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Crude Extracts of Eucalyptus Camaldulensis (Dehnh) Leaves and Bark on Anogeissus Leiocarpus (Dc) Guill & Perr and Daniellia Oliveri Rolfe, Hutch Wood in Control of Termite (Isoptera: Termitidae)

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Abstract- Antitermite effect of Eucalyptus camaldulensis leaves and bark extracts in comparison with solignium on Daniellia oliveri and Anogeissus leiocarpus wood was assessed. Leaves and bark of Eucalyptus camaldulensis were collected from within Makurdi, dried and ground into powder. Plant extracts were prepared by hot and cold water extraction methods. Three levels of concentrations (10%, 20% and 30%) were prepared. Wood samples (2cm x2cm x 4cm) were air dried and soaked in extracts for 72 hours. Treated blocks were air-dried and buried for 5 weeks for grave yard experiment. Complete Randomized Block Design (RCBD) with three replicates was used. Sum of 224 test samples were used for the three replicates. Incidence of termite attack on Daniellia oliveri wood occurred in week2 for 20% cold water bark extract and -control, whereas, attack was observed for 30% hot water bark and leaves extracts with Solignium test samples in week5. Anogeissus leiocarpus attack started in week 2 with untreated test sample, while attack on 30% hot water bark and leaves extracts with solignium treated wood samples commenced in week5. Untreated wood samples of Daniella oliveri had the highest mean percentage weight loss of 79.12% compared to Solignium treated wood with 68.70% while 30% hot water leaves extracts had the least (34.09%). Untreated wood of Anogeissus leiocarpus had highest percentage weight loss (64.52%) compared to Solignium treated wood (52.56%) while 30% hot water bark extracts (23.11%) treated wood was the least. In conclusion, 30% hot water bark extract showed the best resistance to termite. We therefore recommend further research into the active agents present in Eucalypts camaldulensis and development of higher concentrations of extracts in control of termite attack.

Keywords- *Attack, Extract, Incidence, Percentage Weight Loss, Termite, Wood Sample*

I. INTRODUCTION

Wood remained one of the major essential renewable natural resources accessible to man. It is a natural, cellular, renewable resource, with excellent strength to weight properties. It easily produces composite material of botanical origin, and possesses unique structural and chemical characteristics that render it desirable for broad variety of end users [1]. Wood can be put into various uses which may include the use for constructional purpose like furniture making, building of wooden fabricated houses etc. On the other hand, one of the major objections of the use of wood for many purposes is the question of its long-term resistance to the natural processes of degradation [2]. The demand for wood by the populace for constructional purpose is very high thereby having serious effect on the forest. Wood in service left unpreserved are been destroyed by termite thereby leading to more demand. Protection of wood and wood-based products against biological agents requires various chemicals worldwide and these chemicals are said to cause environmental pollution and a few of them are hazardous to animals and human beings [3]. Synthetic chemicals create environmental problems and negatively affect many beneficial organisms.

Termites are the most troublesome pest of plants, trees and wooden structures. They severely damage agricultural crops and urban infrastructure. There are about 2,500 species of termites in the world and only 10% have pest status. Termites can attack plants at any stage of development from the seed to the mature plant [4]. Termites are most successful of all the social insects because colony members are long lived and because they utilize cellulose as food source. They depend entirely on wood, either living or dead, or the woody tissue of plants, intact or partially decayed as well as in the form of humus and dried animal dung. Termites are attracted to odours of wood decay fungi that make the wood easy to penetrate [5]. Termite pests include subterranean, dry wood, and damp wood species. Damp wood termites derive their name from the fact that they live in moist wood, especially in stumps and fallen trees in forests. Dry wood termites are common and can survive in very dry conditions, even in dead wood in deserts and do not require much moisture or contact with soil. Subterranean termites are very abundant even at elevations above 8,000 feet, live and breed in soil and sometimes many feet below the soil surface [6].

Wood preservatives are toxic materials used for protecting wood in service against deteriorating agents like termites and fungi. These preservatives are classified as Tar oil preservative, water borne preservative and organic solvent base preservatives. Oil borne preservative treatment are generally recognized as imparting superior dimension stability to treated wood products when compared to water borne preservative treatments because of the none polar nature and natural water repellence of oil borne system. Oil borne preservative treatments are also generally recognized as having less effect on mechanical prosperities than to water borne treatment because they do not react with the wood cell wall material. While water-borne preservatives are usually among the cheapest options available to consumers, their greatest drawback is that due to the presence of water in such preservatives, their application can and often will lead to swelling and/or warping of the wood to be treated - especially if it is already porous.

