EFFECT OF LOCALLY PREPARED COMPOUNDS ON THE RESISTANCE OF GUM ARABIC WOOD TO TERMITE ATTACK

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ABSTRACT

The effect of three locally prepared compounds (table salt,potash and tamarind leave extract) and their combinations as preservatives of gum Arabic tree (Acacia senegal) wood against attack by termites was investigated in a 12-week experiment in Yobe State of Nigeria. One hundred and ninety two (192) wood samples of same dimensions were cut from branches of freely growing gum Arabic trees. The samples were carefully debarked to avoid scaring the wood, rinsed in clean water and oven-dried at 105 ± 3°C until constant weight was achieved. The samples were then weighed and measured for length and diameter and then exposed to three termite mounds of similar size housing the same subterranean termite species (Macrotermes bellicosus) for 12 weeks at 3 different locations using a randomised complete block design. At the end of the 12th week, they were removed, rinsed and oven-dried, weighed and inspected for possible damage. Treated wood samples were heavier, longer and had bigger diameters than the untreated control. Location had no significant effect on the extent of termite attack. It was concluded that the compounds in test could have either toxic, repellent or both effects on the insect, thus suggesting that the compounds have high potential as wood preservatives.
Keywords: *wood, termite attack, locally prepared compounds*

INTRODUCTION

Gum Arabic (Acacia senegal) is a widely distributed tree in the semi-arid zone of Nigeria. The tree can live through long periods of drought. It grows in site with annual rainfall between 100-900mm, usually between 300- 400mm, and 5-10 month dry periods (Cossalter, 1991). Okatahi (1999) has reported that in Nigeria, *Acacia senegal* grows best in sandy soil with 200 to 400mm of rain a year, and also in clay soil with 400 to 800mm of rainfall a year, it tolerates high daily temperature, dry wind and sand storms. In Nigeria, the average minimum and maximum temperatures in which *Acacia senegal* plants thrive are 14°C and 40°C, respectively (Okatahi, 1999). The wood is widely used in Nigeria, especially in the northern part as a roofing material. However, like most woods, the wood from gum Arabic tree is prone to termite attack which reduces its strength and durability. Toxic chemicals such as creosoted poles and railway slippers have been used as wood preservatives in Nigeria.

The effects of these repellent were found to have short life span because they can easily be leached out of the wood. In addition, they may be too expensive and not always safe for application. There is therefore, the need to look into cost effective and safer chemicals for preserving wood against termite attack. According to Collins (1982) chrome tannin and vegetable tannin reduce the susceptibility of leather to termites attack. Hence, the objective of this study was to investigate the efficacy of locally prepared compounds namely, leaves of tamarind (Tarmarindus indica), Sodium chloride (Table salt) and, Potassium nitrate (potash) as preservatives on gum Arabic wood in the semi-arid region of Nigeria.

MATERIALS AND METHODS

The study was conducted in Damaturu local government area in Yobe State of Nigeria. The area falls under Sahel zone, which lies between latitude 12^{o}-13^{o}N and longitude 10^{o} -11^{o}E .The temperature varies from day and night and lies between 32^{o}C and 42^{o}C (Mathesis, 1976). The raining season commences late June and ends around late November with the annual rainfall ranging from 400-600mm (Farkoner 1990; Ugherughe and Ekedolun, 1986; Gadzama 1986). Gum Arabic thrives well in the area (Okatahi, 1999)

Preparation of the Compounds: The compounds were prepared from three different local raw materials as follows.

i *Leaves of tamarind (Tarmarindus indica),* the fresh leaves were collected, sun-dried for one week and ground into powder form;

ii *Sodium chloride (Table salt)* was purchased from the market;

iii *Potassium nitrate (potash)* was equally obtained from the market and ground to powder

iv *Master solution,* the three compounds were weighed in an equal ratio and then thoroughly mixed and dissolved in deionized water to produce a master solution.

All the compounds were diluted in clean water at the ratio of 1kg of compound /litre of water

Preparation of Wood Samples: 192 wood samples each of equal dimensions were cut from branches of many freely growing gum arabic trees. All the samples were carefully debarked to avoid scaring the wood, rinsed in clean water, and then oven-dried at 105 ± 3^{o}C until constant weight was attained.

Application of the treatments: The wood samples were allotted to eight different treatments (T_1 - T_8) using a randomized complete block design as follows:

T_1 Wood specie treated with Potash + table Salt;

T_2 Wood species treated with Potash + Tarmarindus Leaves;

T_3 Wood specie treated with table Salt + Tarmarindus Leaves;

T_4 Wood species treated with Tarmarindus leaves extract only;

T_5 Wood species treated with common table salt only;
T_6 Wood species with salt peter only;
T_7 Wood species treated with table salt + tamarind leaves extract + potash; and
T_8 Control (untreated) wood samples.

