

## Repellent activity of wood ash, cow dung, urine and bird dropping sprays against termites

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### Abstract

Wood eating termites are major threats to crops, plantations and household properties across the African continent. The harmful effects of chemical-based termiticides have resulted in the agitation for a safe, affordable and environmentally- friendly insecticides. The aim of this study was to investigate the repellent and residual efficacy of wood ash, cow dung, urine, and bird droppings in the management of termites. The synthetic insecticide, (0.1% Chlorpyrifos) and water were included in the study as controls while the repellent action of the treatments was based on an area of preference test. All the treatments exhibited significant repellent activity against termites in time- dependent manner under laboratory conditions; with wood ash demonstrating the highest repellency efficacy, and significantly comparable with the synthetic insecticide. The study clearly shows that the test treatments are effective and could serve as potential alternative to termite control.

**Keywords:** wood ash, dungs, urine, bird droppings, termite, repellency

### Introduction

Termites are small bodied and lightly pigmented insects usually confused to be the white ants, but phylogenetically related to cockroaches <sup>[1]</sup>. They belong to the order *Isoptera*, with approximately 2753 valid names of species in 285 genera, documented worldwide <sup>[2]</sup>. In Nigeria, <sup>[3]</sup> and <sup>[4]</sup> reported that two important families, *Rhinotermitidae* and *Termitidae* belonging to eight genera namely; *Coptotermes*, *Macrotermes*, *Microtermes*, *Microcerotermes*, *Ancistrotermes*, *Odontotermes*, *Adaiaphrotermes* and *Amitermes* are recorded as pest of crops. Termites have both medicinal and nutritional values to man and livestock's <sup>[5, 6]</sup> reported that for some time now, the Food and Agriculture Organization (FAO) has been making calls to adopt insects as a source of food. They are important contributors to the ecological support systems considering their tunneling and burrowing activities in the soil which facilitates aeration. In Zimbabwe, termites are used to predict climate change <sup>[7]</sup>. Despite their utilization in various ways by nature and man, termites are most recognized for their role as plagues, they target structural timber in buildings through wood close to or in contact with the soil, particularly at porches, steps, terraces and go even deeper into other things within the buildings such as furniture, clothing and books <sup>[8]</sup>. In Nigeria, *Macrotermes* spp, the subterranean fungus growing and mound building termites are the most destructive and economically important pests of wood and other cellulose products <sup>[9]</sup>. These species of termites live in colonies and their numbers vary from several hundred to several million individuals per mound and build nests around the roots of forest trees and tree crops which sometimes results in trees being ring-barked, pods scarified, holes made in tubers and in some cases lawns and farmlands claimed by the ant hill. Although some countries in Africa are able to table the losses they have incurred as a result of termite damage, it is difficult to establish the exact amount of such damage even though estimates of yearly damage of \$1 million are common, but generally, losses due to termite damage worldwide runs into billions of US dollars <sup>[10]</sup>.

In the past, termite control measures have totally been based on the use of organo-chlorines such as aldrin, lindane, chlordane and dieldrin. The ban imposed on these chemicals brought about a shift to the use of some other synthetic insecticides such as carbamates and pyrethroids. However, their high costs, adverse effects on human health, development of insecticide resistance to target pests, as well as concerns for environmental deterioration later triggered public suspicion against their widespread usage. Today, the substitution of these chemical insecticides with non-toxic and naturally derived products appears to be universally accepted <sup>[11, 12, 13]</sup>. In Kenya, various indigenous cultural practices such as the use of traps, wood ash, and animal excreta have been widely reported as some of the effective termite control practices across the African continent <sup>[14, 15]</sup>. Similarly <sup>[16]</sup>. Reported the use of wood ashes sprinkled around the base of cocoa and kola trees and vegetables to keep termites in check. Management and control strategies of termites per continent vary <sup>[11]</sup>, some of the traditional methods used in Africa are limited to certain countries depending on indigenous understanding, while majority are ubiquitous across the continents. Traditional methods are simple to follow, conduct and are cost effective especially in the African setting. A number of publications on termite control shows that insect pests are strongly repelled by some foul- smelling toxic materials to the extent they become confused and unsettled. In this study, the repellent effects of cow dung, urine, bird droppings and wood ash are being evaluated against termites in the Laboratory.

