

Laboratory Evaluation of Different Botanicals for the Control of Termite, *Microtermes* spp (Isoptera: Termitidae)

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Abstract

Termites are amongst the most destructive insect pests that causes severe damage to many cultivated as well as uncultivated plants in Ethiopia. It is obvious that the main solution to these problems is the development and adoption of a more ecologically-friendly Insect Pest Management (IPM) strategy. In this case, the use of botanicals could be a fundamental component of this strategy. The value of botanicals in the control of termite is not well investigated under Ethiopian conditions. The study of effective botanicals that are potential for the control of termite is crucial. Thus, seven different of water extract botanicals were evaluated for their mortality rate of against termites under laboratory condition at Ambo Plant Protection Research Center, during March to June 2007. The effects of water extracts of tobacco leave (*Nicotiana tabacum*), Birbira seed (*Militia ferruginea*) and Endod leave (*Phytolacca dodecandra*) caused 100% mortality after 24 hours the same as the *Standard check* (chlorpyrifos 48% E.C) and Pyrethrum E-185 flower (*Chrysanthemum* sp) caused as an average 91.25% mortality on both worker and soldier termite and non significantly different when compared with the *Standard check*, but highly significant differences were observed with the control check. Neem seed (*Azadirachta indica*), Kosso seed (*Hagenia abyssinica*) and Bisana seed (*Croton macrostachys*) were gave relatively very low percentage when compared with the other botanicals tasted and showed highly significant differences when compared with the *Standard check*. After 72 hours exposures Neem seed (*Azadirachta indica*) and Kosso seed (*Hagenia abyssinica*) extracts showed low mortality effect and non significant differences were observed with control. Bisana seed (*Croton macrostachys*) water extract was low toxic effect among all treatments even after 5 days. All Botanicals were high mortality effective on worker termites when compared with soldier termites.

Keywords: Botanicals; Chlorpyrifos; *Macrotermes*; Mortality; Water extract

Introduction

Termite cause wide spread damage to a great variety of crops in tropical Africa. The damage can occur from seedling to harvest and usually occurs every year, as termites form more or less stable populations and foraging by various combinations of several species occurs throughout the year. In Africa the most important termite genera are: *Macrotermes*, *Odnoterme*s, *Pseudocanthoterme*s, *Ancistrotermes* and *Microtermes*. They are serious pests of agricultural crops, forest trees, rangeland, furniture and building structures made of wood in the region [1]. Sands [2], mentioned also termite poses serious threat to agricultural production in Ethiopia, particularly in western Wellega. The gradual increase in human and livestock populations, depletion of natural resource bases, lack of agricultural technology and information support system and poor land management, among other factors, in the West Wollega region have resulted in a gradual increase in termite population over decades [2].

According to a survey made in Western, Southern and Eastern Ethiopia, fifteen new termite species belonging to five genera were identified [3]. Some of the species reorded in Welega areas are *Macrotermes* damaging seedlings of maize, and noted serious damage to land by mound building, *Macrotermes* and subterranean *Odnoterme*s and *Pseudocanthoterme*s. For any casual observer, it is not uncommon to notice up to five large termite mounds per hectare of land in the Wellega area [4]. The land holding per household has already dwindled as a direct consequence of fast population growth and the building of large numbers of mounds by termites.

The over use of chemical insecticides were lead to various problems including environmental pollution, resistance of pest to chemical pesticides, pest resurgence, secondary pest out breaks and direct hazard to users. The solution to these problems is the development

and adoption of ecologically-rational pest management strategy, commonly referred to as IPM. The use of botanical is a fundamental component of IPM, but their value in controlling of termite is not well investigated under Ethiopian condition. Therefore, the study of effectiveness of some botanicals that are potential for the control of termite is very important.

Materials and Methods

The study was carried out at Ambo plant protection research center, under laboratory condition by using number of available botanicals viz, *Phytolacca dodecandra* (Endod leave extract), *Hagenia abyssinica* (Kosso seed extract), *Croton macrostachys* (Bisana Seed extract), *Chrysanthemum* sp. (Pyrethrum E-185 flower extract), *Milletia ferruginea* (Birbira seed extract), *Azadirachta indica* (Neem seed extract) and *Nicotiana tabacum* (Tobacco leave extract). Each material part were dried under shade and crushed in a small hand-operated manual grinder. The ground-up powder 25 gm with 100 ml of distilled water was filtered through a cheese cloth.

