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Some Studies on the Field Performance of Plant Extracts against Termites (*Odontotermes guptai* and *Microtermes obesi*) in Sugarcane at Faisalabad

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ABSTRACT

The crude extracts of Aksen *(Withania somnifera*), Absinthe (*Artimisia absinthium*), Chulai (*Amaranthus virides*) and Babchi (*Psoralae corylifera*) were tested against termites (*Odontotermes guptai* and *Microtermes obesi*) in sugarcane (*Saccharum officinarum*), cv. HSF-240, which was sown in 880 m^2 area. Chlorpyrifos was used as reference to compare the effectiveness of plant extracts. Application of all the treatments was done on setts. Aksen (*W. somnifera*) had comparable results with chlorpyrifos towards bud, seedling damage and population of foraging termites in the field. Absinthe, Chulai and Babchi suppressed the population of foraging termites in the field but was not successful in checking the percentage of bud damage (14.06^b, 12.50^b, 10.94^b) when compared with Aksen and chlorpyrifos (4.68^c and 1.56^c) respectively.

Key Words: *Odontotermes guptai* and *Microtermes obesi*, sugarcane, *Withania somnifera*, *Artimisia absinthium*, *Amaranthus virides*, *Psoralae corylifera*

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is a very important sugar crop of the world, which is under attack of many insect/pests. Borers and termites are the most important insect pests of sugarcane worldwide. Subterranean termites are the major problem which affect the sugarcane crop from its germination through shoot emergence and finally on the quality of canes. At germination stage, the termite losses up to 90-100% have been recorded in sugarcane (Salihah *et al*., 1988; Sattar & Salihah, 2001). *Microtermes mycophagous*, *Microtermes obsi*, *Microtermes unicolor*, *Eremotermes paradoxalis*, *Odontotermes obesi* are the species mostly recorded from agro-ecosystems of the Pakistan (Ahmed *et al*., 2004).

For the control of termites, many methods have been adopted, among which chemicals were dominated means of the control for long time, however, chemicals are expensive and have many harmful effects. The insecticides in liquid or dry formulation *viz*., chlorpyrifos, imidacloprid and fipronil are being applied as sett treatment in furrows at the time of sowing of sugarcane (Ahmed *et al*., 2006b). The success of such treatment with insecticides is highly variable. In order to find alternates to these insecticides, the termites should be repelled up to the time of successful shoot emergence by some natural products particularly of the plant origin. .

Many plants have been found to contain chemicals but their potential has not been explored for field use (Logan *et al.*, 1990; Pathak *et al*., 2000; Robert, 2001; Zhu *et al.*, 2001). The reduction in infestation of termites in the sugarcane with neem and *Calotropis* extracts has been reported (Deka & Singh, 2001; Singh *et al.*, 2002). Plant parts and plant extracts can be used effectively because these are less expensive and biodegradable and hence environmentally suitable. Many farmers in Asia and Africa had been using plant extracts such as neem, wild tobacco, dried chillies, *Calotropis procera* and wood ash etc. for controlling and repelling termites (Anonymous, 2000).

Present research was conducted with objective to optimize the use of plant extracts such as Aksen, *Withania somnifera*), Absinthe (*Artemisia absinthium*), Chulai (*Amaranthus virides*), and Babchi (*Psoralae corylifera*) which were compared with chlorpyrifos, a standard insecticide used for the control of the termites in Pakistan.

MATERIALS AND METHODS

A variety of sugarcane, HSF-240, was sown in 880 m^2 area in the Entomological Research Area at Campus of University of Agriculture, Faisalabad, using Randomized Complete Block Design with four replications and six treatments. The area was divided into 24 equal plots. The dimension of each plot was 4.84 m x 7.75 m. Each plot consisted of 4 equal rows. Number of setts was 65 in each row. The detail of treatments is as follows:

T_1 (Aksen, *Withania somnifera*)
T_2 (Absinthe, *Artemisia absinthium*)
T_3 (Chulai, *Amaranthus virides*)
T_4 (Babchi, *Psoralae corylifera*)
T_5 (Insecticide, chlorpyrifos)
T_6 (Control)

Preparation of Crude extract. The crude extracts of Aksen *(W. somnifera*) and Chulai (*A. virides*) were prepared by chopping 1kg leaves and soaked in 5 L water for one week.

One kg seeds of Babchi (*P. corylifera*) and leaves and branches of Absinthe (*A. absinthium*) were soaked in 5 L of water for obtaining the crude extract.