### 2. Materials and Methods

#### 2.1 Study area, collection of termites, wood ash and animal wastes

The study was carried out at the Department of Animal and Environmental Biology Laboratory of the Cross River University of Technology Calabar, in December, 2018 under ambient temperature of  $26 \pm 2^{\circ} \text{C}$  and  $65 \pm 5\%$  relative humidity. *Macrotermes* species of termites were collected from a nearby old termitarium, while bird

droppings were obtained in clean containers from a poultry farm within the University community. Similarly, cow dung and urine were collected in sterilized transparent plastic containers from Marian market Abattoir, while wood ash was prepared by burning dry stems of *Azadirachta indica*. A. Juss. Prior to use, 50 g of pulverized wood ash was mixed with 50 ml of distill water to make a slightly watery paste, while the other treatments (cow dung, urine, bird droppings) were applied in the semi liquid forms collected.

## 2.2 Test for repellency using treated papers.

The study adopted [17] and [18] methodology, which is based on test insects' area of preference to determine the repellent activity of sprays of wood ash, cow dung, urine and bird droppings against termites. Test area was number 1 Whiteman filter paper 11cm diameter, cut into equal halves that have no contact with each other to prevent exchange of content; 2 cm space was created between. Half of the papers were evenly sprayed with 5 ml each of the natural- derived treatments, and 0.1% Chlorpyrifos, a standard synthetic insecticide serving as a control and allowed to drain before being placed into 11.00 x 4. 50 x 9.40 cm<sup>3</sup> transparent plastic containers. The other half was treated with distilled water (control), allowed to drain too and placed sideway with the first half. Five termites of unknown age and sex (workers and soldiers) were released separately using a fine brush into the space between the two halves of the filter paper in the test containers. The test containers were thereafter covered with hollow covers having nylon mesh to permit aeration and confinement of insects. Each treatment was replicated three times and laid out in a Completely Randomized Design (CRD). The number of termite present on control (NC) and treatment (NT) halves were recorded after one hour exposure while the percent repellency (PR) values were calculated using the method of [19] as follows:

$$PR = \frac{(NC-NT) \times 100}{(NC-NT)}$$

## 2.3 Test for residual effect of treatments on termite repellency

A measure of residual effect or persistence of treatments was also investigated. Half of each filter paper were again sprayed with 5 ml of liquid wood ash, bird droppings, cow dung, urine and a standard synthetic insecticide and separately placed in the test containers. The other halves of filter papers were soaked in distilled water and served as control. The set up was replicated three times and kept for a whole day (24 hours). Thereafter, five termites were separately introduced into the test containers and left for 1 hour. Like in the first experiment, the numbers of termites present on control and treatments halves were noted and percentage repellency computed.

## 2.4 Data analysis

Statistical analysis of data was based on SAS's general lineal model procedure [20]. The data was subjected to Analysis of Variance (ANOVA) and Least Significant Difference (LSD) used in separating means.

## 3. Results

### 3.1 Repellency effect of treatments on termites

Table 1. Shows the percentage repellency of treatments against termites. The synthetic insecticide, (0.1%

Chlorpyrifos) induced the highest insect repellency of 86.80 %, followed by the wood ash, 73.20 %, bird droppings 60.00%, cow urine 46.80 % and cow dung 33.20 %. The mean percentage repellency recorded by the standard insecticide was however not significantly ( $p > 0.05$ ) different from that of wood ash.

### 3.2 Residual effects of treatments on termites

The residual effect of treatments on termite is shown in table 2. The synthetic insecticide and wood ash induced 100 and 86.80 % residual repellency respectively. This was followed by bird droppings and cow urine with 73.20 % each. Mean percentage repellency caused by wood ash and the other treatments were however not significantly ( $p > 0.05$ ) different from that caused by the synthetic insecticide.

