Greener Journal of Agronomy, Forestry and Horticulture
Vol. 7(1), pp. 1-7, 2021
ISSN: 2354-2306

http://gjournals.org/GJAFH

Efficacy of *Euphorbia balsamifera* Extract (Lbi), Solignum and Gamalin on *Triplochiton scleroxylon* and *Isoberlinia doka* exposed to Termites

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ARTICLE INFO

Article No.: *070721060*
Type: *Research*

Accepted: *07/07/2021*
Published: *09/07/2021*

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Keywords: *Euphorbia balsamifera; Solignum, Gamalin; Triplochiton scleroxylon; Isoberlinia doka; Termites.*

ABSTRACT

This study was carried out to investigate the effects of Solignum, extracts of Aguwa (*Euphorbia balsamifera*) and Gamalin against termites on *Triplochiton scleroxylon* (Obeche) and *Isoberlinia doka* (Doka) wood species. Non-pressure method (brushing) was used in applying the preservatives. The treatments combination consisted of four treatments, i.e. one local bio-insecticide Aguwa extract (LBI), two conventional insecticide (Solignum and Gamalin) and a control replicated five times and laid out in a randomized complete block design (RCBD), the wood was exposed to termite mound to test the efficacy of the preservatives on the wood species. Data obtained were analyzed using Analysis of Variance (ANOVA) at 5% probability level. The results showed that there were significant difference between the two species (i.e. Obeche and Doka) ($p<0.05$) and between treatment. Solignum and LBI has the lowest percentage weight loss of 107.80g and 104.62g with best density of 0.30g/m^3 and 0.33g/m^3 and the control sample have the highest percentage weight loss of 116.64g with lowest density of 0.28g/m^3 on obeche, while on Doka, Solignum and LBI has the lowest percentage weight loss of 185.80g with best density of 0.38g/m^3. The control sample had the highest percentage weight loss of 213.48g with highest density of 0.43g/m^3. It can therefore be concluded that Solignum and LBI were effective in reducing the biodegradation on *Triplochiton scleroxylon* (Obeche) and *Isoberlina doka* (Doka) woods. However, it was recommended that more research should be carried out on Aguwa extract (LBI) to test its effect on different wood species.

INTRODUCTION

Wood is a natural durable material produced by trees, it is the first structural material discovered by man (Ogbogu, 1990). Wood is in the forefront of world raw materials. It is one of the most abundant renewable raw materials in the forest. It is cheap and easy to work and fashion into different shapes and sizes (Ifebueme, 1993). It is a natural organic material whose use is widely spread (FAO, 2006). In most places and phases of use, there is possibility of deterioration from any of biological, physical and chemical agents (Wong *et* al., 2005). The most important of these agents are the biological namely: termite and fungi which cause tremendous havoc if the right conditions are available. Where these agents are absent, wood is really very resistant and can survive in construction for a long time (FAO, 2006). It has been estimated that 5% weight loss from decay can result in loss of strength as high as 50% (Jerrold, 1995). If the warm moist conditions required for decay cannot be controlled then the use of naturally decay resistant wood species and or chemical treatments are required to impede decay. Insects such as termites and certain types of beetles can be damaging to mechanical performance. Insect's infestation can be controlled via mechanical barriers, naturally durable species or by means of chemical treatment (Anon, 2007; Jerrold, 2005).

There are several attempts and approaches on termite control. In the past, researchwas on chemical methods of control with an obvious lack of concern over side effectscaused by the use of these chemicals (Femi-Ola *et* al., 2008). Researches are now focused towards alternative, non toxic and biological methods of control. Thesemethods include baiting, extreme temperatures, barriers of various types and biological control (Malaka, 1996; Peralta *et* al., 2004). Naturally resistive woods and extractives have great promise for prevention of termite attack (Nakayama *et al*., 2000; Peralta *et al*., 2004), these extractives in form of phenolic compounds like terpenes-and falconoid have insecticidal activities (Nagnan and Clement, 1990). The uses of synthetic pesticides have some benefits, but they are also known to harm the environment, plants and animals it controls. Therefore, there is need to develop an alternative method with low adverse effect on consumers and one that is less persistent to the environment. These facts influence researchers to develop interest in plants and plant products as sources of insecticides. Plants and plant products are useful and desirable tools in most pest management programs because they are effective and often complement the action of natural enemies (Schmutterer, 1990; Ascher, 1993).Indigenous Knowledge (IK) is a local knowledge that is unique to a given culture or society. This knowledge forms information base for a given society. It is also known as ethno science or folk science. The IK is accumulation of information in the form of shared environmental knowledge, beliefs, rules and techniques for productive activities.

