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Toxic Effects of Ak (*Calotrpis procera*) Plant Extracts Against Termites (*Heterotermes indicola* and *Coptotermes heimi*) Isoptera: Rhinotermitidae

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Abstract: A research project was carried out to study the toxic effects of Ak (*Calotropis procera*) crude extracts against two species of termites i.e. *Heterotermes indicola* and *Coptotermes heimi* at Nuclear Institute for Food and Agriculture (NIFA), Peshawar-Pakistan in April 2002. Results revealed that maximum mortality in case of *H. indicola* was 21.3, 14.7, 10.7 and 5.3% of *C. pocera* leaves extracts in concentration of 1:1, 1:2, 1:3 and control, respectively while in flowers extracts these values were 45.3, 34.7, 25.3 and 9.3%, respectively. For *Coptotermes heimi* leaves extracts caused maximum mortality of 24.0, 16.0, 13.3 and 9.30% while in flowers extracts these were 56.0, 37.3, 32.0 and 10.7% in concentration 1:1, 1:2, 1:3 and control, respectively. In each extracts mortality was significantly different from that of control. Toxic effects of both extracts (leaves and flowers) were more profound against the *Coptotermes heimi* than *Heterotermes indicola* during these ten days of feeding. Also the flowers extracts caused more mortality than the leaves for both spp. suggesting the availability of high contents of toxic materials in flowers.

Key words: Toxic effects, Ak, leaves, flowers, *Heterotermes indicola*, *Coptotermes heimi*

INTRODUCTION

Termites like *Odontotermes, Heterotermes* and *Coptotermes* spp. have been observed to infest apricot, pear, plum, peach, orange and lemon at Ternab and in NWFP Agricultural University Peshawar and plum in Tangi District Charsadda. The termites are abundantly distributed in university of Peshawar causing 100% infestation on pear, 73% on plum and 52.17% on peach trees. *Microtermes unicolor* and *Heterotermes indicola* were recorded from apricot and pear in Lala Kali causing 5.68-7.00% infestation[1].

The injudicious use of pesticides for the control of termites has generated a number of biological and environmental hazards in air, water, soil and food. These man-created problems have further resulted in phytotoxicity, mammalian toxicity, pesticides residues, insect resistance and increased cost of production.

More than 1000 species of plants have been reported to have chemicals in leaves, stem, flowers, seeds and roots which have Insecticidal property, only a few of them have been used for practical insect control on commercial scale in the past. The chemical poisons of plants are mostly alkaloids. Alkaloids are plant products, which are nitrogenous in nature. They are heterocyclic compounds having strong effect on the nervous system of animals. The alkaloidal extracts when applied to the insects bring about disturbance in the nervous system and cause death. They are, therefore, basically nerve poisons[2].

Various Scientists[3-9] have studied different plant extracts for their toxicity, attractancy and repellency in various natural products against different termites and insects spp.

Keeping in view the economic importance of the two termite genera *Heterotermes indicola* and *Coptotermes heimi* as common problematic pests of agricultural crops and importance of some weed plants as a cheap source of insecticides, laboratory trials were conducted to find out the toxic effects of Ak plant's extracts, which may serve as toxicant in termite's control.

MATERIALS AND METHODS

Collection of experimental termites: The experimental termites were collected from an infested termites' Orchards/ building by using a trapping technique[10]. NIFA- TERMAPS were installed in an infested 6 kanal bungalow at University town Peshawar. After fifteen days the infested bundles of NIFA-TERMAPS were brought to the Entomology laboratory where termites along with the soil and other debris were passed through different sieves and were separated from soil. After separating from soil and debris they were identified with the help of the taxonomic keys[11] and were maintained in the laboratory

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for experimental use. Termite workers along with a few soldiers were used in the experiments.

Collection of experimental plants and extracts preparation: The Ak (*Calotropis procera*) plants were collected from Malakandhir Research Farm, NWFP Agricultural University, Peshawar, Pakistan. These plants were brought to Entomology laboratory of Nuclear Institute for Food and Agriculture Tarnab, Peshawar. The flowers and leaves were removed from the plants and were chopped in pestle and mortar finely. Then the chopped flowers and leaves were mixed separately in distilled water in the ratio of 1:1, 1:2 and 1:3. (W/V) different aqueous solutions were prepared from both flowers and leaves, respectively. Then the extracts were filtered by a Whatman filter paper No. 42. and were stored in refrigerator for experimentation. To study the toxic effect of these extracts two termites spp. *Heterotermes indicola* and *Coptotermes heimi* were used for bioassays.

