NATURAL RESISTANCE OF SOME INDIGENOUS TIMBER SPECIES TO TERMITE DAMAGE IN PART OF NIGERIAN NORTHERN GUINEA SAVANNA

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Abstract: Timber can be protected from termite attack by their natural resistance or through chemical treatment. Not all wood/timber species have inherent ability to resist the attack of bio-deteriorating agents without treatment with chemical preservatives. There is paucity of information on the natural resistance of some indigenous timber species to termite damaged in part of Nigerian Northern Guinea Savanna. Therefore, natural resistance of selected economic indigenous species of the ecological zone was investigated. The study was conducted at Federal College of Forestry Mechanization. "Timber Graveyard" method was adopted in evaluating the natural resistance of selected indigenous timber species which were sawn to similar rectangular stalks measuring 30 x 5 x 2 cm and the initial volume of each were noted. Volume changes rather than changes in weight were used to avoid complication that could arise from weight changes due to evaporation of water, chemicals and other highly volatile liquid from wood surface. The test ware carried out in two (2) phases, a trial and test phase. The experiment was laid out in Complete Randomized Design (CRD). Observations for signs of attack on rectangular wooden stalks were taken at fortnight intervals. Four (4) out of the Ten (10) species (*Millicia excels, Khaya senegalensis, Terminalia superba* and *Prosopis africana*) of timber tested showed high resistant to termite attack at 2.53, 5.20, 8.00 and 8.21%, respectively. *Ceiba petendra* had the lowest natural resistance while *Milicia excelsa* had the highest natural resistance to the ravaging attack of subterranean termites. The economic implication of this calls for the use of extremely resistant timber.

Keywords: Termite, wooden stalks, natural resistance, Guinea savanna, timber graveyard

Introduction

Termites are insects of the order "Isoptera". They are very unique group of organism, which lives in colonies with a well-organized social formation. Due to their appetite for wood and plant materials, they cause significant and serious damage to wood products and timber employed in buildings or used for other purposes (Sajap, 1999; Lee *et al.*, 2003). If there is one thing that people know about termites, it's that they love to chow down on timber-framed homes. In addition, they nibble at a number of materials and metallic (Sodimu, 2005; Sodimu *et al.*, 2005). Their habits bring them into direct competition with man. The loss of materials through termite attack is colossal (Ausat *et al.*, 1960; Haris, 1961; Sodimu *et al.*, 2005). Surprisingly, of the more than three thousand termites (3000) species on record today, only a minority are considered pests. Some regions of the world are more saturated with termite pests than others. For example, termite infestations are exceptionally rare in Canada due to the colder temperatures, and only a few different species are considered pests in America. Annon (1985) had recognized the magnitude of termite's menace in Nigeria. Despite this early discovery, much works on termite in Nigeria have been directed towards termite to food crops (Johnson and Wood, 1979; 1980).