Chlorpyrifos was used as reference to compare the effectiveness of plant extracts. The control treatment received only water. The aqueous crude extracts of leaves of Aksen, Chulai and Absinthe and seeds of Babchi were poured on the setts with the help of garden sprinkler. Chlorpyrifos was applied in furrows on setts with help of knap sack sprayer at the rate of 1 L acre^{-1}. The setts were covered with soil and plots were separated by boundaries so that irrigation water may not cross the boundaries.

Data. The numbers of total buds in each plot were determined by supposing end-to-end placing of 22.5 cm setts with two eyes in each sett in a furrow. The numbers of seedling from each plot were counted and their percentage was thus calculated.

The big gaps in the furrows between two seedlings at random were supposedly containing damaged setts. From each plot, 5 such gaps per places were dug and buds were observed. The holed buds were termite eaten. The percentage of bud damage was calculated by using Formula = damaged buds/total buds observed x 100.

Data on termites' count were taken from five random digging in each plot by taking a soil core of 20×20×40 cm dimension. These counts were continued and a second application of the above materials was done when there were > 100 termites in any plot. Comparison of mean were carried out by Mann Whitney and Fried Mann' Test of significance at 0.05%.

RESULTS

Seedling Germination. Mean percent seedling germination after 15, 30, 45, 60 and 75 days after sowing is given in Table I. Absinthe, Chulai and Babchi had non-significant difference among them, respectively, with 3.84, 3.64, and 3.64% germination. Highest (6.92%) was recorded in chlorpyrifos treated plots and lowest (2.48%) in control at 15 days after sowing. After 30 days of sowing, percent germination was significantly highest (14.41%) in chlorpyrifos followed by Aksen with 9.42% germination. Chlorpyrifos was statistically different from all other treatments, but Aksen had non-significant difference with Absinthe, Babchi, Chulai and control with 7.50, 6.53, 6.92 and 4.99%.

After 45 days, control had minimum percentage germination (13.45%) and was significantly different from all other treatments. Chulai, Absinthe and Babchi with 17.31, 16.92 and 16.92% germination had non-signoficant difference among themselves but statistically different from chlorpyrifos (37.31%) and Aksen (29.61%), latter two had significant difference between each other also. At 60 days after sowing, control (16.53%) chlorpyrifos (55.58%) and Aksen (49.81%) were significantly different from all other treatments. Absinthe, Chulai and Babchi, respectively, with

Table I. Mean percent seedling germination of sugarcane in plots treated with plant extracts and insecticide

Treatments	Days after sowing				
	15	30	45	60	75
T_1 Aksen	5.55 b	9.42 b	29.61 b	49.81b	59.42a
T_2 Absinthe	3.84 c	7.50 bc	16.92c	35.00c	40.19b
T_3 Chulai	3.64 c	6.53bc	17.31c	30.96c	43.07b
T_4 Babchi	3.64 c	6.92bc	16.92c	30.76c	41.72b
T_5 Chlorpyrifos	6.92 a	14.14a	37.31a	55.58a	64.80a
T_6 Control	2.48 c	4.99c	13.45d	16.53e	26.34c

Table II. Mean bud and seedling damage on setts in plots treated with plant extracts and insecticide

Treatments	Bud damage					Seedling damage	
	15	30	45	60	75	90	125
T_1 Aksen	1.56b	3.12cd	5.75c	4.68cd	4.68c	0.00b	1.56b
T_2 Afsuntene	3.12ab	6.25bc	12.50ab	12.50b	14.06b	3.12ab	3.12ab
T_3 Chulai	3.12ab	7.81b	7.81abc	7.81bc	12.50b	4.68a	3.12ab
T_4 Babchi	4.68ab	6.25bc	9.37abc	12.50bc	10.94b	4.68a	4.68ab
T_5 Chlorpyrifos	0.00b	1.56d	4.68bc	1.56d	1.56c	0.00b	0.00b
T_6 Control	7.81a	14.06a	15.63a	18.75a	20.13a	6.25	6.25a

35.00, 30.96 and 30.76% germination were statistically at par among themselves. At 75 days after sowing, chlorpyrifos and Aksen with mean value of 64.80 and 59.42%, respectively, had non-significant difference between each other. Absinthe, Chulai and Babchi, were statistically the same but different from chlorpyrifos, Aksen and control.

