

COMPARATIVE EFFICACY OF *DATURA ALBA NEES*, *CALOTROPIS PROCERA* AND IMIDACLOPRID ON TERMITES IN SUGARCANE AT FAISALABAD

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ABSTRACT

In order to determine the role of crude extracts of *Datura alba nees* and *Calotropis procera* for the protection of sugarcane setts from termites at the time of sowing, and, then sugarcane seedling and cane later in growth stage of sugarcane, when whole plants of *D. alba nees* and *C. procera* into pieces were added to the soil, the experiments were conducted separately in Randomized Complete Block Design with three replications. The application of plant extracts and imidacloprid on setts showed that control having highest termite counts (109.1) was statistically different from imidacloprid, *C. procera*, and *D. alba nees*, latter two had non-significant difference between one another with mean 76.0 and 66.9 termites' count. Imidacloprid with 3.56 termites' count was also statistically different from the three treatments. Regarding bud damage, highest (86.7%) was recorded in control, which was statistically different from three other treatments. *C. procera* and *D. alba nees* having 70 and 66.7% bud damage had non-significant difference between each other. Imidacloprid had only 10% bud damage and was statistically different from other treatments. Mean seedling germination was 46.98, 51.04, 57.29 and 30.73% in *D. alba nees*, *C. procera*, imidacloprid and control, respectively. There was a significant difference between control and all other treatments but all other three treatments had non-significant difference among them.

Effect of whole into prices plants, compared with imidacloprid and control, control showed that (99.07 termites' count) was statistically different from other three treatments. *C. procera*, and *D. alba nees* with 56.54 and 50.39 termites' count had non-significant difference between each other. Imidacloprid had least termites' count (3.26) and was statistically different from other treatments.

INTRODUCTION

Sugarcane is the very important sugar-producing 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 percent have been recorded in sugarcane (Salihah *et al.* 1988; Sattar and Salihah, 2001). *Microtermes mycophagous*, *Microtermes obesi*, *Microtermes unicolor*, *Eremotermes paradoxalis* and *Odontotermes obesus* 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 along time. However, chemicals are expensive and have many harmful effects. The insecticides in liquid or dry formulation viz., chloropyrifos, imidacloprid and fipronil are being applied as sett treatment in furrows at the time of the sowing of the sugarcane. The success of such treatment with insecticides is highly variable. In order to find alternates

to persistent insecticides, it is thought that termites should be repelled up to the time of successful shoot emergence.

Many plants have been found to contain anti-termite chemicals but their potential has not been explored for field use (Logan *et al.*, 1990). The reduction in infestation of termites in sugarcane with neem and *Calotropis* extracts has been reported (Deka and Singh, 2001; Singh *et al.*, 2002). Plant parts and plant extracts can be used effectively because these are less expensive and biodegradable, 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 the objective to optimize the use of plants of *Datura alba nees* and *Calotropis procera*.

MATERIALS AND METHODS

The experiments were conducted at Entomological Research Area (University of Agriculture, Faisalabad). Comparative efficacy of some botanicals and insecticide was evaluated in two separate application methods. The experiments were laid down in Randomized Complete

Block Design (RCBD). Row to row distance was 90 cm. Sugarcane variety HSF 240 was sown for the experiment. Two Botanicals (Plant Extracts) and one insecticide was used in this experiment. The detail of the treatments as first application is as follows:

T ₁	Ak (<i>Calotropis procera</i>) extract
T ₂	Datura (<i>Datura alba nees</i>) extract
T ₃	Imidacloprid (200 SL) 0.4%
T ₄	Control

These treatments were replicated three times. Total experimental area was 2688 m², which was divided into 12 equal plots. The size of each plot was 224 m² with dimension 16m x 14m.

As the first application, the crude extracts of Ak and Datura were sprayed on setts at the time of sowing in furrows; in the same way, imidacloprid was sprayed in furrows. The setts were wetted to the soaking condition. After the application, data on termites' count were taken at weekly basis. After 45 days of sowing, seedling germination and bud damage was also recorded.