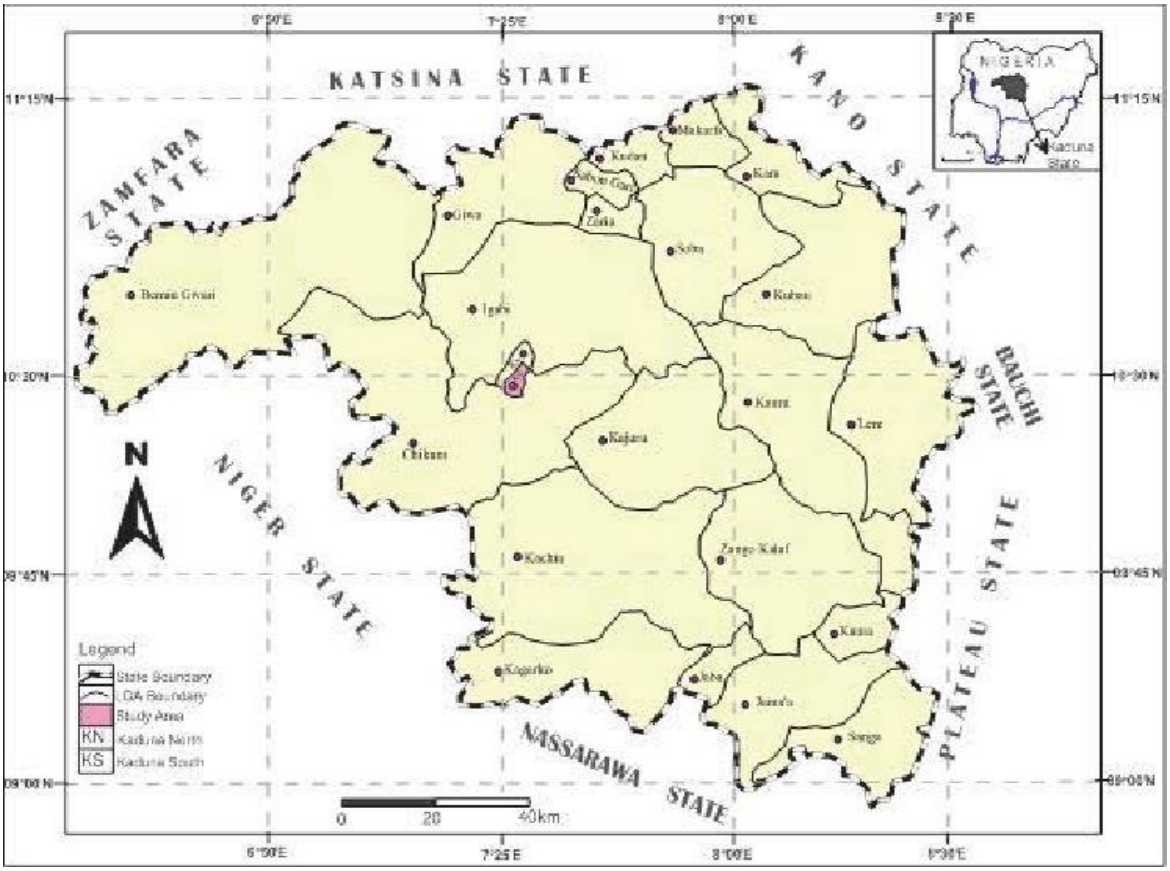
Presently in Nigeria of today, builders buy wood and use directly for construction work without going through preservative treatment process. This could be as a result of lack of knowledge about the natural resistance status of some of the Nigerian wood species, users only rely on experience acquired over the years but which is no longer reliable because of dwindling supply of mature timber from the forest. Wood as a biological product undergoes various physiological changes in the process of growth. According to Homan and Jorissen (2004) most fast grown wood species tend to deteriorate rapidly under biological and physical influences. Sapwood of most wood species have low durability. The durability of most heartwood is enhanced by the presence of toxic extractives which vary with different species and determine their level of durability. Natural resistance is the inherent ability of some wood species to resist the attack of bio-deteriorating agents without treatment with chemical preservatives. The natural resistance exhibited by some species is the resultant effect of the presence of extractives in the heartwood region. Milton (1995) revealed that the sapwood of all known tree species is very susceptible to decay, regardless of any natural resistance of the heartwood. Unless sapwood is entirely removed or impregnated with preservatives, decay is likely to occur even in durable resistant species (Adam *et al.*, 2002)

Termite resistant heartwoods contains extractives which have termite toxicity and/or repellency properties (Scheffrahn, 1991). However, the extractive content of heartwood varies with physiological age of wood in the tree as well as its growth site (Grace *et al.*, 1996). According to Ausat *et al.* (1960), plant can be protected from termite attack by their natural resistance or through chemical treatment. However, this work is a comparative study of natural resistance of ten (10) indigenous timber species that are commonly used in Northern Nigeria. It aims at assessing the amount of damage done to these timber species by termite when left untreated with chemicals. The ten (10) species are *Khaya senegalensis* (mahogany), *Prosopis africana, Isoberlinia doka* (Doka), *Anogeissus leiocarpus, Triplochiton scleroxylone* (Obeche), *Tectona grandise* (Teak), *Terminalia superba* (Afara), *Milicia excels* (Iroko), *Danielia oliveri* and *Ceiba patendra* (Rimi).

