termite damage to living trees fall under two distinct categories mainly the damage by monophagous termites which have restricted distribution and colonies are confined to single species of trees, and the damage by polyphagous termites that the forage over a wide range of trees (Das 1958; Roonwal, 1979; Sammaiah, 2002; Sammaiah and Reddy, 2005).

Termites also know one of the prominent ecosystem engineers; (Jones et al 1994, Pardesh, M and A.K. Prusty 2010). Which modify the soil properties by constructing huge mounds and long

subterranean galleries and which provide animals and plants, with heterogeneous habitats. Termites as ecosystem engineers, they contribute significantly to ecosystem processes including carbon fluxes, soil formation and soil conditioning (Lee and Wood 1971, Bignell et al 1997, Bignell and Eggleton 2000).

MATERIALS AND METHODS

Survey and Sampling

The study was carried out in the deciduous forest region of Mulakalapally in Khammam district A.P. I was surveyed during June, 2008 to May 2010 for termite attack to trees, decomposition of litter foraging activity of termites. From the general survey it was clear that the general activity of termites was more during mornings and late evenings. Hence, the studies were mainly carried out during that time. Trees susceptibility to termite damage was checked. Samples of unhealthy looking trees from selected forest area were sampled. Termites were collected from different parts of the trees. Furthermore, effects were also made to sample all possible habitats.

Intensive observations were made on ground, trees, branches, twigs, dead stumps, woody litter and leaf litter for presence of termites. Tunnels, foraging triats on ground, trees or under leaves and debris were also searched. Termites were collected by forceps information in relevant to the specimen, were recorded in writing and also photographed, specimen were preserved in 80% alcohol. The trees were closely and carefully inspected for signs of termite foraging activity such as earthen sheet covering, run-ways and galleries on living tree-trunks, dead trees and roots were carefully recorded.

The infestation of termites were recorded based on the penetration in to wood and covering of earthen sheet following the slightly modified method of Esenther and Beal (1974) and Beal *et al.* (1979) which is as follows

0 = No infestation
+=Plastering of earthen sheet of about 5% of the stem of the trees
++=Plastering of earthen sheet of about 25% of the stem of the trees
+++=Plastering of earthen sheet of about 35% of the stem of the trees
++++=Plastering of earthen sheet of about 65% of the stem of the trees
+++++=80% portion of the trees was covered with earthen sheet

Photometric method: In Mulakalapally forest region, a large amount of forest litter falls regularly to the forest floor. In the present study the rate of disappearance of leaf litter due to termite feeding was estimated by visual and photometric methods has been described by Heath et al., 1964, but without using the litter bags.

Table: 1 Termites infestation to tress in Mulakalapally forest region

Termite Species	Plant species	Intensity of damage	Damage of Plant Parts
Odontotermes brunneus (Hagen)	*Polyalthia longifolia*	+++++	stem (live)
	Tectona grandis	++++	dead stem
	Terminalia arjuna	++++	dry log
	Miliusa tomentosa	++++	stem (live)
	Albizia amara	+++	dry wood
	Dalbergia paniculata	+++	dry wood

	Hardwickia binata	+++	stem (live)
	Madhuca indica	+++	dead wood
	Buchanania lanzan	++++	stem (live)
	Acacia chundra	+++	dry part of tree
	Largerstroemia parviflora	+++++	dry part of branches
Odontotermes obesus (Rambur)	*Bridelia retusa*	+++++	dead wood
	Ixora pavetta	++++	live bark
	Chloroxylon swietenia	++++	stem (dry)
	Senna auriculata	+++	dry wood
	Madhuca indica	+++++	dry branches of tree
	Albizia odoratisima	++++	stem (dry tree)
	Azadirachta indica	+++	stem (live)
	Lannea coromandelica	++++	dead wood
	Alangium salvifolium	+++	dead wood
	Schleichera oleosa	+++	dead stem
	Grewia tilaefolia	++++	fallen leaves
	Morinda pubescens	+++	stem (live)
	Anacardium occidentale	+++++	stem (live)
	Anogeissus latifolia	++++	dry bark
	Senna auriculata	++++	stem (live)
	Miliusa tomentosa	++++	stem (dead)
	Tectona grandis	++++++	dry stem
Odonotermes indicus (Thakur)	*Albizia odoratissima*	+++	dead wood
	Miliusa tomentosa	+++	dead wood
O. feae (Wasmann)	*Anogeissus latifolia*	++++	stem (dead)
	Lagerstroemia parviflora	+++++	dry wood
	Senna auriculata	+++	bark (live)
	Schleichera oleosa	++++++	stem (live)
	Syzygium cumini	++++	stem (live)