Generally, the method used in wood preservation against destructive insect over the years has been insecticides,these chemicals are however expensive and have many harmful effects. Artificial insecticides can quickly find their way into food chains and water sources, thus creating health hazards for humans. There is also much concern for people using pesticides. The products may be misused because the instructions are not in vernacular and may present a problem to most users (Malaka, 1996). There are a number of harmful effects that synthetic insecticides can have on the environment. Artificial insecticide can kill useful insects which eat pests. In fact, even one spray can upset the balance between pests and the useful predators. Some chemicals are highly persistent and can stay in the environment and in the bodies of animals for many years. Insects also become resistant to synthetic insecticides there by requiring more powerful chemicals on continuous basis. In the light of all these, the use of bio-insecticides becomes imperative.

All measures that are taken to ensure a long life of wood fall under the definition of wood preservation. Apart from structural wood preservation measures, there are a number of different chemical preservatives and processes that can extend the life of wood. These generally increase the durability and resistance and protect wood from being destroyed by insect or fungus. This study will be justifiable in bringing out the appropriate preservatives for a particular timber treatment and also the easier way of prolonging the serviceable life span of timber as well as making use of affordable (less expensive) preservatives for timber use.

The study is aimed to compare the effect of one local bioinsecticides (LBI) *Euphobia balsamifera* (Aguwa extract), Solignum and Gamalin on Obeche and Doka exposed to termite.

MATERIALS AND METHODS

Study Area

The study was conducted in Sokoto State. The State has a land area of 28,232.37 square kilometers, located between latitude 12^0N and $13^0 58'$N and longitude 4^0 8'E and 6^0 54' E. It is bordered in the North by Niger Republic, Zamfara State to the East and Kebbi State to the South and West (SSTG, 2010). The state has a population of 4,244,399 individuals (National Population Commission, 2006).

The climate of the area is dry sub-humid with mean rainfall and temperature of about 550mm and 34.9^0C respectively (Malami and Tsoho, 2013). There are two major seasons in the state, namely wet and dry. The dry season starts from October and lasts up to April in some parts and may extend to May or June in other parts of the state. The wet season on the other hand begin in most part of the state in May and last up to September or October (SSTG, 2010). The harmattan, a dry cold and fairly dusty wind is experienced in the state from November to February/March; heat is more severe in March and April, but the weather in the state is always cold in the morning and hot in the evening. The vegetation is Sudan savannah which consists of few scattered trees, shrubs and grasses that covers about 30% of the ground (Baba *et al*., 2005).

Sampling

Dried wood samples of Obeche and Doka were cut into test samples measuring 10cm length, 5 x 5cm width and breadth each. Twenty (20) defect free samples each of obeche and doka were selected (Malami and Tsoho, 2013).

Field Layout and Experimental Procedure

The treatment combination consisted of four treatments i.e. one local bio-insecticide LBI (Aguwa extract) two conventional insecticides (Solignum and Gamalin) and a control replicated five times and laid out in a randomized complete block design (RCBD). The wood was exposed to termite mound (termitaria) to test the efficacy of the preservatives on the wood species.

The method used in applying the treatment was the non pressure method (Brushing), in which samples were brushed with preservatives. The dried wood species of *Triplochiton scleroxylon* and *Isoberlinia doka* were processed into test samples measuring 10cm in length and 5cm x 5cm in width and breath each. Twenty defect free samples were selected from each species. Five samples of each species were treated with Solignum, Gamalin. *Euphobia balsamifera* (latex or milk) LBI and a control. The density of the samples was obtained from the equation of density (p=m/v). The SI unit of kilogram per cubic centimetre (kg/m^3).Five samples each of the species were selected and treated with fresh latex of *Euphobiabalsamifera* which was collected directly from the stem and small branches using knife and applied to the samples.