The haphazard use of pesticides for the control of termites has generated many of biological and environmental hazards in air, water, soil and in food chains [7]. Insecticidal plant materials which are numerous and are environmentally friendly offer a enormous, virtually untapped reservoir of chemical compounds with many potential uses especially in the management of termite [8]. Artificial pesticides can quickly find their way into food chains and water courses. This creates health hazards for humans. There is also much concern for people using chemical pesticides. The products may be misused because the instructions are not written in the language understood by the person using them. This has led to many accidents and deaths. There are a number of harmful effects that chemical pesticides can have on the environment. Artificial pesticide can kill useful insects which eat pests. Just one spray can upset the balance between pests and the useful predators which eat them; artificial chemicals can stay in the environment and in the bodies of animals causing problems for many years. Pests become resistant to pesticides so more powerful chemicals are needed. They are also expensive. The Nigeria dependence on imported wood preservatives attracts huge sum of foreign exchange, which could have been used in other sectors of the economy.

[9] Stated that the use of local botanicals has gained much significance largely among the researchers as a result of their high bio-efficacy against the termites. Numerous plants have been recognized to have anti-termitic and repellent activities against the termites, such as lemon grass (Cymbopogon citratus), Cassia leaf (Cinnamomum cassia), vetiver oil (Vetiveria zizaniodes), Eucalyptus (Eucalyptus citrodora, Eucalyptus globules), cedar wood (Cedrus atlantica), clove bud (Syzgium aromaticum) [10], Calotropis procera [11], isoborneol [12] and Coleus amboinicus [13]. Extractive isolated from naturally resistant heartwood and some plant species may provide alternative in pest control because of their bioactive chemicals. In addition, plant extractives are biodegradable and they seem to help resolve environmental problems caused by synthetic pesticides.

This study would provide opportunity for more wood and wood based product to be preserved at affordable price. Provide alternative to synthetic preservatives, which are environmental friendly and biodegradable. Wood extracts have been reported to be safe, non-harmful to man but still effective against pathogens. The objective of this study was to evaluate the effect of Eucalyptus camaldulensis leaves and back extracts in control of termites on selected wood species of Anogeissus leiocarpus and Daniellia oliveri.

II. MATERIALS AND METHODS

A. Study area

The study was carried out at the University of Agriculture, Makurdi. The University of Agriculture, Makurdi was established in 1989. It is located at Nyiev district, North-East of Makurdi Local Government Area of Benue State. This University lies at latitude 7° 44′ N and Longitude 8° 35′ E of the Middle Belt region of Nigeria and it covers a land area of 7,978 km^2. It is surrounded on the North East by Guma Local Government Area and by River Benue in the South [14].

The vegetation of FUAM is guinea savanna, having very green trees and grasses during the rainy season, while the grasses turn brown during the dry season. The plants have several ways of adapting themselves to the seasons and constant bush fires that occurs here. They have long tap roots that go far underneath in search of water, their backs are thick, a phenomenon which project them from fire. The trees usually are about 12m-15m high and rarely up to 27m even 30m. The study area is predominantly blessed with Lophira lanceolata, Vitex doniana, Terminalia schimperiana, Gmelina aborea species etc.

III. METHODOLOGY

A. Collection of Samples

Leaves and bark of Eucalyptus camaldulensis were collected from 72 Barracks, Makurdi, Benue State. The wood of Anogeissus leiocarpus and Daniellia oliveri were bought from Timber Shed at North Bank, Makurdi, Benue State and were cut into size of (2 x 2 x 4) cm.

B. Method of Extraction

Cold and hot water methods of extraction were used in this study. The leaves and bark of Eucalyptus camaldulensis were collected, dried under room temperature and reduced into powdered form by pounding. The plant materials were weighed and different concentrations of their extracts were constituted. Weight of 100g 200g and 300g were mixed in 1liter of cold and hot water respectively to constitute 10%, 20% and 30% concentration.

1) Hot water extraction

This method of extraction was done using the following procedure:

- The plant materials were poured in 1 liter of water and allowed to heat to a temperature of 100^{o}c.

- The mixture was allowed cool and the extract was sieved out of the mixture into bottles.

2) Cold water extraction

This method of extraction was done by the following procedure:

- Plant material was poured in cold water
- The mixture was left overnight before sieving into bottles.

