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EFFECT OF SOME BOTANICALS AGAINST TERMITES, MACROTERMS SPP. (ISOPTERA: TERMITIDAE) UNDER LABORATORY CONDITIONS

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ABSTRACT

Seven different plant extracts as botanical insecticides were evaluated for their toxicity against termites in Ethiopia. Aqueous extracts of tobacco leaves (Nicotianatabacum), Birbira seeds (Militia ferruginea) and Endod leaves (Phytolaccadodecandra) were achieved 100% mortality after 24 hours which as did positive control (chloropyrifos 48% E.C). Also Pyrethrum E-185 flowers (Chrysanthemum sp.) caused an average of 91.25% mortality in both workers and soldiers termites with no significant difference between them. Neem seeds (Azadirachtaindica), Kosso seeds (Hageniaabyssinica) and Bisana seeds (Croton macrostachys) were less active than the other botanicals but significantly better than the negative control. Bisana seeds (Croton macrostachys) was less toxic effect among all treatments even after 5 days. All treatments were more effective against workers termites than against soldiers termites.

Keywords: Botanicals, Chloropyrifos, Worker, Solider, Termites, Macrotermes spp.

Contribution/ Originality

The paper's primary contribution is finding that to identify the promising research output under laboratory condition. Then develop a termite Management Strategic Plan (PMSP) to address the issues of greatest concern for farmers in Western Shawa of Ethiopia. The input gathered at this study provided an important perspective on the pest management products and techniques used in laboratory as well as on the field.

1. INTRODUCTION

Termites are destructive structural pests as well as agricultural pests found primarily in the tropical regions of the world, where they play an important ecological role in the recycling of wood and other cellulose-based materials (Abdurahaman, 1990). There are currently approximately 2,800 named termite species in 282 genera worldwide. They include the subterranean genus *Reticulitermes* and *Coptotermes.* Many regions of the world are currently experiencing expansions and/or invasions of subterranean termites. In some areas, including Ethiopia, termites constitute a significant pest problem in agriculture. In general, plants exotic to the specific area and water stressed plants are most prone to attack by termites.

Termites cause widespread damage to a great variety of crops in tropical Africa (Abdurahaman, 1990). The damage can occur from seedling stage to harvest time 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*, *Odnotermes*, *Pseudocanthotermes*, *Ancistrotermes* and *Microtermes*. They are serious pests of agricultural crops, forest trees, rangeland, furniture and building structures made of wood (Crowe *et al*., 1977). The gradual increase in human and livestock populations, depletion of natural resources, lack of agricultural technology and information support system and poor land management, among other factors, in the West Welega region of Ethiopia have resulted in a gradual increase in termite populations (Sands, 1976).

According to a survey made in Western, Southern and Eastern regions in Ethiopia, fifteen new termite species belonging to five genera were identified (Abdurahaman, 1990). Some of the species recorded in Welega areas are *Macrotermes*, damaging seedlings of maize, and damage us land by mound building, *Macrotermes* and subterranean *Odonotermes* and *Pseudocanthotermes*. It is not uncommon to notice up to five large termite mounds per hectare of land in the Welega area (EEMY-WS, 1997). 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. In Ethiopia, much of the pest management is done by local residents, removing nests and queens by hand although the key pest species (*Microtermes*) nest below ground out of the farmers' direct reach (FAO and UNEP, 2000).

Devendra *et al*. (1998) reported that yield loss due to termiteattack reache to 62% and 36% reduction in yields of hot pepper and maize, respectively. In addition it causes severe soil degradation by reducing vegetation and leaving the soil surface barren and exposed to the elements of erosion (Abraham, 1990). Yield losses in tef was ranged between 0 to 85% (Wood *et al*., 1980) reported that damage to tef was up to 20% yield losses in Sidama and GamoGoffa regions, howevere it was 100% in Welega region. In East Africa severe losses (50 to 100%) in various crops and tree species can occur (Nyeko and Olumbayo, 2005).Control measures depend heavily on application of chemical insecticides.

The over use of chemical insecticides can lead to various problems including environmental pollution, resistance in pests to chemical pesticides, pest resurgence, secondary pest outbreaks and direct hazard to users. One solution to these problems is the development and adoption of ecologically-rational pest management strategies, commonly referred to as integrated pest management (IPM). Botanical extracts based on locally available plants, have frequently been claimed to be effective in termite management. The use of botanicals can be a fundamental component of integrated pest management, but their value in controlling termites has not been well investigated under Ethiopian conditions. Therefore, the study of efficacy of some botanicals that have potential for the control of termites is very important.

2. MATERIALS AND METHODS

The study was carried out at Ambo Plant Protection Research Center, under laboratory conditions (22 ± 3 ºC). Seven different botanicals viz, *Phytolaccadodecandra* (Endod leaves extract), *Hageniaabyssinica*(Kosso seeds extract), *Croton macrostachys* (Bisana seeds extract), *Chrysanthemum* sp. (Pyrethrum E-185 flowers extract), *Milletiaferruginea* (Birbira seeds extract), *Azadirachtaindica*

(Neem seeds extract) and *Nicotianatabacum* (Tobacco leaves extract), were collected from different localities of Ethiopia during experimental period , identified by Professor EnsarmuKelbessa, Department of biology, Addis Ababa University and evaluated for control of termites problems. All treatments were dried under shade then grounded to a fine powder using a small hand-operated manual grinder as described by Jembere *et al.* (2002). About 25 gm fine powder of each treatment was mixed with 100ml of distilled water and filtered through cheese cloth, then stored until used.

