

INSECTICIDAL ACTIVITIES OF SOME PLANT EXTRACTS AGAINST BOOK DESTROYING TERMITES

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Abstract- A study of efficacy of some botanicals for the control of termites affecting book in Abia State Polytechnic library was carried out in the Biology/Microbiology laboratory of the institution. The botanicals used are *Eupatorium odoratum*, *Lycopersicon esculentum*, *Gongronema latifolium* leaves and *Citrus sinensis* epicarp with ethanol and water as the extracting medium. After 2 hours of application of treatments, *Eupatorium odoratum* leaves had the highest mortality followed by *Citrus* epicarp at 5 % level of application table 1. After 6 hours of application, *Eupatorium odoratum* leaves still recorded the highest level of mortality. The results of the ethanolic and aqueous extracts of the botanical treated books against the termites indicate that at 25% concentration the rate of destruction by the termites for the paper treated ethanolic extract ranged from 5.53 ± 0.15^d (*Eupatorium odoratum*) – 13.47 ± 0.06^a (*Lycopersicon esculentum*) while that of aqueous extract ranged from 8.73 ± 0.06^d in *Eupatorium odoratum* - 16.33 ± 0.15^a (*Lycopersicon esculentum*) tables 3 and 4. In all the concentrations *Eupatorium odoratum* with least significant difference showed more potency followed by *Citrus* epicarp while *Lycopersicon esculentum* with highest significance difference in all concentrations showed least potency. It is evident from these results that extracts did pose a hindrance to activities of the termites. That efficacy of biopesticides was also shown to increase with increased rate of application time and period of exposure to the target pests.

Keywords: botanicals, library, termite, books, potency, mortality extracts.

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I. INTRODUCTION

Books as library material are prone to damage by termite which poses a lot of academic and economic problems. Termites belonging to the order isoptera are social insects living in colonies. Termites are soil or wood inhabiting insects which generally have soft, white bodies and secretive habits. Globally, termites play an important role in reducing dead plant material but they can be quite destructive to human-built structures. Subterranean termites are highly destructive polyphagous insect pests which largely damage house hold materials. They damaged goods, plants and agricultural crops such as sugarcane, millet, barley and paddy [1]. In addition termites also consume valuable books, documents and photographs. Subterranean termites are social insects. This means that they live in family groups called colonies. In the past, the control of termites has been totally based on chemicals, especially synthetic insecticides such as persistent organo-chlorine and organophosphate insecticides [2]. The maximum residual effects as well as the development of insecticide resistance in target pests along with adverse effects on human health and concerns for environmental deterioration are some of disadvantages that hinder widespread use of pesticides. Plant extracts offer a vast, virtually untapped reservoir of chemical compounds with many potential uses. The use of bio-based materials in controlling subterranean termites has been observed by many researchers due to the economic and environmental reasons as well as their potential availability and variability [3][4] 5] [6]. It is seemingly due to their extract ingredients potentially affecting the life of many kinds of insects, including termites. The plant extracts with complex mixtures of

such compounds have been investigated for their insecticidal, repellent, and anti-feedant properties [7]. Plants contain chemicals such as terpenoids, flavonoids, saponins, etc. or mixtures of chemicals that repel or kill termites or interfere with their gut flora [8]. It is therefore the objective of this work to evaluate the rate of mortality and the rate at which termite can destroy books after treatment.

II. MATERIALS AND METHOD

COLLECTION AND IDENTIFICATION OF ANT MATERIALS

The herbs were collected from the wild areas of Aba North, south and Osisima local Government Areas of Aba, Abia State and were identified at the herbarium of the Department of Biology, Abia State Polytechnic Aba.

COLLECTION OF TERMITES

Subterranean termites were used for the laboratory study. They were sourced in areas around the Library and bookshop and from a termite mound in the premises of the Abia State Polytechnic Aba, Abia State Nigeria.

PREPARATION OF EXTRACTS

These leaves were washed with tap water and then air dried in a laboratory for 2 weeks ensuring sufficient air flow to avoid damping. The air dried leaves were reduced to powdered form by grinding with an electric grinder running at a speed of 6000 rpm for 50-60 sec.

