DENUDATION EFFECT OF TERMITARIA AND CHARACTERIZATION OF ASSOCIATED TERMITE SPECIES IN LAFIA NASARAWA STATE, NIGERIA

Musa Mohammed, B. Agric
Department of Crop Production and Protection,
Federal University Dutsin-Ma, Dutsin-Ma Katsina State Nigeria
Ajayi Folorunso Abiodun, Prof.
Department of Agronomy, Faculty of Agriculture
Shabu-Lafia Campus, Nasarawa State University
Abdulhadi Bawa Jibia, M. Sc.
Department of Biological Sciences, Federal University Dutsin-Ma,
Dutsin-Ma Katsina State Nigeria

Abstract

Termite infestation is an important factor in the livelihood of the dwellers in the savanna region of Nigeria. This study evaluates the denudation effect of termitarium and characterization of associated termites' species in Lafia Local Government of Nasarawa State of Nigeria. Structured questionnaire was administered to 21 farmers at random to access information on the effect of termite infestation on crops, the loss incurred due to termite infestation, the type of crop the farmers grow, the yield of the crop after harvest, farm size, and the total area denuded by termites in the study area. Also representative sample of termites' species was taken and identified. The respond of the farmers was subjected to simple statistics for analysis, the termite species found include: *Odontotermes, Callotermes, Eutermes* and *Termes* species. The mean width and height of termitarium, the mean of farm size were obtained after the analysis. The total area denuded by each termite species was determined after the analysis and it was found that *Odontotermes* (47.9%) was found to cause larger termitaria than *Callotermes* (42.9%), *Termes,* and *Eutermes* that recorded 4.8%, respectively. Thus, *Odontotermes* caused more denudation of farm land than other species found in the study area.

Keywords: Termite Species, denudation, Crop and termitarium

Introduction

Termites are group of Eusocial insects of the epifamily, Termitoidae. Like ants, some bees, and wasps, which are all placed in separate Order Hymenoptera, the termites divide labor among castes, produce overlapping generation and take care of young collectively. Termites mostly feeds on dead plant material, generally in the form of wood, leaf litter, soil, or animal dung and about 10 percent of the estimated 4,000 species (about 2,600 taxonomically known) are economically significant as pest that can cause serious structural damage to buildings, crop or plantation forests (Mitchell, 2002).

There are over 660 known species of termites in Africa (Kambhampati and Eggleton, 2000) but species diversity varies within and between regions. Due to the xeric condition in northern Africa, species diversity is low (<15 species) compared to the Eastern, Western, and Southern region of the continent. Over 177 species were recorded in East Africa (i.e. Uganda, Kenya, and Tanzania) alone. Out of these, 143 species belongs to the east Africa fauna, which is also continuous with that of Somalia, Ethiopia, and the Sudan to the North and Malawi, Zimbabwe and Mozambique to the south (Wanyonyi *et al*., 1984). Some 165 species have been recorded from the South Africa region including South Africa, Zimbabwe Mozambique, Botswana, Swaziland, Lesotho and Narnibia (Uys, 2002).

Termites are usually divided into lower and higher termites. Members of the family Kalotermitidae feed mainly on dry wood, and do not construct definite nests and live in small colonies in sound or dead wood (Grimaldi and Engel, 2005). The family Termopsidae is represented by two species (Khambanpati and Eggleton, 2000), which feed on and nests within damp and decaying wood. The family Rhimnotermitidae consists of mainly subterranean, wood eating termites. The family Hodotermidae consists of the so-called harvester termites, which are among the most notorious pests of pasture, crops and structural timber (Uys, 2002).

Higher termites feeding is also not limited to wood, some feed exclusively on soil, while others “cultivate” and consume cellulolytic fungi. In Africa, the Terrnitdae are represented by 600 species (>90% of all known species) (Kainbhampati and Eggleton, 2002) in four subfamilies, Apicortermitinae, Termitinae, Macrotermitinae and Nasutitermitinae.