Three replicates of the compound were used in treating the selected wood. The treatment method was by soaking the wood samples into the compound mixture for a period of 24 hours. Thereafter, the treated wood samples were spread in mesh wire separately to allow for drying until constant weight was obtained.

Determination of termite effects: The treated wood samples were appropriately labeled using metallic tags and randomly allocated in seven replicates to three locations. The termite mounds used were of similar size housing the same termite species (marcotermes bellicosus). The samples were buried randomly in a circle around the base of the mound, each at a depth of 15 to 20cm below soil surface. All the wood samples were buried at the same distance from the peak of the mound. After twelve weeks, they were exhumed, carefully rinsed in clean water and oven-dried at $105 \pm 3^{o}C$ for twenty four hours. The weight, length and diameter of the wood samples were determined before and after applying the treatment. The extent of damage was calculated by difference between the initial measurements (weight, length and diameter) and the measurements at the end of the experiment.

Statistical Analysis: Analysis of Variance was carried out on data collected and means were separated for significant differences using the Least Significant Difference (LSD). The results of termite damage are presented on Tables.

RESULTS AND DISCUSSON

Woods treated with table salt + Tamarindus leave extracts and Tamarindus leave extracts + potash weighed significantly heavier than those untreated (Control) woods. There were no significant differences in weight between woods treated with table salt + tamarinds leaves extract; potash + table salt, Tamarindus leaves extracts + potash + table salt, potash only, table salt only and Tamarindus leaves extracts only. Similarly, the weight differences between potash + table salt, Tamarindus leave + potash + table salt, potash only and Tamarindus leaves extracts only and the untreated (control) were not significant.

Untreated woods (control) were significantly shorter than the potash treated but longer than Tamarindus leaves extracts + potash. There were no significant differences in length between Tamarindus leaves extracts + table salt, potash + table salt, Tamarindus leaves, + potash + table salt as well as Tamarindus leaves only. The diameter of untreated woods (control) was significantly smaller than the treated woods. Among the treated woods, those treated with Tamarindus leaves extract only recorded a slightly but not significantly bigger diameter. There were no significant differences in the extent of attack at the three locations. The results obtained in this study agree

with those of Tella, Okunsanya and Dishan (2000) who reported that termite mounds that were of similar size and housed same species of termites had no significant effect in the extent of damage. However, in this experiment the slight difference observed could have been as a result of differences of repellant as well as toxic effect of the different compounds put to use in some of the preservatives especially leaves compound only. The wood sample treated with them would have been totally destroyed, had the sample been left buried for extended period.

The results suggest that the compounds used contain certain active principles that inhibit the action of termites. Other studies by Tella, Okunsanya and Dishan (2000) highlighted the effectiveness of Azadirachtin, the active ingredient in neem oil, and also reported the pesticide potential of some other plants such as calamus (Accours calamus L), basil (Dsimum basillcum), Big Sagebrush (Artemisia tridentate wutt.) and mammey (Mannea americana L.). They pointed out that these plants have developed chemical substances that could act as toxicants, repellents, feeding deterrent, growth inhibitors or/ and sterilants against pest and disease causing orgasms.

Table 1: Damage done by termites (Macrotermes bellicosus) on treated wood samples of Acacia Senegal

Treatments	Weight (g)	Length cm)	Diameter (cm)
Table Salt and Tamarindus Leaves extracts	1.22^{a}	15.67^{ab}	7.15^{a}
Tamarindus leaves extracts and Potash	1.30^{a}	15.02^{b}	7.11_{a}
Potash and table Salt	0.97^{ab}	16.17^{ab}	5.81_{a}
Tamarindus leaves extracts Potash and table Salt	1.13^{ab}	16.65^{ab}	6.02^{a}
Potash only	1.02^{ab}	16.81^{a}	6.63^{a}
Table Salt only	1.09^{ab}	16.81^{a}	6.50^{a}
TamarindusLeaves extracts only	0.90^{ab}	15.62^{ab}	7.50^{a}
Untreated (control)	0.36^{b}	1.14^{c}	0.93^{b}
S.E.M.	0.17	0.37	0.40
BLOCKS			
Location I	7.0	116.23	50.02
Location II	8.18	112.89	47.33
Location III	8.75	112.58	45.59

a,b,c: means within the same row bearing different Superscripts differs significantly ($P < 0.05$).

S.E.M. Standard Error of the Mean

CONCLUSION

This study aimed at investigating the efficacy of locally prepared compounds, namely, leaves of tamarind (Tarmarindus indica), Sodium chloride (Table salt) and, Potassium nitrate (potash) as preservatives on gum Arabic wood in the semi-arid region of Nigeria. The results from this investigation showed that potash, common salt, tamarind leave extracts singlely or in combination are effective in preventing termite attacks on woods. This is of paramount importance as it will not only save cost, but also reduce the environmental risks in applying strong chemicals against termites.

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