Crude ethanolic extract of leaves

One hundred gram (100 g) of powder from each of the plants was extracted in 200 ml of 80 % ethanol in the ratio of 1:2 (w/v) by following method of extraction [9]. It was kept for 72 hours at room temperature and shaken at intervals to get a better extraction. Thereafter, the extract was filtered through Whatman filter No. 42. After filtering, the ethanol was removed at 60 °C using rotary evaporator, to obtain solid extract, dried in vacuum desiccator. The final yield of dry material was used to prepare percent solution of crude extract with 2% ethanol.

Aqueous extracts of leaves

To get the aqueous extracts, above procedure was followed except powder was extracted in distilled water. The filtrates were stored in a refrigerator at 5°C for subsequent use in bioassay.

2.3 Bioassay procedures for botanical toxicity

For toxicity bioassay, various serial concentrations of different extracts were loaded on Whatman paper strips (1x1 cm²) and air dried to remove the solvent. These pre-coated solvent free strips were placed in the center separate Petri dishes (42mm diameter) as tests and uncoated as control. Twenty termites of undetermined age and sex were released in the Petri dish to observe the mortality. Each treatment was tested at 2 concentration (5, 10%, cw/v). The experiment was replicated thrice and in all the setup. The termites were examined at 2 h intervals after application for 6 h and the insect mortality was recorded.

Life and dead termites were counted and percentage mortality was calculated according to the following equation;

$$\text{Percentage mortality} = \frac{\text{No of dead termite} \times 100}{\text{Total no of termite}}$$

Also thick papers were collected from some books in the library and cut to size. The papers which were cut to size were impregnated with different dilute concentrations of the plant extracts. This treatment was allowed to stand for 24 hrs in order to evaporate the solvent used in the dilution. Forty termites were separately introduced into each of the experimental vials containing thick paper coated with different concentrations of different plant extracts. Each treatment was replicated three times. The experiment was allowed to stand for 8 weeks. Termite responses were determined by taking the length (cm) of the paper damaged or destroyed.

III. RESULTS AND DISCUSSION

Different concentrations of the botanicals were tested against termites for 6 hrs. Maximum mortalities in species were observed at higher concentration. Results (Table 1) showed percent mortalities of the termites within 2-6 hrs of treatment ranged from (40 %) in *Lycopersicon esculentum* – (65 %) in *Eupatorium odoratum* and *Citrus sinensis* at 5 % by using ethanol leaf extracts while toxicity at 10 % using ethanol leaf extracts ranged from (60 %) *lycopersicon esculentum* - (80 %) in *Citrus sinensis* and 85% in *Eupatorium odoratum* respectively. The analysis revealed that the percent mortality recorded at 10% of the extracts where higher than that of 5%. Our results showed that termite was more sensitive in *Eupatorium odoratum* and *Citrus sinensis* extracts at both concentrations. In essence, plant extracts can be used as insecticides, insect repellants, anti-feedant, insect growth and development regulators.

TABLE 1: Percentage mortality of the termites exposed for 2-6 hours to the toxicity of ethanolic plant extracts 5-10% concentration.

Plant extracts	Concentration	Total number of Termites	Mortality Rate (%)			Total number of dead termites	%Mortality
			Exposure time (Hrs)	2	4		
<i>Eupatorium odoratum</i>	5%	20	3	6	4	13	65
<i>Lycopersicon esculentum</i>			2	4	2	8	40
<i>Gongronema latifolium</i>			1	3	5	9	45
<i>Citrus sinensis</i>			3	4	6	13	65
<hr/>							
	10%						
<i>Eupatorium odoratum</i>			4	9	3	17	85
<i>lycopersicon esculentum</i>			3	4	5	12	60
<i>Gongronema latifolium</i>			3	8	4	15	75
<i>Citrus sinensis</i>			3	8	6	16	80

Our study indicated that extracts of the selected tropical herbal plants possess some insecticidal properties against termite but several variations occurred, based on the concentration of the extracts as these influenced the efficacy or termicidal activities of the plant materials. The results showed that aqueous and ethanol extract of *the botanicals used in this study* contain insecticidal activities and percent mean mortality of both species were directly proportion to the concentrations of treatments.