Bioassay: Force feeding tests were conducted in the petri dishes (5.5 cm dia.) for both termites spp. The extracts preparation procedure is discussed earlier. Petri dishes were sterilized in the oven at 200°C for 2 h. Circular blotting papers were cut and the bottom of each sterilized glass petri dish was provided with two of them and the lid of each petri dish with one. Each filter paper in the bottom was soaked with 0.2 mL of the respective extracts concentrations to the extent that the extracts were fully absorbed. Soaking was carried out with the help of a syringe, for each concentration a new syringe was used. Three petri dishes consisting of untreated filter papers were placed as control in each experiment. Then a population of 22 workers termites and 3 soldiers were added to each petri dish. The petri dishes were placed in desiccators having water at the bottom (92% RH) and were kept in the controlled room at temperature of 27±3°C. Daily observations on the mortality of both species i.e. *Heterotermes indicola* and *Coptotermes heimi* were made and the dead individuals in each Petri dish were sorted out through forceps. Each treatment was replicated thrice for each termite's sp. After ten days of feeding the experiments were closed and the data were subjected to Statistical Analysis using SAS (Statistical analysis System Version. 6.12) Package. For all the experiments, mortality data were analysed using F-test at 5% level of significance for ANOVA means were separated by DMR test.

RESULTS AND DISCUSSION

In leaves extracts against *Heterotermes indicola* (Table 1), for first four days percent mortality at 1:1, 1:2 and 1:3 was not significantly different from the percent mortality recorded in control (2.7). Percent mortality at 1:1,1:2 and 1:3 concentration remain non significant on day 5th, 6th and 7th (i.e. 12, 8 and 8). Mortality at 1:1 was significantly greater than that of 1:2 and 1:3. However a significantly lower mortality of 4% was recorded in the control. On day 8th and 9th percent mortality of 8.00, 9.3, 8.00 and 10.7 was recorded in concentrations 1:3 and 1:2, were similar to each other but were significantly different from the percent mortality 14.7 and 16.00 at 1:1 concentration. The mortality recorded at all these three concentrations was significantly different from mortality (4.0%) recorded in the control. Maximum mortality was recorded on day 10th in 1:1 followed by 1:2 and 1:3 i.e. 21.3, 14.7 and 10.7% which was significantly different from the percent mortality recorded in control (5.3).

In flowers extracts (Table 2), on first day percent mortality at 1:1, 1:2 and 1:3 was 13.3, 8.00 and 5.3, respectively, which was significantly different from the percent mortality in control (1.3) while percent mortality at 1:2 and 1:3 concentration was not significantly different to each other. On day 3rd and 4th percent mortality recorded in 1:2 and 1:3 was 12.00 and 8.00,16.00 and 9.3. Which were similar to each other, but were significantly different from percent mortality in control (1.3 and 4.00). While percent mortality recorded in these two days in 1:1 were significantly different from 1:2, 1:3 and control. On days 5th to 10th percent mortality recorded at 1:1,1:2 and 1:3 was significantly different from each other as well as from that in control. Maximum mortality 45.3% was achieved on the 9th day in 1:1 concentration.

For *Coptotermes heimi*, percent mortality in leaves extracts (Table 3) was not significant in all the treatments including control for the first 7 days, though it ranged from 0.0 at 1:2 concentration on day 1st, to 14.70 at 1:1 on day 7. On day 8th and 9th percent mortality in 1:2 and 1:3 was statistically similar to each other but significantly different to that of control while mortality recorded in 1:1 was also significantly different to these two treatments and control. Maximum mortality (24.0%) was recorded on day 10th in 1:1 followed by 1:2 causing 16.0% mortality and was significantly different from each other as well as from control.