Experimental field was cleared, followed by staking of the sampling units (treated and untreated wood samples) at random around the termite mound (termitaria) for a period of eight (8) weeks (Mailumo and Falemera, 2013). Each sample was tagged with a label made up of small iron bar written with black paint as follows:

Table 1: Environmental layout

S/N	Species	Treatments			
		Solignum	Gamalin	Local Bioinsecticide	Control
1	Obeche	Os	Og	Ol	Oc
2	"	"	"	"	"
3	"	"	"	"	"
4	"	"	"	"	"
5	"	"	"	"	"
1	Doka	Ds	Dg	Dl	Dc
2	"	"	"	"	"
3	"	"	"	"	"
4	"	"	"	"	"
5	"	"	"	"	"

Keys: Os = Obeche treated with solignum
Og = Obeche treated with Gamalin
Oc = Obeche Untreated samples (Control)
Ol = Obeche Local Bioinsecticide (Aguwa extract)
Ds = Doka treated with solignum
Dg = Doka treated with Gamalin
Dc = Doka Untreated samples (Control)
Dl = Doka Local Bioinsecticide (Aguwa extra

Data Collection

Data were collected based on field experimental research principles, through observation (visual inspection), weighing of samples and recording of values. Pre-infestation weights of wood samples were measured using a sensitive weighing scale and the values recorded before exposure of samples to termite infestations. Post-infestation of wood samples after application of preservatives and after infestation wood was measured and values also recorded. Data collected include: weight of the sample before and after applying preservatives and weight of the sample after exposure to termite attack at two weeks interval for a period of 8 weeks.

The experimental data was subjected to the analysis of variance (ANOVA). Means were separated using Duncan's Multiple Range Test (DMRT), where significance difference existed. SPSS software was used for the analysis.

RESULTS

Effect of Preservatives on Density of Obeche

Effect of preservatives on density of *Triplochiton scleroxylon* (Obeche) is shown in Table 2. It was revealed that there was no significant difference with respect to the treatments. Though not significant, control treatment recorded the highest value (0.39g/m^3) followed by LBI (0.33g/m^3). The least value was recorded in Gamalin with the value of 0.29g/m^3.

Table 2: Effects of Preservatives on Density of Obeche

Treatment	Initial Density (g/m^3)	Final Density (g/m^3)	Density Loss (g/m^3)
LBI	1.32	1.00	0.32
Solignum	1.36	1.05	0.30
Gamalin	1.29	0.98	0.29
Control	1.27	0.88	0.38
S.E. ±	0.01	0.03	0.02
Significance			NS

Effect of Preservatives on Density of Doka

Effect of preservatives on density of *Isoberlina doka* is presented in Table 3 with no statistical difference among the treatments. Highest density value (0.43g/m^3) was revealed in control treatment. Lowest density loss value (0.38g/m^3) was recorded in LBI and Solignum treatments.

Table 3: Effects of Preservatives on Density of Doka

Treatment	Initial Density (g/m^3)	Final Density (g/m^3)	Density Loss (g/m^3)
LBI	2.34	1.96	0.38
Solignum	2.34	1.96	0.38
Gamalin	2.31	1.92	0.39
Control	2.26	1.83	0.43
S.E.	0.09	0.85	0.57
Significance			NS

Effect of Preservatives on Weight of Obeche

Results on the effect of preservatives on weight of *Triplochiton scleroxylon*is presented in Table 4. The result shows that there was no significant difference with respect to the preservatives used.

Table 4: Effects of Preservatives on Weight of Obeche

Treatment	Initial Weight (g)	Final Weight (g)	Weight Loss (g)
LBI	329.92±14.06	225.30±15.14	104.62±9.07
Solignum	340.78±25.09	232.98±21.13	107.80±5.17
Gamalin	321.48±8.73	206.16±7.14	115.32±2.29
Control	316.90±16.44	200.26±20.22	116.64±3.12
S.E.	4.09	3.66	2.05
Significance			NS

Effects of Preservatives on Weight of *Doka*

Table 5 shows the effects of preservatives on weight of *Isoberlinia doka* infested termite. It was revealed that there was a significant difference among the treatments. Highest weight (213.48g) was recorded in control followed by Gamalin (197.22g). The lowest value (185.80g) was observed in both LBI and Solignum treatments.

Table 5: Effects of Preservatives on Weight of Doka

Treatment	Initial Weight (g)	Final Weight (g)	Weight Loss (g)
LBI	584.72±113.40	398.92±44.55	185.80±79.33[c]
Solignum	584.72±113.40	398.92±44.55	185.80±79.33[c]
Gamalin	676.08±95.64	478.86±69.86	197.22±29.48[b]
Control	633.90±91.19	420.00±69.81	213.48±26.57[a]
S.E.	23.05	14.34	12.26
Significance			*

Interaction Effect of Species Weight

Result on the interaction effect of samples weight is presented in Table 6 with statistical difference among the treatments. Highest weight loss (225.41g) was recorded in Obeche sample, while the lowest value (189.83g) was observed in Doka wood sample.

