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Effect of Neem Seed Oil and Locust Bean Extracts in Preservation of *Milicia Excelsa* (Iroko) Wood Species Exposed to Termite Infestation

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Abstract: *The study was conducted in Wamakko local government area in Sokoto state, to investigate the effect of neem seed oil (NSO) and locust bean extracts (LBE) in preservation of Milliciaexcelsa (Iroko) wood specie.Iroko wood sampleswere collected from Kara market Sokoto weighing 250g. Non-pressure method were used in applying the preservatives. Trial combinations consisted of four treatments, two local bio-insecticides i.e. neem seed oil and locust bean extracts (NSO and LBE), one conventional insecticide (Solignum) and a control, all of which were replicated five times and laid in complete randomized design (CRD). Treated wood samples were exposed to termite infestation (Termitaria) for a period of 12 weeks using two weeks' intervals to test the efficiency of the preservatives on the wood specie. The results revealed that, there were significant differences among the treatments. Solignum which is the conventional has the lowest percentage weight loss of 114.80g and also had mean weight loss of 135.2±0.06 recorded the best preservable effect and statistically significant at ($p<0.05$).Followed by LBE that has the weight loss of 113.20g.Then NSO recorded the weight loss of 89.17g and mean weight loss of 160.83±0.01. The control samples had the highest weight loss of 43.26g with mean weight loss of 206.80±0.06. It can therefore, be concluded that even though solignum records the highest preservable effect, both LBE and NSO were effective in control of Macrotermsnatalensis termite species on Milicia excelsa (Iroko) woods species.*

Keywords: *Neem seed oil (NSO), Locust bean extract (LBE),Solignum, Milicia excelsa (Iroko), termite, weight loss.*

INTRODUCTION

Wood is an organic material with a hard fibrous tissue found in trees and many plants. It is made up of compounds mainly of cellulose fibre having long, straight and strong glucose molecules forming the skeleton of the plant wall (Porter & Rose, 2007). According to Hodgson *et al.,* (2009), wood is made up of cellulose (up to 45%), hemicellulose (20-30%), lignin (25-30%) and other substances.Throughout history, people have relied on wood for needs varying from housing, furniture, tools, transport, entertainment, learning, certification and multitude of other products. As important as timber is to the wood industries and the end users, there is however the threat of wood degradation brought about by mechanical wear through abrasive action, decomposition caused by physical agencies such as prolonged heating or exposure to weather and chemical decomposition (Porter & Rose, 2007; Goodell *et al.,* 2003). Anothercommon major cause of wood degradation is bio-deterioration which is the action of foreign biological agencies such as fungi, insects, bacteria and marine borers.Among all the known insects that attack wood, termites are the most destructive world over (Malaka, 1996).Potential of using several control measures such as bio-insecticides and botanical method straight or in combination rather than chemical insecticides have been reported (Sahayaraj&Borgio, 2012; Silva *et al*., 2012; Sujatha *et al*., 2012; Khorram*et al*., 2011; Raghavendra*et al*., 2011; Mirmoayedi&Maniee, 2009; Mirmoayedi*et al*., 2010).

Due to hazards caused by application of chemical pesticides uses in managing or preventing termite infestation on human and environment, it is necessary to find alternative methods of termite control.In view of mounting concerns over the side effect caused by the use of these toxic and environmentally unfriendly chemicals, new direction of research is now focusing on the alternative nontoxic, biological, and environmentally friendly methods of control and prevention.The main aim of this study was to determine the effects of neem seed oil and locust bean extracts in preservation of*Milicia excelsa* (Iroko) wood species exposed to termite attack.

MATERIALS AND METHODS

Study area

Study was conducted in Wamakko Local Government area of Sokoto state. The area is located on the latitude 11° 13' 13° and longitude 3° 5' 7°. The climate is semi- arid and characterized by alternating wet and dry season with a short cool and dry period, which starts in November and end in late February (Hassan and Bode,1990). Mean annual rainfall in the area is between 625 to 700mm, ambient temperature ranges from 14℃ during harmattan period to 36℃ during the hot season (SERC, 2004). The natural vegetation of the area is dominated by grasses with sparse trees of about 5 – 9m tall that cover about 30% of the ground (Baba *et al.*, 2009).