The trial was arranged in Completely Randomized Designs (CRD) with four replications. Each replication contained 10 adult *workers* and 10 adult soldiers of *Macrotermes* termites. About 5 kg of soil was placed in wooden boxes with specified dimensions (55×40×15cm) of

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length, width and height respectively and inserted all plastic jars in to the soil. A piece of carton and filter paper were added in to each jar to serve as a food for the termites. The jars were maintained in a room temperature $22 \pm 3^\circ\text{C}$ and $80 \pm 5\%$ relative humidity. Chlorpyrifos 48% E.C and distilled water would serve as a *Standard check* and control, respectively. Mortality in the treated, *Standard check* and control were recorded after 24 hour.

Data analysis

Analysis of Variance (ANOVA) was conducted using Statistical Analysis Software [5] compared treatment effects and mean comparisons were carried out using Duncan's Multiple Range Test (DMRT).

Results and Discussion

There was highly significant difference ($P < 0.0001$) among the different treatments after 24 hours. Among botanicals Tobacco (*Nicotiana tabacum*) leaves water extract and Birbira (*Milletia ferruginea*) seed extract caused statistically comparable mortality rate to the *Standard check* Chlorpyrifos. The two botanicals *Milletia ferruginea* and *Nicotiana tabacum* after 24 hours showed 100% mortality on both soldier and worker *Macrotermes* termites. The toxic effect of both Endod (*Phytolacca dadecandra*) leaves water extract and Pyrethrum E-185 (*Chrysanthemum* sp.) flower water extract also showed that relatively high toxic effect as an average ($>91\%$) on both soldier and worker termites compared to Neem (*Azadirachta indica*) leave water extract, Kosso (*Hagenia abyssinica*) seed water extract and Bisana seed (*Croton macrostachs*) seed water extracts which showed low toxic effect less than (45%). However, all treatments after 24 hours showed toxic effect as compared to the control (Table 1).

The mortality rate termites treated with Bisana (*Croton macrostachs*) seed, Neem (*Azadirachta indica*) seed and Kosso (*Hagenia abyssinica*) seed showed that less than 48% after 48 hours and no significant differences were observed from with the control. Pyrethrum E-185 (*Chrysanthemum* sp.) flower and Endod (*Phytolacca dadecandra*) leaves extracts were showed highly significant different from the control where as the Endod leave extracts showed 100% mortality on worker and soldier termites (Table 1).

After 72 hours the toxicity of pyrethrum flower water extract showed 97.5% mortality on soldier and 100% on worker termites. Neem (*Azadirachta indica*) seed water extract indicated 90% mortality on soldier and 95% on worker termites (Table 1) while non against

worker termites. The effect of Kosso (*Milletia ferruginea*) seed extracts on soldier termite were gave equal mortality percentage to the control check. The toxicity effect of pyrethrum flower water extract showed 97.5% mortality on soldier and 100% on worker termites (Table 1).

According to the present finding, the toxicity differ from a similar work done by Sabiiti [6] on *Chilo partellus*, in which *Milletia ferruginea* seed (at 15%) applied topically did not inflict 100% mortality of the insect even after several days. Mulatu and Gebremedhin [7] reported from the laboratory study that the oil of *Milletia ferruginea* and *Azadirachta indica* were able to prevent the infestation of faba bean by partially or completely preventing egg-laying, and no bruchids emerged from the few egg laid. Moreover, similar to the present finding, tobacco leave powder extract and Birbira (*Milletia ferruginea*) seed powder water extract caused more mortality percentage than Endod (*Phytolacca dadecandra*) leave powder water extract and Neem (*Azadirachta indica*) seed powder extract.

The mortality caused by *Nicotiana tabacum* leaf water, *Milletia ferruginea* seed powder water extract and *Standard check* were generally higher (77.5 and 67.5) on soldier and worker than bisana (seed powder water extract This is an agreement with the work of Daniel and Bekele [8] conducted on *macrotermes* termites. The authors reported that the toxicity effect of *Croton macrostachs* leaf at 10 and 25% on the alate termite was not significantly difference from the control.