Materials and Methods

Study area

The study was conducted between February 2020 and September 2020 in Igabi Local Government Area of Kaduna State at timber graveyard of Federal College of Forestry Mechanization, Afaka, located at latitude 10°37'N, 11°40'N and longitude 7°17'E, 8°10'E (Sambo, 2011). The temperature varying from 29 to 40^{0}C, with maximum in April and minimum in August; the annual rainfall is about 1000 – 1500 mm (Sodimu, 2016).



Source: Sodimu (2016)

Fig. 1: Map of Kaduna State showing the study area

Methodology

The methodology employed was "timber graveyard test" which has been used by several workers (Haris, 1961; Smith, 1969; Usher and Ocloo, 1979; Sodimu *et al.*, 2005). The timber species were sawn to similar rectangular stalks measuring 30 x 5 x 2 cm and the initial volume of each was noted. Volume changes method were adopted instead of popular weight changes method to avoid complication that may perhaps arise from weight changes methods due to evaporation of water, chemicals and other highly volatile liquid from wood surface. The test was carried out in two (2) phases, a trial and test phase. The trial phase ensured uniform saturation of termites in the test area before commencement of the test proper. The experimental stalks were laid out using Complete Randomized Design (CRD). Litters were gathered round the experimental stalks and watering was employed to serve as a means of providing a more conducive environment for termite attack.

Data analysis

The data collected was analysed using descriptive statistic such as mean and percentages.

The percentage damage of the timber was calculated as below:

$$PD(\%) = \frac{\text{FAV} - IAV}{IAV} \times 100$$

Where: PD (%) = Percentage Damage; FAV = Final Average Volume; IAV = Initial Average Volume

Results and Discussion

The average volume changes for different timber species, which was employed as a measure of termite damage, are shown in Table 1. Iroko showed the least decreased in volume and was therefore, the least damaged (2.45%), followed by Dry-zone Mahogany (5.21%), Afara (8.00%), Ironwood (8.21%), Doka (18.99%), Ogea (20.34%), Marke (20.65%), Obeche (26.10%), Teak (26.40%) and Rimi with the least (37.67%).

Table 1: Initial and final volume of the timber species, before and after the termite attack

S/N	Standard or local trade name	Botanical name of timber	Initial average volume (cm^2)	Final average volume (cm^2)	Decrease in volume (cm^2)	% damage
1.	Rimi	*Ceiba petendra* L.	65.10	40.58	24.52	37.67
2.	Mahogany	*Khaya senegalensis* Ders.	96.00	91.00	5.00	5.21
3.	Teak	*Tectona grandis* L.f	160.33	118.00	42.33	26.40
4.	Afara	*Terminalia superba* Engl. & Diels.	90.00	82.80	7.20	8.00
5.	Doka	*Isoberlinia doka* Craib & Stapf.	122.83	99.50	23.33	18.99
6.	Obeche	*Triplochiton scleroxylone* K. Schum.	70.17	51.83	18.34	26.10
7.	Iroko	*Milicia excelsa* (Welw.) C.C. Berg	164.50	160.33	4.17	2.54
8.	Iron wood	*Prosopis africana* Guill,Perrott. & Rich.	93.80	86.10	7.70	8.21
9.	Ogea	*Daniellia oliveri* (Rolfe) Hutch & Dalz	87.50	69.70	17.80	20.34
10.	Marike	*Anogeissus leiocarpus* (DC.) Gull.& Perr	97.80	77.60	20.20	20.65

Ceiba petendra (Rimi) showed the greatest susceptibility to termite attack and hence has the least natural resistance. *Milicia excelsa* (Iroko) showed the least susceptibility as well as the best naturally resistant wood. The results obtained are in consonance with the test carried out by other foresters (Lee *et al.,* 2003; Sodimu *et al.,* 2005). Iroko was found to be resistant and has been classified as such by Haris (1961), Usher and Ocloo (1979) and Sodimu *et al.* (2005). However Dry Zone Mahogany (*Khaya senegalensis*) and Afara (*Terminalia superba*) were also resistant but can be greatly damaged when exposed to starving termites. The greater durability of these three (3) woods may be attributed to chemical substances present in them. Chlorophorin has been found in Iroko while mahogany and Afara has a high lignin content (Haris, 1961; Rudman and Gery, 1963; Sodimu, 2005). These substances render the wood unpalatable to termites (Sodimu, 2005). However, the results may vary from one region to the other due to environmental factors such as the type of soil, rainfall, weathering condition which may affect the biodegradation activities on the test specimens (Noor-azrieda *et al.,* 2016).