This study was undertaken to evaluate the denudation effect and loss caused by the presence of the termitaria and to assess the constraint imposed on farming system as a result of the termites’ infestation.

Materials and method

Study Area

Lafia is the largest town in Nasarawa Central Nigeria, located on Latitude 8°N and Longitude 8°E. It is the capital city of Nasarawa State and has a population of 330,712 inhabitants according to the 2006 census results (Jatau, 2013). Agriculture is the mainstay of the state's economy, producing varieties of cash crops throughout the year. The area is almost entirely woodland savannah and tall grass savannah. Cassava, yam, rice, corn, guinea corn, beans, soya beans and millet are the major crops grown. Animal husbandry is a significant commercial activity. Minerals found in the state include: coal, iron ore, zinc, copper, columbite, barite, salt, bauxite and aquamarine (CGIDD, 2008).

Research Design and Sampling Technique

Structured questionnaire was used to obtain information from farmers about their farms.

Seven, locations were selected at random within the study area. In each of these randomly selected locations, three farms harboring termitarium were identified and selected.

The selected termitarium in each site was broken in order to obtain insect samples and even the termite queen. Before the termitarium was broken, the height and surface area denuded by the termites was measured and calculated.

Insect Identification

Representatives of all insect samples collected from each site was stored in 10% ethanol solution and was sent to Entomology Laboratory of Ahmadu Bello University, Zaria for identification.

Statistic and Data Analysis

The experiment was carried out in a randomized complete block design (RCBD). Each of the seven locations serves as the block, while the three sites selected in each location serve as the replicates thus

n = 7 x 3=21. The structured questionnaire was analyzed and information on:

- The type of management practices the famer uses to thwart infestation of his farm by termites.

- Socio-economic analysis of the farm, were obtained.

The measurement of the termitarium relative to the denuded areas was used to calculate the amount of loss in terms of money that was realized from the farm when compared to the size of the farm.

The relative percentage of the species of termites identified in the study area was analyzed.

Results

The result obtained from the denudation effect of termitaria and characterization of associated termite species indicates on the socio-economic loss of the respondents (Table 1). Highest loss was recorded at Ilori (Farm 3) where the farmer lost ₦1222.79, at Agumji (Farm 2) and Azuba center, the loss of ₦793.73 and ₦767.85 were recorded, respectively. Figure 1 shows the different termites' species as associated to the total area denuded by each termite spp. From the result in Fig. I, *Odontotermes* spp. has the largest area denuded in the study area and so they are the large mound builders. The area with the highest denudation effect is Agumji while area denuded by the other species (*Callotermes, Eutermes and Termes*) is less compared to the one denuded by *Odontotermes* spp.

Table 1: Socio-economic loss of the Respondents in the study area

Location	Farm	Type of crops grown	Farm size (m^2)	Total area denuded (m^2)	Expectation of farmer from sales of farm produce (₦)	Expected loss / denuded area (₦)
Agyaragu Tofa	1	Yam	15,000	6.24	30,000	77.88
	2	Maize	5,000	7.43	10,000	110.34
	3	Yam	21,000	12	80,000	548.52
Akurba	1	Cassava	20,000	28.2	12,000	477.14
	2	Cassava	140,000	0.03	60,000	0.0051
	3	Maize & Cassava	15,000	23.75	9,800	368.60
Danka Sarki	1	Maize & Millet	40,000	15.81	97,000	511.29
	2	Millet & Cassava	175000	20.37	100,000	236.29
	3	Sesame & Cassava	60,000	0.69	68,000	0.55
Agumji	1	Cassava	20,000	1.75	12,000	1.84
	2	Cassava	40,000	40.25	196,000	793.73
	3	Yam & Millet	10,000	1.69	21,000	6.02
Ilori	1	G/nut & Cowpea	30,000	5.0	70,580	58.80
	2	Yam & Cassava	15,000	13.68	68,000	19.5
	3	Yam	20,000	28.55	30,000	1222.79
Angwan Azara	1	Cassava & G/nut	75,000	16.66	51,500	190.59
	2	Cassava	12,000	13.80	6,000	95.22
	3	Millet	15,000	6.05	28,500	68.94
Azuba	1	Cassava	3,000	20.91	1,800	262.42
	2	Millet	15,000	22.88	22,000	767.85
	3	Cowpea	175,000	5.69	15,400	2.85