**Table 1:** Mean percentage repellency of termites by treatments

Treatments	% repellency
Cow dung	33.20 <sup>a</sup>
Cow urine	46.80 <sup>a</sup>
Bird droppings	60.00 <sup>b</sup>
Wood ash	73.20 <sup>b</sup>
0.1% Chlorpyrifos	86.80 <sup>b</sup>

Means followed by the same letter are not significantly different from each other at (0.05), significant means were separated using Least Significance Difference (LSD)

**Table 2:** Residual effects of treatments on termite repellency

Treatments	% repellency
Cow dung	60.00 <sup>b</sup>
Cow urine	73.20 <sup>b</sup>
Bird droppings	73.20 <sup>b</sup>
Wood ash	86.80 <sup>b</sup>
0.1% Chlorpyrifos	100.00 <sup>b</sup>

Means followed by the same letter are not significantly different from each other at (0.05), significant means were separated using Least Significance Difference

## 4. Discussion

In this study, wood ash, cow dung, cow urine, and bird droppings were significantly repellent to termites. This result corroborates that of [14] who reported that human urine and dung of either goats or cow has been used successfully by some communities in Kenya to control termites. Similarly, [21] and [22] reported the use of fresh cow dung in maize fields of Monze region of Zambia to reduce termite damage on maize crops. The present study also agrees with that of [23] and [22] who both reported the use of wood ash as one of the major control practices in Uganda.

These farmers use ash to broad cast in pasture swards or top dressed in rows of re- seeded pasture seedlings.

In Nigeria, [16] reported that wood ash is sprinkled around the base of cocoa, kola and vegetables as a pest control measure. In this study, 0.1% Chlorpyrifos that served as a standard check insecticide caused a higher percentage repellence of termites than the other treatments. This again is in agreement with the findings of [24] who reported that 0.1% Chlorpyrifos is effective in controlling termites.

The comparative effectiveness of all the naturally derived treatments with the synthetic insecticide is a good development for the management of termites, and is in consonance with the findings of [25] which indicated that, naturally occurring anti- termite compounds extracted from organic sources have potentials for managing termites [26].

had earlier reported that naturally occurring repellents are safe in pest control operations, minimize residues and ensure safety of food and environment. It was also observed in this study that percentage repellency caused by treatments was directly related to the duration of exposure of termites to the treatments. The residual repellent effect of all the treatments appear to have been boosted greatly after a day of application hence the higher termite repellency performance. According to [23], although most of these methods are reportedly effective, the mechanisms of action of these organic materials are not clear and quantities applicable are not constant. However, [21] reported that dungs and urine have some foul-smelling toxic organic chemicals in them which could repel and make termites become confused and unsettled. These chemicals also work by increasing the activity and survival of termite predators. Wood ash which proved most effective among the naturally occurring insecticides are widely used to kill weeds, destroy ant mounds and in protecting fence posts, is caustic in nature and contains roughly 20 % Calcium, about 4 % Potassium and less than 2 % Phosphorous, Manganese, Aluminum and Sodium. According to [27] some poultry farmers make dust bath for their chickens by combining equal parts of wood ash, builder's sand, soil and diatomaceous substances; chickens routinely give themselves baths to prevent mites and lice from moving in on them.

In Africa, these traditional methods are limited to certain countries depending on indigenous understanding while majority are ubiquitous across the continent and beyond. [11], urges the use of these traditional control methods as alternatives to the chemical control method rather than looking upon them as non-scientific based. [28], however argues that the use of traditional methods should be complemented with conventional methods to achieve better results.

## 5. Conclusion

The use of traditional methods to control termites is not a new thing in Africa and even in some Asian countries. The same way Africa is perceived to be rich in termites, so is it rich in the traditional control strategies which cannot be overlooked as just lacking scientific base. Methods such as use of wood ash, dungs, urine and even red pepper alone or in combination with other organic based mixtures are quite effective and affordable and with further research, its exact mechanism can be understood, improved upon and could subsequently become a revived and useful method of managing termite problems for farmers and property owners.

## 6. References

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