TABLE 2: Rate of book damage by termites in response to varying concentrations of ethanolic extract of the botanicals

Conc	Rate of damage (%)			
	<i>Eupatorium odoratum</i>	<i>Lycopersicon esculentum</i>	<i>Gongronema latifolium</i>	<i>Citrus sinensis</i>
25	5.53 ± 0.15 ^d	13.47 ± 0.06 ^a	8.33 ± 0.15 ^b	6.73 ± 0.06 ^c
50	4.07 ± 0.12 ^e	11.53 ± 0.15 ^a	9.30 ± 0.20 ^b	6.47 ± 0.06 ^c
75	3.63 ± 0.12 ^e	8.63 ± 0.12 ^a	7.57 ± 0.15 ^b	4.53 ± 0.12 ^c
100	3.33 ± 0.15 ^b	7.3 ± 0.06 ^a	6.83 ± 0.12 ^a	3.50 ± 0.20 ^b

NOTE: Cells with the same index label across the rows are not significant.

Similarly, the responses of the termites with respect to paper destruction 56 days after treatment by using aqueous and ethanol leaf extracts of the botanicals were examined. The result of the ANOVA showed significant difference between *Eupatorium odoratum* and *Citrus* peel in terms of potency and were the most effective treatments table 2. The result of the ethanol extracts ranged from 3.33 ± 0.15^b to 13.47 ± 0.06^a and 3.53 ± 0.15^e to 16.33 ± 0.15^a for aqueous extract at 25% concentration respectively after 56 days of exposure. Similar trend was observed for all the concentrations of both aqueous and ethanol extracts after 56 days of paper treatment tables 2 and 3.

TABLE 4: Rate of book damage by termites in response to varying concentrations of aqueous extract of the botanicals

Rate of damage (%)				
Conc	<i>Eupatorium odoratum</i>	<i>Lycopersicon esculentum</i>	<i>Gongronema latifolium</i>	<i>Citrus sinensis</i>
25	8.73 ± 0.06^d	16.33 ± 0.15^a	12.77 ± 0.06^c	14.60 ± 0.10^b
50	6.73 ± 0.06^{de}	13.40 ± 0.10^a	10.13 ± 0.15^b	9.57 ± 0.12^c
75	4.70 ± 0.20^e	7.30 ± 0.10^b	7.73 ± 0.15^a	6.03 ± 0.06^c
100	3.53 ± 0.15^e	7.13 ± 0.15^a	6.87 ± 0.06^b	4.73 ± 0.06^c

NOTE: Cells with the same index label across the rows are not significant.

Eupatorium odoratum leaves and *Citrus* peels were highly efficacious against book destroying termites at all levels of application for ethanol extracts while aqueous extract showed potency at higher concentrations. The result of this study is in agreement with that of others [10],[11] who observed increase in efficacy of the treatments with biopesticides with an increase in the durations after application. Plant extracts on insect pest are being manifested in several ways; this includes altering the behaviour of the insect, growth retardation, toxicity, oviposition deterrence, feeding inhibition and reduction of fecundity and fertility [12]. The variations observed in this may be due to the different active compounds present in the plants. However, the result of the research showed efficacy of the botanicals as barrier to termites destroying book at various levels and period of application. After 56 days papers treated with extracts of *Eupatorium odoratum* leaves showed lowest range of attack followed by that treated with *Citrus sinensis* while *Lycopersicon esculentum* treated paper showed least range of resistant tables 2 and 3.

CONCLUSION

In the present study there were variations in mortality rate of termites and there degree of damage in response to different concentrations of the ethanol and aqueous extract of the plants. These variations may be due to the different active compounds present in the plants. However, the result of the research showed efficacy of the botanicals as barrier to termites destroying book at various levels and period of application. That efficacy of biopesticides was also shown to increase with increased rate of application time and period of exposure to the target pests.

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