Conclusion

The study has shown that out of Nigeria timber examined, *Milicia excelsa* (Iroko) was found to be the best natural resistant to the ravaging attack of subterranean termites while *Ceiba petendra* (Rimi) was the least.

References

Adam MT, Barbara LG & Joffrey JM 2002. Heartwood and Natural durability – A review. *Wood and Fibre Science,* 34(4): 587 – 611.

Annon 1985. Natural Durability of West Africa Indigenous Timber. *West African Termite Research*, p. 45.

Ausat A 1960. Natural Resistance of Different Species of Timbers to Termite Attack 199, 204pp

Grace JK 2003. Approaches to biological control of termites. *Sociobiology,* 41: 115–120.

Grace JK, Yates III JR, Tome CHM & Oshiro RJ 1996. Termite resistant construction: Use of a stainless steel mesh to exclude *Coptotermes formosanus* (Isoptera: *Rhinotermitidae). Sociobiology,* 28: 365–372.

Haris WV 1961. Termites and trees: A review of recent literature. *Forestry Abstract* 27(2):7.

Homan WJ & Jorissen AJM 2004. Wood modification developments. *HERON* 49(4): 361- 386.

Johnson RA & Wood TG 1979. Termites, Friends or Foe? *West African Farming*, pp. 26 – 27.

Johnson RA & Wood TG 1980. Combating Termites. *West African Farming*, March 1980, pp. 1-4.

Lee CY, Yap J, Ngee PS & Jaal Z 2003. Foraging colonies of a higher mound-building subterranean termite, *Globitermes sulphureus* (Haviland) in Malaysia. *Japan J. Envt., Entomol. and Zool*., 14: 105–112.

Milton FT 1995. The Preservation of Wood: A Self-Study Manual for Wood Treaters. Minnesota Extension Service, BU-6413-S; University of Minnesota, College of Natural Resources, p. 100.

Noor-Azrieda AR, Salmiah U & Rahim S 2016. Comparism of accelerated decay and graveyard test on selected Malaysian timber species. *J. Trop. Resources and Sust. Sci*., 3: 238 – 241.

Rudman K & Grey FJ 1963. The causes of natural durability of timber. *Holzforsching,* 17: 21-25.

Sajap AS 1999. Detection of foraging activity of *Coptotermes curvignathus* (Isoptera: Rhinotermitidae) in an *Hevea brasiliensis* plantation in Malaysia. *Sociobiology,* 33: 137 – 144.

Scheffrahn RH 1991. Allelochemical resistance of wood to termites. *Sociobiology,* 19: 257–281.

Smith DN 1969. The natural durability of timber. *Forest Product Resources Records* 30: 61 – 63.

Sodimu AI 2005. Influence of Bush Burning on Termite Infestation in Eucalyptus Wood Lots (Unpublished MSc Thesis). Ahmadu Bello University, Zaria, p 45.

Sodimu AI Oladele NO Akinyemi O Ajala OO & Alabi OO 2005. Effects of timber damage on selected species of Northern Nigeria Timber. *Int. J. Envtal. Issues,* 3(1): 77 – 80.

Sodimu AI 2016. Soil Heavy Metal Content from Some Human Activities and the Effect on Biodiversity in Kaduna Northern Guinea savanna of Nigeria. Unpublished Ph. D Thesis Submitted to Department of Biological Sciences, Nigeria Defence Academy, Kaduna, p. 305.

Usher MB & Ocloo JK 1979. The natural resistance of eighty-five (85) West African heart wood timbers to attack by termites and microorganisms. *Trop. Pest Bull., Centre for Overseas Pest Res*., 6: 56 – 61.