



Efficacy of *Datura stramonium* extracts incorporated into soil samples on termites' mortality.

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Introduction

Wood is a very important and is under attack of many insect pests such as furniture beetles, carpenter's ants and termites. Termites, *Coptotermes formosanus*, *Macrotermes bellicosus* are one of the most important destructive pests of wood and wood products in urban and agricultural areas (Manzoor and Mir, 2010).

Many methods including use of chemicals have been adopted to control termites. The attendant problems associated with the use of these chemicals such as high level of persistence in the environment, destruction of non-target organisms, non-availability, high cost, toxicity to personnel, level of education of the users is of great concern. Many plants have been found to contain chemicals but their potential has not been explored for field use according to Zhu *et al* (2001). As a result of attendant hazards associated with use of chemicals in pest control, research efforts are currently on the use of plant products which are cheap, available, eco-friendly, host specific and cost effective means of controlling pests in the environment (Adedire and Ajayi, 1996). Numerous studies have examined the efficacy of new insecticides for the control of *Coptotermes formosanus* termites (Shelton and Grace, 2003). Previous study shows that *Datura stramonium* plants have been used for anti-bacterial, antifungal, anti-viral and as insect repellent (Prakash and Rao, 1997). Therefore the plant was investigated for its insecticidal effect against termite in soil barrier test.

The aims and the objectives of this research work

The aims and the objectives of using this *Datura stramonium* extract are to:

- investigate the termicidal properties of *Datura stramonium* extracts against *Coptotermes formosanus*;
- determine the level of toxicity of each of the plant extracts;
- determine the level of deterrents of each of the plant extracts; and
- determine the extract with highest termicidal activity.

Materials and Methods.

Fresh leaves of *D. stramonium* were also plucked from their parent plant around FUTA campus, squeezed and the leaves juices were used immediately for the crude water extract bioassay

Plant extracts were prepared by soaking pulverized leaves and seeds in petroleum ether solvent in ratio 1:8 for 72 hours and were filtered with muslin cloth and Watt man filter paper.

Termit collections

Soldiers and workers of *Coptotermes formosanus* were collected from Akure, Nigeria. into the plastic sheets by the use of spade. The insects were acclimatized in the laboratory for 3 days and were fed with paper.

Soil barrier and mortality test

Each experiment was performed solution according to the modified method of Manzoor *et al* (2011) with two different concentrations of 30% and 40% prepared from the stock



Plate 1: *Datura stramonium* (Thorn apple) plant showing leaves, seeds and flowers

Table 1: Mortality of termites in soil arena treated with *Datura stramonium* at different concentrations (Mean \pm Standard Error)

Plant extracts	Mortality at different concentrations (%)	
	30	40
Fresh leaf	15.00 \pm 0.67b	19.33 \pm 0.88b
Dried leaf	23.67 \pm 1.20c	30.67 \pm 3.53c
Seed	41.67 \pm 1.20d	49.00 \pm 1.15d
Untreated control	2.67 \pm 0.33a	2.67 \pm 0.33a
Solvent (petroleum ether) control	5.00 \pm 1.15a	5.00 \pm 1.15a

Means followed by the same letter(s) in a column are not significantly different at $P= 0.05$ by Turkey's Test.

Table 2: Distribution and survival rates of termites *Coptotermes formosanus* in treated soil arena after seven (7) days of treatment with *Datura stramonium*.

Plant extracts	concentrations (%)	introduction Site (LS)	Barrier	Protection Site (P.S)
Fresh leaf	30	19.33 \pm 0.67de	6.67 \pm 1.20c	19.00 \pm 0.58d
Dried leaf	30	17.00 \pm 1.00cd	4.67 \pm 0.33 cd	14.67 \pm 1.45c
Seed	30	12.33 \pm 0.88b	2.67 \pm 0.33a	3.33 \pm 0.88a
Fresh leaf	40	19.67 \pm 0.34e	4.67 \pm 0.33 bc	16.33 \pm 0.88cd
Dried leaf	40	14.67 \pm 0.33bc	3.67 \pm 0.88ab	7.67 \pm 0.67b
Seed	40	8.67 \pm 0.67a	1.67 \pm 0.33ab	0.67 \pm 0.33a
Solvent control	0	20.00 \pm 1.00e	11.33 \pm 0.88d	23.67 \pm 1.86e
Water control	0	19.00 \pm 1.15de	11.33 \pm 1.76d	27.00 \pm 0.58f

Means followed by the same letter(s) in a column are not significantly different at $P= 0.05$ by Turkey's Test.