	Lagerstroemia parviflora	+++++	dead wood
	Acorus calamus	++++	stem (live)
	Buchanania lanzan	++++	stem (live)
	Terminalia alata	++++	dead wood
O.wallonensis (Wasmann)	*Chloroxylon swietenia*	++	stem (live)
	Boswellia serrata	++	stem (live)
	Miliusa tomentosa	+++	bark (live)
	Anogeissus latifolia	++++	stem (live
	Madhuca indica	+++	stem (live)
	Tectona gradis	+++	stem (live)
O.redmanni (Wasmann)	*Cleistanthus collinus*	+++	dead wood
	Premna tomentosa	+++	dead (wood)
	Buchanania lanzan	+++	dead stem
	Anogeissus latifolia	++++	stem (live)
	Syzygium cumini	+++	dead (stem)
	Tectona grandis	+++	stem (live)
	Polyalthia longifolia	++++	dead wood
*O. guptai (*Roonwal and Bose)	*Wrightia tinctoria*	+++	stem (dead)
	Senna auriculata	++++++	stem (live)
	Terminalia alata	+++++	stem(live)
	Tectona grandis	+++	stem (dead)
Microtermes obesi (Holmgren)	*Terminalia bellerica*	+++	dead stem
	Manilkara hexandra	+++	dead (wood)
	Cassia fistula	+++	stem (dead)
	Premna tomentosa	++	dry bark
	Limonia acidissima	+++	dead (stem)
Microcerotermes beesoni (Snyder)	*Terminalia alata*	+++	live stem
	Calycapteris floribunda	+++++	dead wood
O. boveni (Thakur)	*Polyalthia longifolia*	++++	dry twig

Heterotermes indicola (Wasmann)	*Anogeissus latifolia*	+++	dead wood
	Dalbergia sissoo	+++	dead wood
Coptotermes hemi (Wasmann)	*Lagerstroemia parviflora*	++++	stem (dead)
	Tectona grandis	++++	root and stem (live)
	Cleistanthus collinus	++	stem (live)
	Lannea coromandelica	++	stem (live & dead)

RESULTS AND DISCUSSION:

Various termite species were collected from different trees, mounds, the fallen tree pieces of logs, dead tree stumps, twigs on the forest floor in the mulakalapally forest area. They are belonging to two families viz., Termitidae and Rhinotermitidae. In Termitidae *Odontotermes boveni* (Thakur), *Odontotermes brunneus* (Hagen), *Odontotermes feae* (Wasmann), *Odontotermes guptai* (Roonwal and Bose), *Odontotermes indicus* (Thakur), *Odontotermes obesus* (Rambar), *Odontotermes redemanni* (Wasmann), *Odontotermes wallonensis* (Wasmann), *Macrotermes convulsionaries* (Konig), M*icrocerетermes beesoni* (snyder) and *Microtermes obesi* (Wasmann), and in Rhinotermitidae, *Coptotermes hemi* (Wasmann), *and Heterotermes indicola* (Wasmann).