The treatments were arranged as a completely randomized design (CRD) with four replicates. Each replicate contained 10 adult workers and 10 adult soldiers of M*acrotermes*sp. About 5 kg of soil was placed in wooden boxes (55 X 40 X 15cm) and plastic jars were inserted in the soil. A piece of cardboard and filter paper were added to each jar to serve as food for the termites. The jars were maintained at room temperature 22 ± 3°C and 80 ± 5% relative humidity. Chloropyrifos 48% E.C was diluted in water to make 0.21% based on the recommended field application rate and distilled water alone served as a positive and negative controls, respectively. Botanicals (0.1 ml) each mixed with 2 ml of distilled water were used per jar. Mortality rate in each treatment and controls was recorded after 24, 48 and 72 hours. Analysis of variance (ANOVA) was conducted using Statistical Analysis Software (SAS, 1999) comparing treatment effects and means comparisons were made using Duncan's Multiple Range Test (DMRT).

3. RESULTS AND DISCUSSION

The data in Table 1 revealed there was highly significant differences (P<0. 01) among the treatments after 24 hours. Among the botanicals, Tobacco leaves extract and Birbira seeds extract attained greater mortality comparable to the positive control, Chlorpyrifos, which producing complete mortality (100%) of both soldiers and workers termites. Also, both Endod leaves and Pyrethrum E-185 flowers extracts were toxic (>91%) to both soldiers and workers termites and significantly more toxic than Neem leaves, Kosso seeds and Bisanaseed extracts. Accordingly, all treatments after 24 hours were more toxic as compared to than the negative control (Table 1).

After 72 hours all the extracts that of Bisana seed produced high (>85%) levels of mortality to termites. The effect of Kossoseeds extracts on soldiers termites was less than on workers termites.

Our results in agreement with Daniel and Bekele (2006) who found that seed powder of *M. ferruginea* and *A. indica* water extracts were effective against termite. On the other hand, Sabiiti (2002) stated that *Milletiaferruginea* seed (at 15%) when used against *Chilopartellus* , not reach 100% mortality. Mulatu and Gebremedhin (2000) reported from a laboratory study that the seed oils of *M. ferruginea*and *A. indica* were able to prevent the infestation of faba bean by partially or completely preventing egg-laying by bruchid beetle and no bruchid emerged from the few eggs laid. Moreover, consistent with our results, tobacco leaf extract and Birbira (*M. ferruginea*)seed extract caused greater mortality than Endod (*P. dadecandra*) leaf extract and Neem (*A. indica*) seed extract.

The efficacy of neem observed in the present study agrees with that of Gold *et al.* (1991) and Epilla and Ruyooka (1988) who reported that, neemposses insecticidal, repellent, or antifeedantproperties. Several species of plants have been reported as being toxic or repellent to termites, however, only neem and *Ipomeafistulosa*products have been field-tested (Gold *et al.*, 1991). Gupta and Petel (1992a) reported that using of tobacco wastes as soil amendment were effective in management termites.

Table-1. Percentage mortality of soldiers and workers of termites as influenced with aqueous extracts of different botanicals under laboratory conditions.

Treatments	Mortality rate after 24 hours		Mortality rate after 48 hours		Mortality rate after 72 hours	
	Soldiers	Workers	Soldiers	Workers	Soldiers	Workers
Bisana seeds *(Croton macrostachs*)	32.5b	32.5b	32.5b	40.00c	47.5b	55.0b
Neem leaves(*Azadirachtaindica*)	45.0b	45.0b	70.00a	57.50ab	90.0a	95.0a
Kosso seeds (*Hageniaabyssinica*)	32.5b	47.5b	37.50b	60.00a	67.50	85.0a
Pyrethrum flowers (*Chrysanthemum* sp.)	82.5a	100.0a	87.50a	**	97.5a	**
Endod leaves (*Phytolaccadadecandra*)	85.0a	100.0a	97.50a	**	100.0a	**
Birbira seeds (*Milletiaferruginea*)	100.0a	100.0a	**	**	**	**
Tobacco (*Nicotianatabacum*)	100.0a	100.0a	**	**	**	**
Chlorpyrifos (Standard check)	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: Means with the same letter is not significantly different at 5% DMRT.

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

The result of our experiment showed that the used different botanical extracts acted as insecticides and can be toxic to *Macrotermes*termites. In general, all botanicals showed more toxicity on workers than to soldiers of termites.

The mortality caused by tobacco leaves, birbira seed extract and the positive control was generally greater on soliders and workers of termites than bisana seed extract. This is an agreement with Daniel and Bekele (2006) on *Macrotermes* termites. They also reported that the toxicity of *Croton macrostachs* leaves at 10 and 25% on alate termites was not significantly different from the positive control. Also, the mortality rate at using pyrethrum flowers extract after 48 hours high (93.75%) for both workers and soldiers of termites. Tierto (1994) reported that the pyrethrum flowers extract 0.5% (w/w) was effective against the stored grain pest *Prostephanus truncates.*

Application of tobacco leaves extract as soil drench around plants to kill or repel aphids, flea beetles and thrips is useful (Anonymous, 1970). Research conducted in India indicated that Treating beans and wheat leaves with tobacco extracted containing 0.01% active compounds as foliar spray was almost completely protected against Rust disease (Elwell and Maas, 1995). Moreover, endod seeds extract showed good potential for snail control (100%) within 48 hours (Morallo-Rejesus and Punzalan, 1997).

Among all treatments *Croton macrostachs* seed extract produced the least mortality followed by kosso seed extract against both workers and soldiers of termites. Jembere *et al.* (2002) reported that, the effect of different plants on insects may depend on several factors including chemical composition and species susceptibility.

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