Bud and seedling damage. Table II shows the bud and seedling damage in various treatments. Minimum bud damage from 15 to 75 days after sowing was in chlorpyrifos ranged from 0 to 4.68%, and was at par with Aksen having 5.75% damage at 45 days after sowing, and in other time points it had bud damage in the range of T_5 (insecticide). Similar pattern was seen in the seedling damage.

Population of the termites in the plots treated with different plant extracts. Table III shows median termites' count at different time points after sowing. At 15 days after sowing, Babchi (40.88) and control (43.04) were close to each other whereas chlorpyrifos (-0.21) and Aksen (0.21) had similar termites' count. Absinthe and Chulai had lower median counts than babchi. p-value in overall analysis was 0.14, indicating a non-significant difference among the treatments.

All the treatments had significant difference among them ($P < 0.05$) from 30 to 90 days after sowing. Median termites' count in control was the highest ranging from 26.94 to 194.46. The range of median termites' count in Absinthe, Chulai and Babchi was 8.44 to 158.63. Aksen treated plots contained termites in the range of 2.94 to 51.40 whereas chlorpyrifos treated plots had 0.19 to 11.37 termites.

From 128 to 172 days after sowing treatments had non-significant difference among them. However, lowest median count was recorded in chlorpyrifos followed by Aksen. Absinthe, Chulai and Babchi had close median

Table III. Population of termites in different treatments at various intervals after sowing in the sugarcane

	2005							2006		
Dates→	**8-10**	**23-10**	**7-11**	**22-11**	**7-12**	**23-12**	**7-2**	**23-2**	**10-3**	**26-3**
Days after sowing→	**15**	**30**	**45**	**60**	**75**	**90**	**128**	**143**	**158**	**173**
Treatments										
T_1 Aksen	0.21	34.75	51.40	46.71	43.13	2.94	3.21	15.87	16.96	34.92
T_2 Afusantene	16.96	39.50	145.23	129.46	124.79	8.44	37.62	58.04	75.13	83.58
T_3 Babchi	40.88	54.50	124.23	157.54	158.63	14.10	36.12	53.54	88.87	98.58
T_4 Chulai	29.87	56.83	87.56	99.21	89.62	35.52	15.88	37.96	76.21	89.25
T_5 chlorpyrifos	-0.21	0.83	11.31	11.37	1.21	0.19	0.79	7.62	2.54	14.25
T_6 Control	43.04	116.58	189.65	194.46	185.88	26.94	61.13	111.71	120.04	126.42
p value	0.14	0.06	0.00	0.01	0.03	0.00	0.47	0.08	0.08	0.08

among them during this period.

DISCUSSION

Aqueous extract from *Artemisia cina* (family Compositae), was lethal to larvae of *Culex pipiens* L. The EC_{50} for the mosquito at 24 h after treating with extract was 4.0 g L^{-1} for *Artemisia cina* (Aly & Badran, 2003). Essential oils of *Artemisia absinthium* L. extracted by three methods, a microwave assisted process (MAP), distillation in water (DW) and direct steam distillation (DSD) were lethal to the spider mite but to variable degrees (Chiasson *et al.*, 2001). Essentials oil form *A. absinthium* was not toxic to *Trialeurodes vaporariorum* (Choi *et al.*, 2003). The efficacy of *A. absinthium* against termites confirms the results of Choi *et al.* (2003) but contradict Aly and Badran (2003). These studies used seed either as aqueous or oil extracts whereas leaves of the plant were used in the present studies. The rapid degradation of leaf extract of *A. absinthium* in soil could be one reason for being not able to prevent damage by the termites. Absinthe, Chulai and Babchi were equal in rendering germination percentage, bud and seedling damage. Ahmed *et al.* (2006a) have reported termiticidal activity of Babchi from the laboratory experiment. Though Babchi suppressed the population of foraging termites in the field but was not successful in checking the bud damage when compared with Aksen and chlorpyrifos. Aksen (*W. somnifera*) had comparable results with chlorpyrifos towards bud, seedling damages and population of foraging termites in the field. We have previopusdly reported successfuyl use of crude extracts of *Calotropis procera* and *Datura alba nees* against the termites in the sugarcane (Ahmed *et al.*, 2005b).

Extracts of neem leaves and whole plant of *Haloxylon recurvum* were not able to protect the setts from termites (Ahmed *et al.*, 2005a). Further studies on the use of extracts of plants mentioned herein at other sugarcane growing area will enforce the use of these plants as an alternate to insecticides.

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