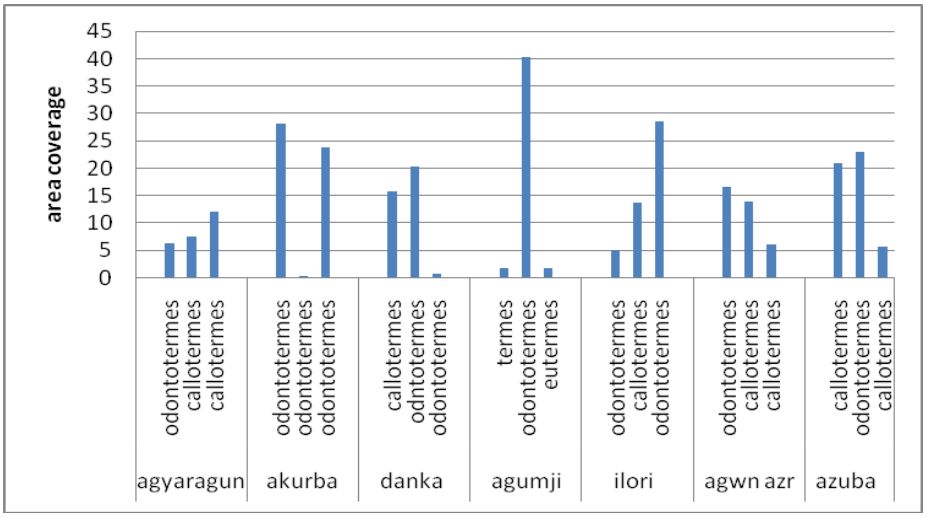

Fig I: Total area Denuded by Termites Species in Each Farm at Different Locations of the study area

Fig. II shows the mean height of the temitarium. Taller termitarium was found at Azuba Center (mean = 2.50 m) and Ilori (mean = 2.32 m). The shortest of the termitaria was observed at Agyaragun Tofa (mean =1.40 m) Fig. III shows the mean width of the temitaria. The termitarium with the highest width was found at Angwan Azara (mean = 7.88 m) while the termitarium with the lowest mean (5.57 and 5.61 m, respectively) were found at Danka Sarki and Agumji. Fig. IV shows the mean farm size (ha) of the respondents. The area with the largest farm size was recorded Danka Sarki (mean = 9.17 ha) while Agyaragun Tofa has the least farm size (mean = 1.37 ha).