Table 3: Percentage protection of the second food source present at the protected site against termites *Coptotermes formosanus*

Plant extracts	Concentrate (%)	Total number of insect introduced	Number of insects before the protected site	Number of insects at the protected site	Total Number of dead insects	Percentage protection (% protection)
Fresh leaf	30	60	27.67	17.33	15	26.93 %
	40	60	24.33	16.33	19.33	32.88 %
Dried leaf	30	60	21.67	14.67	23.67	32.30 %
	40	60	18.33	07.67	34	58.16 %
Seed	30	60	14.67	3.33	41.67	77.30 %
	40	60	10	0.66	49	93.40 %
Solvent control		60	31.33	24.67	4	21.26 %
Untreated control		60	30.33	27	2.67	10.98 %

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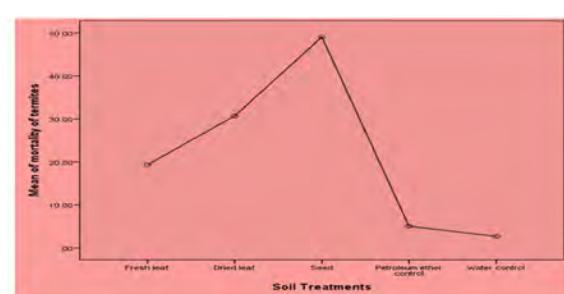
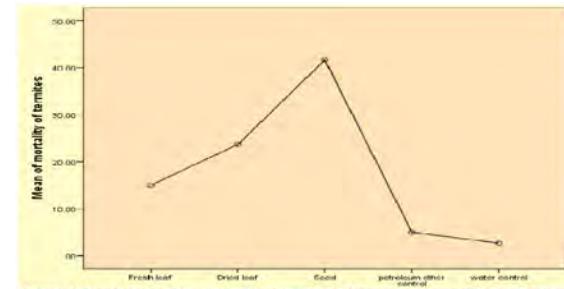


Figure 1: Visual observation of termites (*Coptotermes formosanus*) mortality on soil arena treated with plant extracts of 30% concentration.

Conclusion
The research result reveals that the extracts of *Datura stramonium* are promising botanicals in termite control. The extracts used in this project work have repellent as well as toxic effects to termites *Coptotermes formosanus*. Finally, both the crude water extracts, and dried leaf and seed petroleum ether extracts of *Datura stramonium* plant have termicidal properties. This plants extracts could be exploited to develop new wood preservatives to protect wooden structures, agricultural crop, plants and trees, cellulosic materials, as these are less harmful to environments and humans.

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References

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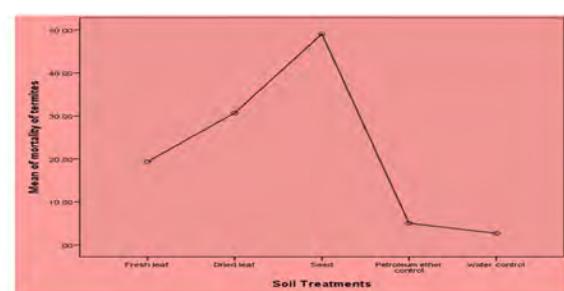
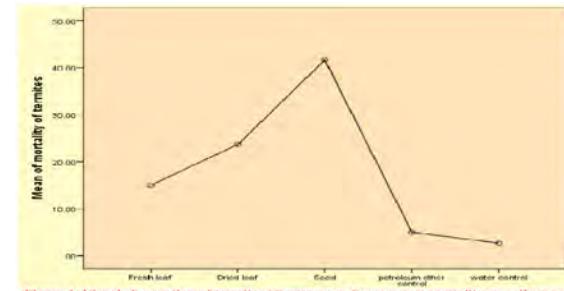


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