3) Treatment of Test Samples

Wood samples for the experiment were marked with permanent marker and allowed to air dry. Samples were air dried for 24 hours before soaking into plant extracts. They were treated by soaking in the extracts for two days. The treated blocks were air-dried for an hour before it was buried.

(a)

(b)

Figure 1. a) Ground Eucalyptus camaldulensis leaves b) Powdered Eucalyptus camaldulensis bark

(a)

(b)

Figure 2. a) Soaked wood samples b) Treated wood samples

C. Experimental Design

The field test was carried out at North-core, FUAM. The treated wood samples were buried for five weeks in Randomized Complete Block Design (RCBD) in termite infested area. Fourteen (14) treatments which include twelve (12) leaves and bark extracts (10%, 20% and 30% respectively) of Eucalyptus camaldulensis, Solignum and control were used. The experiment was replicated three times. Three samples each of the wood species were used for each treatment giving a total of eighty (84) test samples for a replicate. A total of two hundred and twenty test samples were used for the three replicate. Samples were checked and assessed weekly by visual observation of wood samples for any termite attack.

D. Data collection procedure

Inspection and evaluation of the specimen were done by visual assessment every week (7 days) for any sign of termite attack for a period of five weeks. In every inspection, the specimens were removed from the ground, cleaned and damage was assessed. The two methods of assessing termite damage were:

- Incidence of termite attack

Incidence of termite attack was recorded as follows:

+ = attack and

- = no attack

Severity of attack was determined by percentage weight loss calculated mathematically as:

$$\text{Weight loss} = \left(w1 - \frac{w2}{w1}\right) \quad (1)$$

$$Percentage\ (\%) weight\ loss\ =\ (w1 - w2/W1)X\ 100 \quad (2)$$

Where:

w_1 = Conditioned weight after preservative treatment (g)

w_2 = Final weight after termite exposure (g)

IV. RESULT

Table 1 shows the result of incidence of termite attack on Daniellia oliveri and Anogeissus leiocarpus. Termite attack started on Daniellia oliveri wood with the untreated while wood treated with 20% cold water bark extract commenced on the week 2. However, Daniellia oliveri wood treated with 30% hot water bark extract, 30% hot water leaves extract and solignium started in the 5th week. However, incidence of termite attack on Daniellia oliveri treated with the rest plant extracts commenced in week 3.

Incidence of termite attack on Anogeissus leiocarpus wood samples commenced in week 2 with the untreated wood while attack on Anogeissus leiocarpus wood treated 20% and 30% hot water bark extracts, 30% hot water leaves extract, 20%, and 30% cold water leaves extracts and solignium started in week 5. Nevertheless, attack on Anogeissus leiocarpus wood samples treated with the rest extracts commenced 3rd and 4th week respectively.

Table 2 shows the mean weight loss of Daniellia oliveri and Anogeissus leicarpus treated wood samples. From the results, Daniellia oliveri test samples treated with 30% hot water leaves extract of Eucalyptus calmadulensis had the highest mean of 8.18±3.44 compared to means of - control (5.24±1.50) which was the least. However, mean (6.70±1.34) of Daniellia oliveri treated wood with Solignum (+ control) was higher than the mean of the - control, but lower than the means of Daniellia oliveri wood soaked in 30% hot and cold water bark and leaves extracts (7.40±2.54, 8.18±3.44 and 7.60±2.47) except the mean (6.44±1.72) of Daniellia oliveri soaked in 30% cold water bark extract. In this result, higher mean values represent higher amount of weight retained by the wood sample which implies lower weight loss and consequently the more efficient the plant extract. There is no significant ($p<0.05$) among means of hot water barks extracts on treated Daniella oliveri wood. Nonetheless, there is significant different ($p>0.05$) plant extracts. Mean value of - control was significantly lower ($p<0.05$) than plant extracts. While mean value of Daniella oliveri soaked in 30% hot water leaves is significantly higher than mean value of Solignum treated wood.