Table 6: Interaction Effects of Species Weight

Samples	Initial Weight (g)	Final Weight (g)	Weight Loss (g)
Obeche	327.27	101.85	225.41[a]
Doka	619.86	430.03	189.83[b]
S.E.	6.78	4.51	2.28
Significance			*

DISCUSSION

It was apparent from the results that Obeche LBI treatment, which is a water-born preservative, attained best density than solignum which is oil-born preservative. Probably because wood species absorb water-borne preservative more than oil-borne preservative. This agrees with the finding of Okechalu *et al.,* (2013) and Kroese *et al.* (2001) who reported that wood species absorb water-born preservatives more than oil-borne preservatives. It also agrees with the findings of Mann *et al.* (2011) who reported that methanolic and hexane extracts of *Bombax buonapozens* absorbed more preservatives than the samples treated with solignum.

With respect to the effect of preservatives on *Isoberlinia doka*, lowest density loss was revealed in LBI and solignum treatments. This could be due to the fact that LBI treatment is a water-born preservative. Consequently, high retention of solignum enhances decay resistance of wood. Which is in accordance with the finding of Prelta, *et al.* (2004) who reported that solignum when used as a preservative will enable the life time of wood to increase. This agrees with Goktas, *et al.* (2007) who reported that the effectiveness of creosote solution enhances the decay resistance of wood. This is similar to the result obtained by Adedeji *et al.* (2013) who revealed that, wood of *Triplochiton scleroxylon* has the tendency of absorbing more preservatives especially water-borne preservatives.

It was observed that preservatives did not have any effect on the weight of Triplochiton scleroxylon used in the experiment. This could be due to the high effectiveness of the preservatives with respect to the absorption capacity. This agrees with the findings of Malami and Tsoho (2013) that solignum is a chemical preservative that can protect wood from termite and LBI as a local preservative which has a natural bitter taste with aroma that is allergic to termite. Similar finding were obtained from *Eruthropleuns Spp.* (Mailuma, and Falemera 2003; Malami, 2010).

With respect to the effect of preservatives on Isoberlinia doka, highest weight loss was observed in control treatment. This is because of the hygroscopicity of the wood. Consequently, termite attack was generally less on treated samples compared to the untreated samples. This confirms the effectiveness of solignum solution in enhancing the decay resistance of wood Goktas, *et al.* (2007). This is in accordance with the finding of Parelta, *et al.* (2004) that solignum when used as a preservative will enable the serviceable time of the wood to increase.

High weight loss with respect to the effect of preservatives on samples was observed in *Triplochiton* *scleroxylon*. However, *Isoberlinia doka* showed a better performance in all the treatment used in this study. This could be because doka is said to have a natural bitter taste. This agrees with the finding of Malami and Tsoho (2013) that *Digitaria iburia* (Ebu) had a natural bitter taste that termite cannot afford to attack the wood. Similar finding of Okachalu, *et al.* (2013) that found significant values on *Jatropha curcas* and *Azadirachter indica* after exposed to termite attack.

CONCLUSION

The major reason for preserving wood is to increase its life span and to improve its usefulness. The effectiveness of any wood preservative depends on the active ingredients of the preservative itself, also on the depth of penetration and relative properties of the wood being subjected to preservative treatment. This study revealed that, the LBI and Solignum has a potential of reducing termite attack on tropical hardwood. This study also shows that Doka had the lowest weight loss than Obeche when exposed to termite attack.

From the results, there is no need to make use of expensive treatment since LBI is effective and less costly than Solignum. The government and non-governmental organizations (NGOs) should give more priority and funding on researches on LBI as wood preservative treatment, so as to reduce dependence on inorganic substances and hence the cost of preservatives. There is need for massive planting of this plant species (LBI) for biodiversity conservation.

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Cite this Article: Nasiru AM; Zayyanu U (2021). Efficacy of *Euphorbia balsamifera* Extract (Lbi), Solignum and Gamalin on *Triplochiton scleroxylon* and *Isoberlinia doka* exposed to Termites. Greener Journal of Agronomy, Forestry and Horticulture, 7(1): 1-7**.**