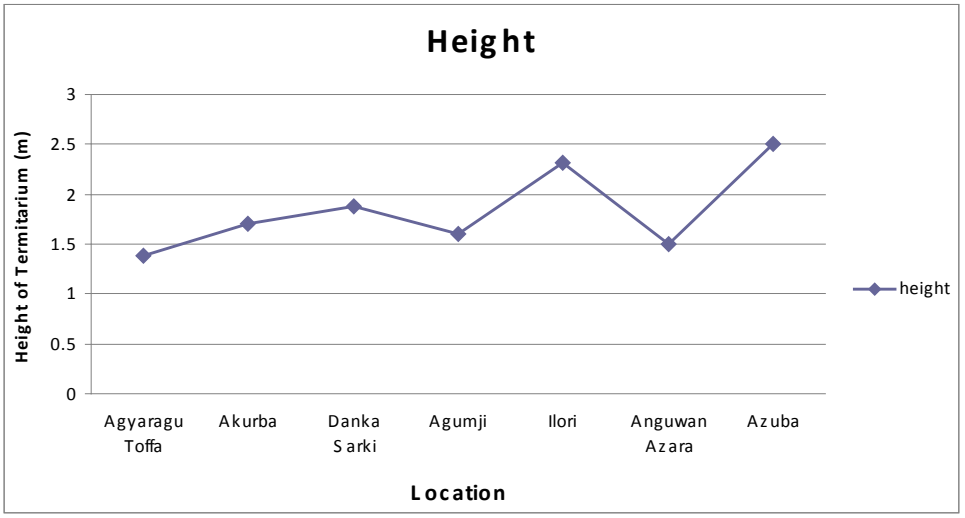

Fig. II: Mean height of the termitarium (m) at each of the study area

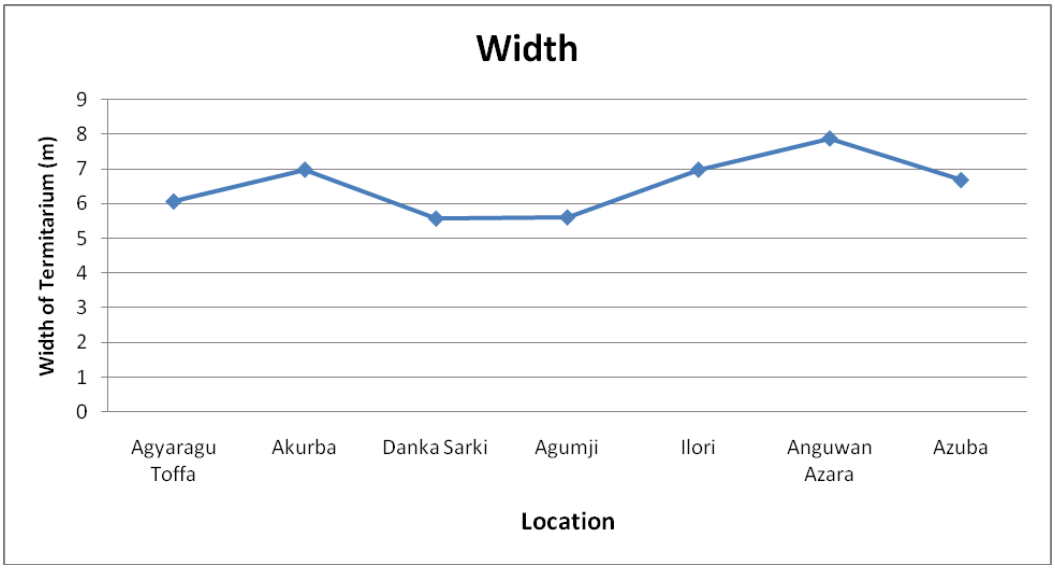

Fig. III: Mean width of the termitarium (m) at each of the study area

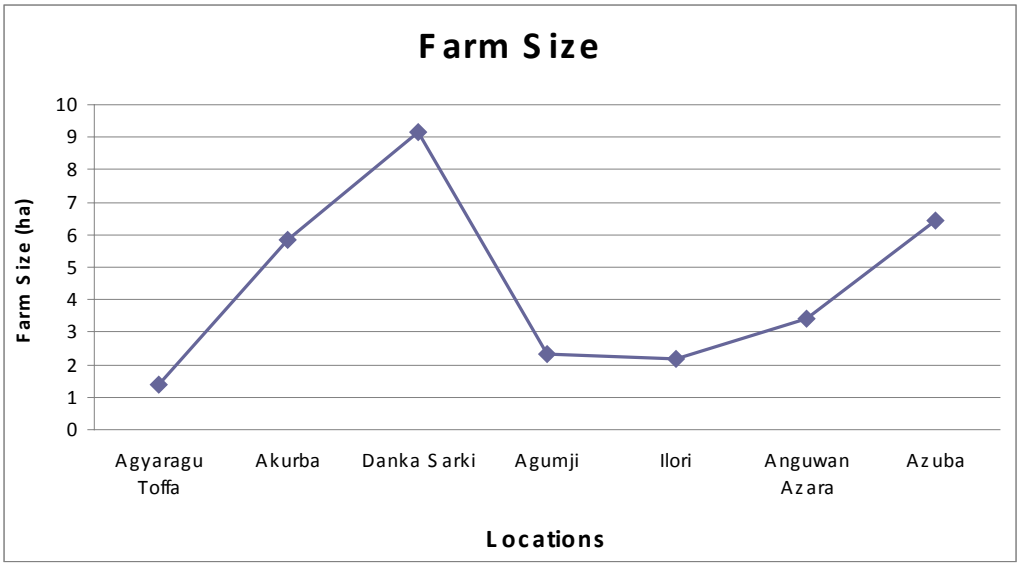

Fig. IV: Mean farm size (ha) at the study area.

Table 2 shows the different species of termites associated to each farm in the area. Their family and order was also indicated in the table. All the termites found in the study area belong to the family Terimtidae. Four species predominates in the study area and theses were *Odontotermes, Callotermes,Termes* and *Eutermes species.*

Table 2: Different Termites Species found at different locations of the Study area

Location	Farm	Order	Family	Genus/Species
Agyaragun Tofa	1	Isoptera	Termitidae	*Odontotermes* spp.
	2	Isoptera	Termitidae	*Callotermes* spp.
	3	Isoptera	Termitidae	*Callotermes* spp.
Akurba	1	Isoptera	Termitidae	*Odontotermes* spp.
	2	Isoptera	Termitidae	*Odontotermes* spp.
	3	Isoptera	Termitidae	*Odontotermes* spp.
Danka Sarki	1	Isoptera	Termitidae	*Callotermes* spp.
	2	Isoptera	Termitidae	*Odontotermes* spp.
	3	Isoptera	Termitidae	*Odontotermes* spp.
Agumji	1	Isoptera	Termitidae	*Termes* spp.
	2	Isoptera	Termitidae	*Callotermes* spp.
	3	Isoptera	Termitidae	*Eutermes* spp.
Ilori	1	Isoptera	Termitidae	*Odontotermes* spp.
	2	Isoptera	Termitidae	*Callotermes* spp.
	3	Isoptera	Termitidae	*Odontotermes* spp.
Angwan Azara	1	Isoptera	Termitidae	*Odontotermes* spp.
	2	Isoptera	Termitidae	*Callotermes* spp.