Wood Sample Collection

Fifty pieces of *Milicia excelsa* (Iroko) weighing 250g was collected from various timber shades in Sokotokara market. Collection was made by cutting the wood into pieces from randomly selected defect free samples with dimension of 5cm × 5cm in width and breadth. Twenty pieces of wood samples was selected randomly out of fifty. The selection of these timber was

based on the fact that *Milicia excelsa* (Iroko) is widely used for various wood/ building construction in Sokoto State and are susceptible to termite infestation.

Extraction of the neem oil

The method of extracting neem seed oil (NSO) used presently was adopted from that described by Ahmed (1995), as stated below:

The extraction was carried out by the means of soxhlet apparatus (500ml) which consist of round bottle, thimble, soxhlet extractor chamber, water flow condenser and heating mantle thermo set. A medium size soxhelt apparatus was properly set-up, 5000g of the grinded (powder) neem seed were use, and it divided into 20 round, 250g of the sample were used at each round and it inserted into a thimble then 500ml of petroleum ether (solvent) were pour in a round bottom flask. The solvent was boiled gently at a temperature of 65^{o}C for 45minutes of each round with the aid of a heatingmantle. The vaporized solvent that passed through the vapour of water in the tube was condensed by the condenser as a result of continuous flow, and the condensed hot solvent falls into the thimble containing the sample. The hot solvent slowly filled the body of the soxhelt. When it reached the top of the siphon tube, it was siphoned over into the flask. This process continued until the oil was extracted from the neem seed kernel. The process was repeated until complete extraction of the oil was achieved. After the extraction, the mixture inside the round bottle flask was separated by removing the thimble and allowing the process to continue without the thimble in order to recover the solvent. The remaining mixture was transferred into the beaker which was placed on water bath to distillate or remove the remaining solvent (Siddiq 1991 and Ahmed 1995).

Extraction of locust bean

The method of extraction ofLocust bean extract (LBE) used presently was adopted from that of Association of Official Analytical Chemistry (AOAC) as stated below:

Pakiabiglobosa seed were obtained from Kara market, then washed and sun-dried before grinding to powdered form. 100 ml of deionized water, 70% alcohol, and acetone was added to each 20g of the powdered seeds of the plant in covered 250 ml glass beakers, for 12hrs. The resultant extract was then filtered using white cloth with 5 mm sieve size, 5liters filtrate was kept in room temperature for bioassay (AOAC, 1990).

Termites collection and identification

Termites were collected from termite mounds found in the study area early in the morning using brush dipped in ethanol and preserved in 75% alcohol as described by (Owusu, 2008). The termite collected was in debris and later separated from the debris with the help of the brush by placing them in a petri dish in which the workers and the soldiers (major and minor) were separatedand preserved in 75% alcohol in 20 ml glass bottle. The termites were identified using a key compiled by ZoologicalSurvey of India (ZSI). They were identified up to genus level by the morphological characters of body parts such as head, eyes, antennae, pronotum, metanotum, legs, rostrum, etc.

Species were identified by taking measurement of different parts and matching them to the compiled keys. The termite identified belong to the order: Isoptera, family: Termitidae, genus:

Macrotermes and species: natalensis.

Experimental Design

The dried wood species of *Milicia excelsa* (Iroko) was processed into test samples weighing 250g. The treatment was applied using non-pressured method (Brushing), in which each sample was brushed with the treatment. Five samples were treated with Solignum, NSO,LBE and a control. Experimental field was cleared, followed by staking of the sampling unit (treated and untreated wood samples) were exposed to termite infestation (termitaria) for a period of 12 weeks as described by (Mailumo and Falemara, 2013).

Field Experiment

Trial combinations consisted of four treatments, two local bio-insecticides i.e. neem seed oiland locust bean extract (NSO and LBE), one conventional insecticide (Solignum) and a control, all of which were replicated five times and laid in complete randomized design (CRD). The treated samples were exposed to termite mound for infestation.

Data Collection

Data collection involved physical observation of the treated samples, weight recording before and after applying treatments, weight of the samples after exposure to termite infestation was done fortnightly in twelve weeks' period as described by (Malami*et al.,* 2015).

Statistical analysis

The data obtained were subjected to one-way Analysis of Variance (ANOVA) to determine significant effects of treatments. Mean separation was done using Duncan Multiple Range Test (DMRT) at 5% level of significance. In order to test the level of significance of the treatment.