Equally, Anogeissus leiocarpus wood samples treated with 30% cold water leaves extract of Eucalyptus camaldulensis had the highest mean weight loss of 12.61±3.15 while, mean (9.70±3.46) of - control was the least. Interestingly, means (12.57±3.14, 12.53±2.70, 11.74±1.71 and 12.61±3.15) of Anogeissus leiocarpus wood soaked in 30% hot and cold water extracts of bark and leaves treated test samples were higher than mean (10.60±4.20) of Solignium treated Anogeissus leiocarpus test sample. In this result also, the heighter the mean value, the lower the weight loss and the more efficient the plant extract. Higher mean values denote higher amount of weight retained by the wood sample which indicates lower weight loss and consequently the more efficient the plant extract. Means ($p<0.05$) of plant extracts on treated Anogeissus leiocarpus wood were not significant. However, there is significant different ($p>0.05$) between means of plant extracts treated and untreated wood.

TABLE I. INCIDENCE OF TERMITE ATTACK ON DANIELLIA OLIVERI AND ANOGEISSUS LEIOCARPUS TREATED WOOD SAMPLES

Extract	Daniellia oliveri					Anogeissus leiocarpus				
	WK1	WK2	WK3	WK4	WK5	WK1	WK2	WK3	WK4	WK5
10% hot water extract of Eucalyptus calmadulensis bark	-	-	+	+	+	-	-	+	+	+
20% hot water extract of Eucalyptus calmadulensis bark	-	-	+	+	+	-	-	-	-	+
30% hot water extract of Eucalyptus calmadulensis bark	-	-	-	-	+	-	-	-	-	+
10% hot water extract of Eucalyptus calmadulensis leaves	-	-	+	+	+	-	-	-	+	+
20% hot water extract of Eucalyptus calmadulensis leaves	-	-	+	+	+	-	-	+	+	+
30% hot water extract of Eucalyptus calmadulensis leaves	-	-	-	-	+	-	-	-	-	+
10% cold water extract of Eucalyptus calmadulensis bark	-	-	+	+	+	-	-	-	+	+
20% cold water extract of Eucalyptus calmadulensis bark	-	+	+	+	+	-	-	+	+	+
30% cold water extract of Eucalyptus calmadulensis bark	-	-	+	+	+	-	-	-	+	+
10% cold water extract of Eucalyptus calmadulensis leaves	-	-	+	+	+	-	-	+	+	+
20% cold water extract of Eucalyptus calmadulensis leaves	-	-	+	+	+	-	-	-	-	+
30% cold water extract of Eucalyptus calmadulensis leaves	-	-	+	+	+	-	-	-	-	+
Solignium	-	-	-	-	+	-	-	-	-	+
Untreated wood	-	+	+	+	+	-	+	+	+	+

TABLE II. MEAN VALUES OF DANIELLA OLIVERI AND ANOGEISSUS LEICARPUS TREATED WOOD SAMPLES

Extracts of Eucalyptus calmadulensis	% Con. of Extracts	Wood Species	
		Daniella oliveri Mean±SDV	Anogeissus leiocarpus Mean±SDV
Hot water extract of bark	10	5.96±2.63^{abc}	11.47±2.17^{bcd}
	20	6.40±1.70^{bcd}	11.59±2.97^{cd}
	30	7.40±2.54^{def}	12.57±3.14^{d}
Hot water extract of leaves	10	5.68±2.07^{ab}	10.88±2.69^{abc}
	20	6.84±1.55^{cde}	11.14±3.01^{abcd}
	30	8.18±3.44^{f}	12.53±2.70^{d}
Cold water extract of bark	10	5.36±2.52^{a}	10.10±2.99^{ab}
	20	6.46±2.69^{bcd}	11.43±3.49^{bcd}
	30	6.44±1.72^{bcd}	11.74±1.71^{cd}
Cold water extract of leaves	10	5.94±1.89^{abc}	9.87±3.31^{a}
	20	6.44±2.19^{bcd}	12.48±3.78^{d}
	30	7.60±2.47^{ef}	12.61±3.15^{d}
+ Control	Treatment with Solignium	6.70±1.34^{bcde}	10.60±4.20^{abc}
- Control	Untreated	5.24±1.50^{a}	9.70±3.46^{a}

Mean values in the same column with same alphabet are not significantly different from each other ($p<0.05$)

Table 3 shows mean percentage weight loss of Daniella oliveri and Anogeissus leicarpus treated wood samples after 5 weeks. The untreated wood samples of Daniella oliveri had the highest mean percentage weight loss of 79.12%. Solignium treated Daniella oliveri wood had lower mean value of 68.70% which was higher than mean value means of Daniella oliveri wood treated with 30% hot water bark and leaves extracts (45.16% and 34.09%), 30% cold water bark and leaves extracts (59.55% and 54.06%) respectively. However, 30% hot water leaves extract treated Daniella oliveri wood had the lowest percentage weight loss of 34.09%.