The mortality caused by pyrethrum flower powder water extract after 48 hours relatively high (93.75%) for both worker and soldier termites. As mentioned by Tiertto [9] the effectiveness of pyrethrum flower 0.5% powder (w/w) was effective against storage pest *Prostephanus truncates*. Anonymous [10] also reported that application of tobacco leaf around plants to kill or repel aphids, flea beetles and thrips is important. Research conducted in India indicated that beans and wheat treated with a spray prepared from tobacco containing 0.01% active compounds were almost completely protected against Rust disease [11].

Phytolacca dadecandra leaf powder water extract and pyrethrum flower powder water extract indicated high mortality percentage after 24 hours on both *workers* and soldier termites with an average of 92.5 and 91.25% respectively. The toxic effect of *Phytolacca dadecandra* leaf powder water extract after 48 hours showed similar mortality percentage to *Standard check* before treatment (Table 1). Seeds of

Treatments	Mortality rate after 24 hours		Mortality rate after 48 hours		Mortality rate after 72 hours	
	Soldier	Workers	Soldier	Workers	Soldier	Workers
Bisana seed (<i>Croton macrostachs</i>)	32.5b	32.5b	32.5b	40.00c	47.5b	55.0b
Neem (<i>Azadirachta indica</i>)	45.0b	45.0b	70.00a	57.50ab	90.0a	95.0a
Kosso (<i>Hagenia abyssinica</i>)	32.5b	47.5b	37.50b	60.00a	67.50	85.0a
Pyrethrum (<i>Chrysanthemum</i> sp.)	82.5a	100.0a	87.50a	**	97.5a	**
Endod (<i>Phytolacca dadecandra</i>)	85.0a	100.0a	97.50a	**	100.0a	**
Birbira seed (<i>Milletia ferruginea</i>)	100.0a	100.0a	**	**	**	**
Tobacco (<i>Nicotiana tabacum</i>)	100.0a	100.0a	**	**	**	**
Chlorpyrifos (<i>Standard check</i>)	100.0a	100.0a	**	**	**	**
Control (Distilled water)	0.0c	10.0c	15.00c	15.0d	20.0c	25.0c
MSE	1.51	1.05	1.43	1.49	1.12	1.47
CV (%)	23.92	14.92	5.23	31.02	13.74	18.40

Note: Mean with the same letter is not significantly different at 5% DMRT.

**Show that mortality percentage was 100% completed before data recorded.

Table 1: Percentage mortality of both soldiers and *workers* termites due to water extracts of different botanicals under laboratory conditions at Ambo, PPRC, 2007.

endod water extract showed good potential for snail control (100%) within 48 hours [12].

Among all treatments *Croton macrostachys* seed water extract indicated the least mortality percentage followed by *Hagenia abyssinica* seed water extract on both worker and soldier termites. Jambere et al. [13] reported that the effect of different materials on insects may depend on several factors such as chemical composition and species susceptibility.

Conclusion and Recommendation

The result of laboratory experiment showed that botanicals could control termites. Based on results, *Nicotiana tabacum* leave water extract and *Milletia ferruginea* seed extract showed higher mortality percentage (100%) and highly significant differences after 24 hours on both soldier and worker termites. Endod (*Phytolacca dodecandra*) leave extracts also showed 100% mortality effect on both soldier and worker termites observed after 48 hours and these were highly significant differences from Neem (*Azadirachta indica*) leave water extract, Kosso (*Hagenia abyssinica*) seed water extract, Pyrethrum (*Chrysanthemum* sp.) and Bisana (*Croton macrostachys*) seed water extracts.

The effects of both Neem (*Azadirachta indica*) leave water extract and Pyrethrum (*Chrysanthemum* sp.) showed 92.25 and 98.75% mortality rate as an average on both soldier and worker termites. But Bisana seed (*Croton macrostachys*) showed the lowest mortality rate on soldier termites as compared to other treatments. In general, all Botanicals were high mortality effect on worker termites when compared with soldier termites. The effective of tobacco, birbira, endod, neem and pyrethrum need further investigation against termites, *Macrotermes* on field condition.

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