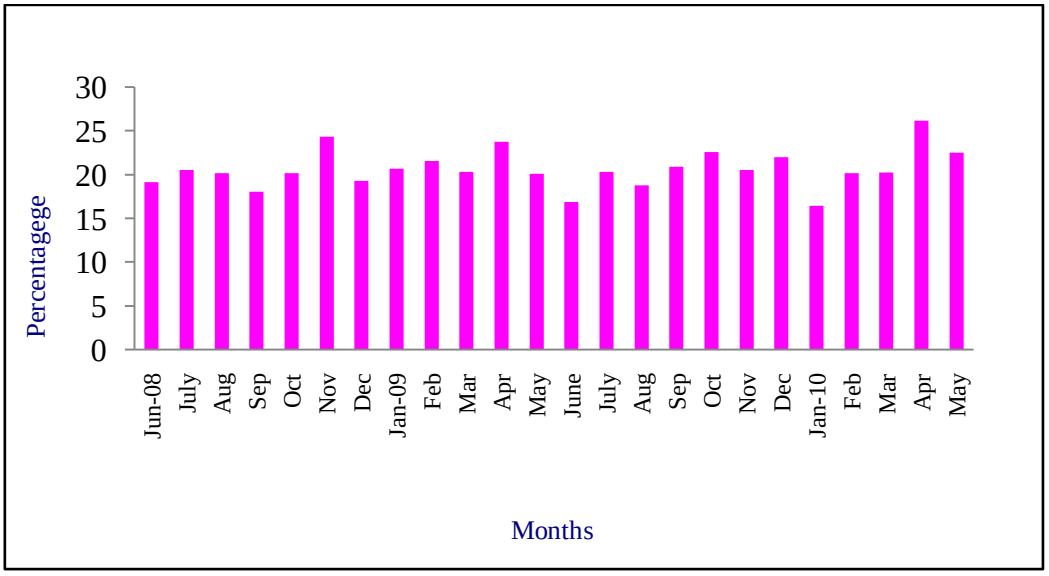
The nature of damage of different species of termites in the different forest trees. The damage of *Odontotermes* species was recorded in the form of nibbling on dead as well as on live bark of both stem and root underneath the cover of earthen sheet and runways. The attack of *Odonototermes* species occurred usually at the basal part of the trunk. The infestation although not severe, was localized resulting in the formation of irregular cavities or grooves of various sizes on the surface of the trunk. The earthen sheet of *O. brunnus* on *Milius tomentosa* was recorded up to 6 meters height. Its damage was recorded on dead part of stem. It is very intensively damage some more plants were *Terminalia* arjuna, *Albiziaamara, Milliusa tomantos. Dalbergia paniculats, Hardwikia binata, Buchanania lanzan, Madhuca indica, Acacia chundra, Lanorgerstromia parviffora.*

The intensity of different termites damage to different trees in Mulakalapally forest region is presented (table -1) The damage of *O. brunneus* was recorded maximum 80% and minimum 35%.The following trees were infested by this species viz..

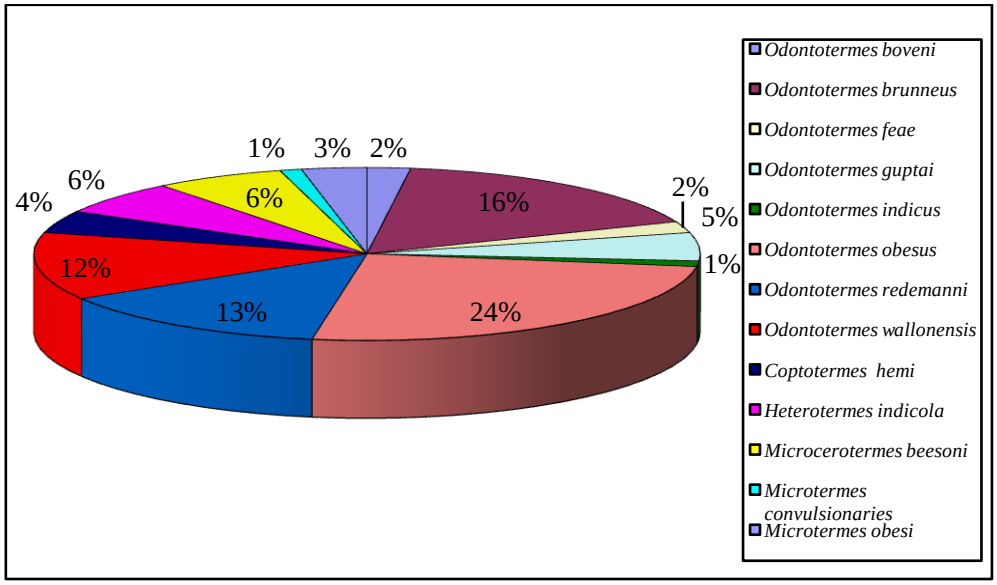
Tectona grandis, Largerstroemia parviflora, Termanalia arjuna, Miliusa tomantossa, Buchanania lanzan. Albiziamara, Dalbergia paniculata, Harwickia binata, madhuca indiaca and Accacia chundra. The damage of *O. obesus* was recorded maximum 80% and minimum 35%.Its damage was recorded on trees *Brideliavetura, Madhuka indiaca, Anacardium occidentalis, Tectona grandius, Ixorapavatta, Cloroxylon swietanliq. Albizia odoratisima, Lannea coromandelica, Grewiatilac folia, Anogeissus latifolia, Miliusa tomentosa and Acassia auriculata. Azadaracta indiaca, alangium salvifolium, Schleichera oleora, Morinda pubescene*, *lagerstroemia parviflora*, *Schleichera oleora*.