	3	Isoptera	Termitidae	*Callotermes* spp
Azuba Center	1	Isoptera	Termitidae	*Callotermes* spp.
	2	Isoptera	Termitidae	*Odontotermes* spp.
	3	Isoptera	Termitidae	*Callotermes* spp.

Table 3 shows the frequency of occurrence of the termite species. Out of the four species found in the area surveyed, 47.6% were *Ondontotermes* species, 42.9% are *Callotermes* species, *Termes* and *Eutermes* species were 4.8%, respectively.

Table 4 shows the problem encountered by farmers due the effect of termites' species in their farms and the control measures attempted in controlling such problem.

Table 3: Showing the Frequency and Percentage of Different Termites' Species found in the Study area

Termite Species	Frequency	Percentage
Odontotermes	10	47.6
Callotermes	9	42.9
Termes	1	4.8
Eutermes	1	4.8

Table 4: Problem and treatment/control measures taken by farmers in the study area on the Denudation effect of termitaria

Location	Farm	Problem	Treatment/ control
Agyaragu	1	Nil	Nil
	2	Eating up root of crops thereby causing lodging	Nil
	3	Total crop destruction	Nil
Akurba	1	Eating up plant stem	Nil
	2	Nil	Nil
	3	Unwanted crop harvesting	Nil
Danka sarki	1	Crop destruction before establishment	Nil
	2	Cause stem destruction in cassava and causes lodging in millet	Nil
	3	Seedling destruction	Nil
Agumji	1	Nil	Nil
	2	Nil	Nil
	3	Nil	Nil
Ilori	1	Nil	Nil
	2	Causes plant lodging	Nil
	3	Eating up plant root and stem	Nil
Angwan Azara	1	Nil	Nil
	2	Plant root destruction	Nil
	3	Foraging effect on the crop	Nil
Azuba	1	Nil	Nil
	2	Nil	Nil
	3	Nil	Nil