Results

The degree of attack on the wood sample as a result of termite invasion is measured in terms of weight loss. The weight loss on treated and untreated samples is shown in Table 1. Termites (Macroterms sp.) were most active on untreated wood samples and the average attack on that wood samples was considerably high as depicted by 43.26g weight loss compared to treated samples. Samples treated with solignum had the least weight loss of 114.80g compared to those treated with LBE and NSO which recorded 113.20g and 111,80g respectively. At week 2 there was no significant differences ($p<0.05$) among the treatments, but from weeks 4 to 12 records significant difference among the treatments with control having drastic decreases in weight throughout the experiment having 173.77,117.35,90.94,69.00 and 43.26 at week 4,6,8,10 and 12 respectively. Samples treated with solignumseldomly decrease in weight but had least weight loss of 217.86,209.37,183.90,142.42,111.80 from week 4 to 12. This was followed by locust bean extract (LBE), observed for weight loss amounting to 217.00,196.20,169.50,134.20 and 113.20 from week 4-12. Then NSO with the following weight loss 202.63,176.50,155.16,109.83 and

89.17. on week 4,6,8,10 and 12.

Table 1: Effect of Neem Seed Oil and Locust Bean Extract on *Milicia excelsa*(IROKO) Expose to termite infestation

Treatment	Mean bi-weekly wood weight loss (g)					
	Week 2	Week 4	Week 6	Week 8	Week 10	Week12
Solignum	233.56[a]	217.86[a]	209.37[a]	183.90[a]	142.56[a]	114.80[a]
NSO	225.40[a]	202.63[ab]	176.50[c]	155.16[b]	109.83[c]	89.17[b]
LBE	233.87[a]	217.00[a]	196.20[b]	169.50[ab]	134.20[b]	113.20[a]
Control	226.60[a]	173.77[b]	117.35[d]	90.94[c]	69.00[d]	43.26[c]
S. E	1.67	6.63	10.88	11.28	9.14	9.13

*Means having the same superscripts are significantly the same ($p<0.05$)

Table 2: Illustrate the effect of different wood preservatives on weight loss of IROKO exposed to termite infestation (termitariun). Solignum with the mean weight loss of 135.2±0.06 recorded the best preservable effect and statistically significant ($p<0.05$) with the lowest value of loss followed by LBE with 136.80±0.06 and NSO record 160.83±0.01 while control has the highest mean weight loss of 206.80±0.06.

Table 2: Effect of organic (NSO and LBE) and inorganic (Solignum) preservatives on mean weight and mean weight loss on*Milicia excelsa* (Iroko) expose to termite infestation.

Treatment	Initial weight (g)	Final weight (g)	Mean weight loss (g)
Solignum	250	114.8±0.06[a]	135.2±0.06[d]
NSO	250	89.17±0.01[c]	160.83±0.01[b]
LBE	250	113.20±0.06[b]	136.80±0.06[c]
Control	250	43.36±0.01[d]	206.80±0.06[a]

*Means in column with different superscript are significant different ($P<0.05$).

DISCUSSION

The use of plant part and its derivatives to control insect pest has been age long practice in African agriculture (Maistrello*et al.,* 2003). In this study the degree of the attack on the wood samples as a result of termite invasion was measure in terms of weight loss. The weight loss on treated and untreated wood samples were recorded and the average attack on untreated samples was considerably high as depicted by 43.26.

The result show that untreated samples were highly susceptible to termite attack. Thus, termite attack was generally less on treated wood samples compared to untreated samples.This is indicative of the high termite susceptibility of the untreated samples. Similar results were obtained by Mailumo and Falemera (2013), on *Erythropleumsuaveolens* (Sasswood).

In this study all extract of the two plants show some level of effectiveness only in an open field trial by protecting treated wood samples. This finding agrees with the report of Syofuna*et al.* (2006), who reported the efficiency of natural plant extract as wood preservatives against termite attack that aqeous extracts on *Milicia excelsa* were more effective.

CONCLUSION AND RECOMMENDATION

This research confirmed that the woods were susceptible to termite attack, nonetheless requires preservative treatment to lengthen its service life. Preservative treatment of the wood with solignum which is the conventional has the site effect. In this research local insecticides gave adequate protection on *Milicia excelsa* against termite attack. Neem seed oil and locust beans extracts, which is an environmentally friendly bio-preservative agent, can serve as alternative preservative in treating *Milicia excelsa*.

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