The damage of *O. guptai* was recorded maximum 80% and minimum 35%.Its damage was recorded on trees *Cassia auriculata*, *Terminalia tomentosa, Wrightinetoria, Terminalia arjuna and Tectona grandis* The damage of *o.feae* was recorded maximum 80% and minimum 35%.The following trees were infested by this species viz. *Anogeissus latifolia, Syrigium cuminilive, Acoras calamus, Terminalia tomentosa* and *buchananai lanzan*, *Cassia auriculata*. The damage of *O. wallonensis* was recorded maximum 65% and minimum 35%. Its damage was recorded on trees *Buchanania lazan,Anogeissus latifolia, Boswellia serrata, tectona grandis*, *Chloroxylon swietenia Madhuca*

indica Miliusa tomentosa The damage of *O. indicus* was recorded maximum 35% and Minimum 35%.Its damage was recorded on trees *Miliusa tomentosa, Aleberzia odoratissiama* The damage of *O. redmanni* was recorded maximum 65% and minimum 35%. The following trees were infested by this species viz. *Szygium cumini, Premna tomentosa, Anogeissus latifolia, Buchanania lanzan, Cleistanthus collinus, Tectona grandis*.The damage of *O. boveni* was recorded maximum 65% and minimum 35%.The following trees was infested by this species viz. *Lanorgerstromia parviffora. Anogeissus latifolia.* The damage of *Microtermes obesi* was recorded maximum 80% and minimum 35%.Its damage was recorded on *Limonia acidissima, Manilkara hexandra*, *Cassia fistula*, *and Premma tomentosa* and *Terminalia bellrica* the damage of *Microtermes beesoni* was recorded maximum 80% and minimum 35%. The following trees were infested by this species viz. *Terminalia tomentosa, Calycapteris floribunda.* The damage of *Heterotermes indicola* was recorded maximum 80% and minimum 35%.Its damage was recorded on *Anogeissus latifolia.* The damage of *Captotermes hemi* was recorded maximum 65% and minimum 25%.Its damage was recorded on *Lagerstromia parviflora, Tectona grandis, Cleistanthus collinus, and Lanne coromandelica.*



The percentage of damage caused by *Odontomermes* sp in Mulakalapally forest region is presented in (Fig.1). Maximum infestation was recorded in month of April 2010 and minimum infestation was recorded month February 2010. The infestation in June 2008 (14.15%), it was slightly increased in month of July and slightly decreased in month of August to October 2008. Again it slightly increased in month of November. Again decreased in month of December 2008 then it was slightly increased from January to February 2009. Again it decreased in March 2009 again suddenly increased in April 2009. Then it gradually decreased from May to September 2009, and slightly increased October and decreased November 2009. Again it was increased December 2009. It was gradually increased from January 2010 to march 2010, and slightly increased in month of April 2010 and again decreased in May 2010.



Overall percentage of damage caused by different species of termites in Mulakalapally forest region.

The damage caused by different species in Mulakalapally forest region is presented in (Fig.2). The damage caused by *O. brunneus (16%)* followed by *O. obesus (24%) O. redemanni, (13%) O. wallonensis (12%) O. guptai* (5%) *O. feae* (2%) *O.boveni* (2%) *Microtermes obesi (3%) Heterotermes indicola (6%) Coptotermes hemi (4%), Microcerotermes beesoni (6%)*

The results indicate that maximum damage caused by *O. obesus* and minimum damage caused by *O. boveni*, *O. feae* and *Microtermes obesi* in Bhadrachalam forest region

CONCLUSION

Termites are widely distributed in Mulakalapally forest region. They play in an important role in decomposition procession in forest and few termites are causing damage to the plants.

The total 22.6% of forest trees damaged by termites in Mulakalapally forest, our results supported by Harris, 1955 and Lee & Wood, 1971. Termites rarely cause significant damage on tree species.

Our results may shed same light on some of the mechanisms responsible for tree resources exploitation by termites. With our results conclude that presence of termite galleries or earthen sheet on trees could be determined more by resources availability than resource quality. Termites selecting large trees merely because they are easier to be encountered during random foraging.

Results indicated that the foraging activities of subterranean termites in rainy season and winter season was the highest slightly decreased at the end of rainy season. Climatic factors especially rainfall declined soil temperature and increase soil moisture and relative humidity might influenced the foraging patterns and increasing foraging activity of subterranean termites these results supported by Lafage et al ., 1976; Black and wood, 1989.

Comparing the foraging activity throughout the year between different termite species found in the forest revealed that *Odontotermes obesus* showed the highest in foraging activity followed by *O. brunneus, O. redemanni, O. wallonensis, H. indicola, C. hemi, O. feae* and *O. guptai.*

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