Random digging in each plot also was carried out for termites' count. Observation of termites' count continued until the termite individuals reached more than 100 in any plot. Then after 5 weeks, second application was done. In the second application instead of extracts, the chopped AK (15 kg) and Datura (15 kg) were spread in furrows in their respective plots. The second application of imidacloprid was done in the same way. Care was taken to avoid the overflow of water from one plot to other. The comparison of treatments in two separate experimental sets was done by Fried Mann test at p<0.05

RESULTS

Results of application of *Datura alba nees*, *Calotropis procera* and imidacloprid as first application

Mean termites' count in plots treated with *D. alba nees* (T₁), *C. procera* (T₂), imidacloprid (T₃) and control (T₄) was 131.9, 123.3, 1.00 and 167.7, respectively after one week of application. The comparison of means showed the significant difference of imidacloprid from other three treatments (T₁, T₂, T₄), while latter three had non significant difference among themselves. Termites' count after 2nd week of application showed significant difference among treatments. Highest termites' count (180.4) was in control (T₄), which was statistically different from other treatments. *D. alba nees* (T₁) and *C. procera* (T₂) with 76.22 and 88 termites were statistically at par with one another. Imidacloprid with nil/no termites' count was also statistically different from other treatments. After third week of application, mean

termites' count in T₁ (*D. alba nees*), T₂ (*C. procera*), T₃ (Imidacloprid) and T₄ (control) was 112.6, 91.3, 1.0 and 187.8, respectively. Control was statistically different from three treatments. T₁ and T₂ had non-significant difference between one another. T₃ was significantly different from T₄, T₁ and T₂. After four and five weeks, the trend of dissimilarity among treatments was identical as observed in the previous weeks.

Cumulative effect of application of plants extracts and imidacloprid on termites showed that T₄ (control) having highest termite counts (109.1) was statistically different from other three treatments i.e. T₂, T₁ and T₃. Among latter three, T₂ (*C. procera*) and T₁ (*D. alba nees*) had non-significant difference between one another with mean 76.0 and 66.9 termites' count. T₃ (imidacloprid) with 3.56 termites' count was also statistically different from other three treatments (Table 1).

Bud damage

Regarding bud damage, highest (86.7%) was recorded in T₄ (control), which was statistically different from three other treatments. T₂ (*C. procera*) and T₁ (*D. alba nees*) having 70 and 66.7% bud damage had non-significant difference between each other. T₃ (imidacloprid) had only 10% bud damage and was statistically different from other treatments (Table 2).

Seedling Germination

Mean seedling germination was 46.98, 51.04, 57.29 and 30.73% in T₁, T₂, T₃ and T₄, respectively. There was a significant difference between control and all other treatments but all other treatments T₁, T₂ and T₃ had non-significant difference among them. Highest germination (57.29%) was recorded in T₃ (imidacloprid) (Table 2).

Results of application of whole *D. alba nees*, *C. procera* plants and imidacloprid as second application

The second application consisted of mixing the chopped whole plants of *D. alba nees* and *C. procera* into the soil with spade after spreading in the plot followed by irrigation.

Results of termites' count after one week of second application showed that control had maximum termites' count (169.5) and was statistically different from other treatments. T₁ (*D. alba nees*) and T₂ (*C. procera*) with mean termites' count of 106 and 100.7 respectively were statistically at par with one another. T₃ (imidacloprid) with least termites' count (2.15) was statistically different from all three treatments. Termites' count from 2nd week to 9th week after second application exhibited the similar trend in the treatments. T₁ (*D. alba nees*) and T₂ (*C.*

procera) were statistically at par with one another. T₃ (imidacloprid) with least termites' count was statistically different from all three treatments. Highest termites' count in control (T₄) had significant difference from other three treatments. Mean termite counts in T₁, T₂, T₃ and T₄ was 45, 56.33, 1.33 and 95.44, respectively, at 10th week after 2nd application. All treatments had significant difference among themselves. Least population was observed in T₃ (imidacloprid). Termites' count in T₁ (*D. alba nees*), T₂ (*C. procera*), T₃ (imidacloprid) and T₄ (control) was 53.22, 78, 3.78 and 103.8, respectively, at 11 week after second application. All treatments had significant difference among themselves. At 12th week after second application T₄ (control) with 99.67 termites was statistically different from other three treatments. T₂

(*C. procera*) and T₁ (*D. alba nees*), with 65.98 and 62.55 termite count, had non-significant difference between one another. T₃ (imidacloprid) had lowest (2.44) termites' count and was significantly different from other treatments.

Cumulative effect of plant parts and imidacloprid in second application is also given in Table 6. The trend of significance among treatments was identical to that observed previously, i.e., T₄ (control) having 99.07 termites' count was statistically different from other three treatments. T₂ and T₁ with 56.54 and 50.39 termites' count had non-significant difference between each other. T₃ (imidacloprid) had least termites' count (3.26) and was statistically different from other treatments (Table 3).