Similarly, the untreated wood samples of Anogeissus leiocarpus had the highest percentage weight loss of 64.52%. Anogeissus leiocarpus wood treated immersed in Solignium had lower mean value of 52.56%. This was higher than mean values of Anogeissus leiocarpus wood treated soaked in 30% hot water bark and leaves extracts (23.11% and 24.86%) and 30% cold water bark and leaves extracts (31.98 % and 42.27%) respectively. However, mean of Anogeissus leiocarpus wood bathed in 30% hot water bark extracts treated wood had the lowest percentage weight loss of 23.11%. In this result, heigh percentage weight loss indicates higher weight lost and by implication, the less efficient the plant extract. There is no significant difference ($p<0.05$) among plant extracts and Solignium. Daniellia oliveri treated wood samples had higher mean value of percentage weight loss than Anogeissus leicarpus.

TABLE III. MEAN PERCENTAGE WEIGHT LOSS OF *DANIELLA OLIVERI* AND *ANOGEISSUS LEICARPUS* TREATED WOOD SAMPLES AFTER 5 WEEKS

Extracts of Eucalyptus calmadulensis	% Concentration of Extracts	Wood Species	
		Daniella oliveri Mean±SDV	Anogeissus leiocarpus Mean±SDV
Hot water extract of bark	10	75.10±11.51^{e}	51.02±13.52^{cfg}
	20	67.42±3.67^{de}	41.89±11.84^{cd}
	30	45.16±10.30^{b}	23.11±4.86^{a}
Hot water extract of leaves	10	75.78±8.79^{e}	54.49±10.61^{efg}
	20	59.80±10.45^{c}	33.48±16.58^{bc}
	30	34.09±25.68^{a}	24.86±4.64^{ab}
Cold water extract of bark	10	71.09±9.07^{de}	59.06±8.96^{fg}
	20	69.94±6.80^{de}	45.69±8.36^{de}
	30	59.55±3.54^{cd}	31.98±4.00^{abc}
Cold water extract of leaves	10	72.92±5.91^{e}	57.06±6.79^{fg}
	20	68.74±8.94^{de}	48.96±8.21^{def}
	30	54.06±13.53^{bc}	42.27±15.14^{cd}
+ Control	Treatment with Solignium	68.70±15.63^{de}	52.56±13.10^{ef}
- Control	Untreated	79.12±5.42^{e}	64.52±4.40^{g}

Mean values in the same column with same alphabet are not significantly different from each other ($p<0.05$)

Table 4 presents visual rating of severity of termite attack on Anogeissus leiocarpus and Daniellia oliveri wood samples after week 5 of the experiment. Daniellia oliveri test samples treated with 30% hot water leaves extract had moderate/severe attack (least attacked) compared to solignum and control which were severely attacked. On the other hand, Anogeissus leiocarpus treated with 30% hot water bark and leaves extracts and 30% cold water bark extracts were moderately attached (least attacked) compared to solignum and control which had moderate/severe attack and severely attack respectively.

TABLE IV. VISUAL RATING OF SEVERITY OF TERMITE ATTACK ON *ANOGEISSUS LEIOCARPUS* AND *DANIELLIA OLIVERI* WOOD SAMPLES IN WEEK 5

Methods of extraction	Extract of Eucalyptus camaldulensis	% concentation of extracts	Visual rating of wood samples	
			Anogeissus leiocarpus	Daniellia oliveri
Hot water	Bark Extract	10	4	3
		20	4	3
		30	3	2
	Leaves Extract	10	4	3
		20	3	2
		30	2	2
Cold water	Bark Extract	10	4	3
		20	4	3
		30	3	2
	Leaves Extract	10	4	3
		20	4	3
		30	3	3
	+ Control	Solignum treatment	4	3
	- Control	untreated	4	4

Keys: 1=Slight attack(1-20% damage), 2=Moderate attack (21-40% damage), 3=Moderate/severe attack (41-60% damage), 4=Severely attack (61-80% damage), 5=Very severely attack (81-99% damage), 6=100% Failure

Wood blocks visually rated using (American Wood Protection Association) AWPA Standard - 2009 rating system is showed in table 5.