Discussion

It was reported in this study that, the denudation effect of termitaria had minimal effect on the total yield of farmers after harvest. This might be due to low occurrence or presence of termitaria by the termites' nuisance in the study area. In Nigeria, farmers have long realized that termite damage is greater in dry season or when crop are just planted (Malaka, 1972). Termites are sometimes mentioned as disturbance agents in savanna (Cromsigt and Olff, 2008), many of their well known roles in the functioning of ecosystem (Wood and Sands, 1978; Eldridge *et al*., 2001) have been ignored in general models in vegetation dynamics, as well as specific studies and pattern formation.. Sands (1971) also reported that the fact that insects of the order Isoptera includes such a wide range of behavior and feeding habits, it is probably true to say that practically every plant used by man is also attacked

by at least one termite species at some stage of its growth in some part of the tropics.

The study had also shown that most farmers in the study area happen to neglect the effect of termites' infestation in their farms as none of the farmers apply any treatment to cure the termites and its denudation effect. Harris (1971) noted that there are enough records to suggest that some termites attack crops in particular localities with sufficient regularity for them to be regarded as primary pests. This explains why termites cause more damage in man-modified environment than in natural habitat (Malaka, 1983).

The major problem that farmers faced with the termite is crop destruction in the field. This could be explained by the fact that termites live in colonies that, at maturity, number from several hundred to several millions individuals, and these colonies use decentralized, self-organized system of activity guided by swarm intelligence to exploit food sources and environments that could not be available to any single insect acting alone. As reported by Moe *et al.* (2009) that termite especially those that live under the ground (subterranean forms) damage planted crops and vegetation by feeding on the root of these crops. Like harvester termites, harvester ants are also a major grainivorous species because they devastate cultivated crops in colonies, thereby collecting sown and fallen seeds, climb plant and harvest matured seedling sand also reduce plant stands by denudation of otherwise cultivable land (Ajayi *et al.*, 1999; Ireland and Andrew, 1995; Jago, 1983). Apart from loss sustained from gathering of these seeds and leaves, harvester ants prevent infested seed from germinating through secretion of herbicide on them and by exposing seeds to heat (Sudd, 1967).

It was however, observed from this study that the loss sustain (monetary) due to denudation effect was economically important at some of the farms while other farms sustained less loss. Also from the study carried out, the species of termites that predominate in the study area are mostly *Odontotermes* species, *Callotermes* species, *Eutermes* and *Termes* species. The Species *Odontotermes* were observed to be the large mound builders due to their subterrenian nature. As reported by McFarlane and Darlington (1991) that the main builders of the large mounds are members of the subfamily Macrotermitinae (mainly *Odontotermes*, *Macrotermes* and *Pseudocanthotermes* spp.) the Termitinae (mainly *Cubitermes* spp) and Nasuitermitinae (mainly *Trinervitermes* spp), build smaller mounds which occur at high density than Macrotermitinae.

Conclusion

Termites are one of the most important insect species that cause considerable damage to our crop plants furniture and many house hold

equipments. To their effect on ecosystem is enough to induce heterogeneity in Nigerian savanna vegetation. Therefore, termites control should be adopted in order to reduce this trend induced due to termite activity; however, proper hygiene should be maintained by farmers both at home and at their farms so as to check the disaster of destruction due to denudation activities of termites. For farms with termites mounds control measures should be accelerated and the mound should be destroyed and incorporated into soil during ploughing. This may add mineral nutrient to soil and results in high yield.

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