Table 1: Comparison of termite count at different time intervals following first application of *D. alba nees*, *C. procera* and imidacloprid.

Treatments	Mean Termites Number					
Weeks	1	2	3	4	5	OVERALL
<i>D. alba nees</i>	131.9±37.6a	76.22±19.1b	112.6±16.7b	105.20±4.6b	104.2±11.3 b	66.89±1.2b
<i>C. procera</i>	123.3±17.5a	88.0 ±16.8b	91.33±13.3b	101.10±7.2b	99.56±15.1 b	76.0±8.9b
Imidacloprid	1.000±1.0b	0.00±0.0 c	1.000±1.0c	3.00±1.5c	5.780 ±0.8 c	3.55±0.8c
Control	167.7±14.5a	180.4±21.1a	187.8±27.4a	148.90±10.2a	160.20±13.5a	109.1±4.6a

Values are Mean ± SE. Means were compared with Fried Mann test at p<0.05

Table 2: Comparison of bud damage and seedling germination in different treatments.

Treatments	Bud damage	Seedling germination
<i>D. alba nees</i>	66.67±3.33	46.98±3.25a
<i>C. procera</i>	70±11.55	51.04±1.63a
Imidacloprid	10±5.77	57.29±4.97a
Control	86.67±3.33	30.73±2.38b

Table 3: Termites' count at different time intervals following the application of *D.alba nees* *C. procera* and imidacloprid

Treatments	Mean Termites Number						
Weeks	1	2	3	4	5	6	
<i>D. alba nees</i>	169.5±4.4a	33.3±6.7b	49.4±10.3b	49.4±3.5b	45.6±0.6 b	53.9±8.4b	
<i>C. procea</i>	100.7±5.2b	33.3±1.9b	58.3±9.8b	76.2±12.6b	54.7±5.2 b	54.2±6.1b	
Imidacloprid	2.153±0.7c	2.8±0.3 c	3.2±1.6 c	10.0±5.9 c	2.0±2.0c	4.9±1.1 c	
Control	106.0±1.9b	95.6±5.9a	120.9±2.6a	114.4±10.9a	106.7±8.4a	96.3±3.0a	
Weeks	7	8	9	10	11	12	OVERALL
<i>D. alba nees</i>	45.0±1.0b	38.4±7.2b	45.2±3.8b	45.0±1.7c	53.2±7.6c	62.5±0.8b	50.4±3.4b
<i>C. procea</i>	40.6±7.8b	31.4±1.8b	53.2±3.5b	56.3±3.0b	78.0±3.0b	65.8±7.2b	56.5±2.8b
Imidacloprid	2.8±1.5 c	1.2±1.2 c	1.1±1.1 c	1.3±1.3 d	3.8±0.6 d	2.4±1.3c	3.3±0.9 c
Control	92.2±12.6a	86.7±1.8a	87.3±7.8a	95.4±7.1a	103.8±1.6a	99.7±9.3a	99.0±0.5a

Values are Mean ± SE. Means were compared with Fried Mann test at p<0.05

DISCUSSION

Crude extracts of the plants as first application on setts in the furrows were effective in controlling the termites when compared to the insecticide (imidacloprid). This is also evident from non-significant difference of seedling germination between plant chemicals and insecticide treatment. The increment in seedling germination in the insecticide treated plot ranged 10 to 19 % in comparison to plant chemicals. The use of chemicals as second application resulted in considerable reduction in the number of foraging termites and there was no damage to the cane in the later stage of crop development (data not shown).

The efficacy of the plant chemicals such as Ak and other plants has already been established by the studies reported elsewhere (Pathak *et al.* 2000; Bohert *et al.* 2004; Zhee *et al.* 2001). Repellency of neem plant against termites is well documented (Deka and Singh, 2002).

Previously we have tried *H. recurvum* and *Azadirachta indica* in a similar fashion in the sugarcane for the control of termites and found that whole plant and leaf crude extract of *H. recurvum* and *A. indica*, respectively were not feasible for the control of termites in the sugarcane (Ahmed *et al.*, 2005)

C. procera and *D. alba nees* appears to be more effective than *H. recurvum* and *A. indica* in the sense that crude extract application on setts and then mixing whole plants of *C. procera* and *D. alba nees* into the soil did not allow the termites to forage in large number.

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