V. DISCUSSION

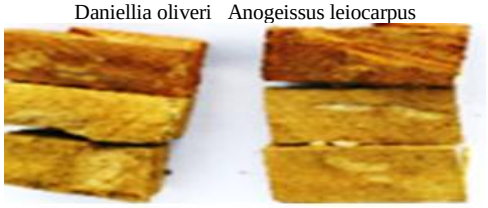
This study has showed that extracts of Eucalyptus camaldulensis had varied level of resistance to termite attack when compared with untreated wood samples which is similar to [15], which noted that natural chemicals derived from plants are possible alternatives to synthetic insecticide for the control of termites.

Extracts of higher concentrations (30%) of Eucalyptus camaldulensis showed more resistance to termite attack which is similar to the result of many who have studied the Eucalyptus and Ziziphus leaves extracts in inhibiting the growth of many microorganisms [16]. A study carried out by [17] showed that the growth of both test organisms (Staphylococcus aureus Gram (+) and Escherichia coli Gram(-) were not inhibited at low concentrations (1 and 2 µl) of eucalyptus oil from Eucalyptus camaldulensis and Eucalyptus globulus. However, in a research on the anti- termitic potential of heartwood and bark extract and chemical compound isolated from Madhuca utilis and Neobalanocarpus heimii by [18] the lowest weight loss was observed in higher concentrations of every extract.

The 30% hot water leaves extract of Eucalyptus calmadulensis was more resistance to termite attack when compared with the bark extract. This conforms with [19], which reported that leaves extract were effective when compared with other plant part in the study of termicidal effect of neem extracts on the wood of Khaya senegalensis. This is at variance with the findings of [20] on their study of antitermitic effect of Moringa oleifera extracts on Gmelina arborea and Ceiba pentandra wood. They observed that 20% Moringa oleifera root extract had the best impact in the control of termite attack as compared with leaves and root of the same species. This result is also not consistent with the findings of [21] that carried out a study to assess crude leaf and root extracts of Cassia alata (Caesalpiniaceae) and their antimicrobial activity against clinically resistant Neisseria gonorrhoeae bacteria. From the result, both leaf and root extracts of Cassia alata had antibacterial activity against Neisseria gonorrhoeae, whereas root extracts were more potent compared to leaf extracts, regardless of the solvent used for the extraction.

Anogeissus leiocarpus wood samples showed more resistance to termite attack when compared with Daniellia oliveri which could be attributed to its hardness. The hardness of wood affects termite chewing ability resulting in less attack of wood according to [22]. [23] Also reported that the degree of susceptibility of wood varies from species to species. Numerous authors' report attributes this relative susceptibility to wood hardness and to the quality and quantity of chemical components and extractives present in the wood [24, 25, 26, 27]. The extractive compounds in wood plays important role in termite consumption rate which affect termite attack [28].

TABLE V. PICTURE OF TERMITE ATTACK AFTER THE 5TH WEEK WHERE: D = *DANIELLIA OLIVERI*, A = *ANOGEISSUS LEIOCARPUS*

S/No	Treated Wood Samples	Treatment
1	Daniellia oliveri Anogeissus leiocarpus 	30% conc. hot water extract of Eucalyptus camaldulensis bark.
2	Daniellia oliveri Anogeissus leiocarpus 	30% conc. hot water extract of Eucalyptus camaldulensis leaves.
3	Daniellia oliveri Anogeissus leiocarpus 	30% conc. cold water extract of Eucalyptus camaldulensis bark.
4	Daniellia oliveri Anogeissus leiocarpus 	30% conc. of cold water extract of Eucalyptus camaldulensis leaves
5	Daniellia oliveri Anogeissus leiocarpus 	Solignium
6	Daniellia oliveri Anogeissus leiocarpus 	Control

I. CONCLUSION

This study reveals the presence of termicidal properties in Eucalypts camaldulensis leaves and bark extracts. It further shows that, the higher the concentration of the plant extracts, the higher the efficacy on termite attack. Interestingly, 30% hot water extract of Eucalyptus camaldulensis leaves showed best resistance to termite attack compare synthetic Solignum and other levels of concentrations. Anogeissus leiocarpus wood showed more resistance to termite attack compared to Daniellia oliveri wood. Therefore, Eucalypts camaldulensis leaves and bark extracts could be exploited to develop new wood preservatives. This present study shows that Eucalypts camaldulensis leaves and bark extracts can serve as useful source of bioactive agent against termites. The use of these extracts would reduce cost and environmental effects of synthetic chemicals.

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