In flowers extracts (Table 4), during the first three days of the experiment percent mortality was significantly greater at 1:1 concentration while there was no significant difference at 1:2, 1:3 and control. From day 4th onward morality was significantly greater at 1:1 concentration, non significant between 1:2 and 1:3. While significantly lower mortality was recorded in the control trials. Parihar[6] studied the efficacy of *Calotropis procera* latex leaves against termites and found that all the treatments controlled the infestation and gave effective control of termites. The present study also found that percent mortality due to leaves and flowers extracts were

Table 1: Effect of different concentrations of leaves extract of *Calotropis procera* on the percent mortality of *Heterotermes indicola*

After days	1:1*	1:2	1:3	Control
1	2.7a	0.0a	1.3a	2.7a
2	5.3a	2.7a	1.3a	2.7a
3	5.3a	5.3a	5.3a	2.7a
4	8.0a	6.7a	6.7a	2.7a
5	12.0a	8.0ab	8.0ab	4.0b
6	12.0a	8.0ab	8.0ab	4.0b
7	12.0a	8.0ab	8.0ab	4.0b
8	14.7a	9.3ab	8.0ab	4.0b
9	16.0a	10.7ab	8.0ab	4.0b
10	21.3a	14.7b	10.7b	5.3c

Means with in a row followed by the same letter(s) are not significantly different at 5% level of significance. *= Amount of distilled water

Table 2: Effect of different concentrations of flowers extracts of *Calotropis procera* on the percent mortality of *Heterotermes indicola*

After days	1:1*	1:2	1:3	Control
1	13.3a	8.0b	5.3b	1.3c
2	17.3a	10.7b	6.7b	1.3c
3	22.7a	12.0b	8.0b	1.3c
4	25.3a	16.0b	9.3b	4.0c
5	36.0a	22.7b	10.7c	5.3d
6	38.7a	24.0b	13.3c	5.3d
7	40.0a	28.0b	16.0c	5.3d
8	41.3a	28.0b	21.3c	8.0d
9	45.3a	29.3b	22.7c	8.0d
10	45.3a	34.7b	25.3c	9.3d

Means with in a row followed by the same letter are not significantly different at 5% level of significance. *= Amount of distilled water

Table 3: Effect of different concentrations of leaves extracts of *Calotropis procera* on the percent mortality of *Coptotermes heimi.*

After days	1:1*	1:2	1:3	Control
1	2.7a	0.0a	1.3a	2.7a
2	5.3a	4.0a	1.3a	2.7a
3	5.3a	6.7a	5.3a	2.7a
4	8.0a	8.0a	8.0a	2.7b
5	12.0a	9.3a	10.7a	5.3a
6	13.3a	10.7a	10.7a	6.7a
7	14.7a	12.0a	10.7a	8.0a
8	20.0a	14.7a	13.3ab	8.0b
9	22.7a	16.0ab	13.3ab	8.0c
10	24.0a	16.0b	13.3bc	9.3c

Means with in a row followed by the same letter(s) are not significantly different at 5% level of significance. *= Amount of distilled water

Table 4: Effect of different concentrations of flowers extracts of *Calotropis procera* on the percent mortality of *Coptotermes heimi*

After days	1:1*	1:2	1:3	Control
1	13.3a	1.3b	0.0b	1.3b
2	20.0a	8.0b	6.7b	2.7b
3	24.0a	13.3b	9.3bc	2.7c
4	29.3a	17.3b	14.7b	4.0c
5	37.3a	20.0b	17.3b	5.3c
6	42.7a	25.3b	22.7b	5.3c
7	45.3a	29.3b	25.3b	9.3c
8	49.3a	32.0b	25.3b	10.7c
9	53.3a	34.7b	29.3b	10.7c
10	56.0a	37.3b	32.0b	10.7c

Means with in a row followed by the same letter are not significantly different at 5% level of significance. *= Amount of distilled water

significantly different from control in ten days of feeding, suggesting the toxicity of this plant against termites. Moursy[12] find out the insecticidal activity, expressed by LD50 values, of acetone, ethanol, petroleum ether and water extracts of *Calotropis procera* leaves against the flesh fly, *Sarcophaga haemorrhoidalis* Fallen was evaluated in the laboratory. Based on LD50 values, ethanol extract was nearly 1.7, 1.3 and 1.3 times more toxic to larvae than water, petroleum ether and acetone extracts, respectively. It was 1.9, 1.4 and 1.2 times more toxic to pupae than water, acetone and petroleum ether extracts, respectively. It was 2.0, 1.5 and 1.4 times more toxic to male flies and 2.2, 1.6 and 1.4 times more toxic to female flies than water, petroleum ether and acetone, extracts, respectively. Thus, ethanol extract of *C. procera* was the most toxic, of all solvents used, to different stages of *S. haemorrhoidalis*. Findings also suggested that *C. procera* extracts may produce larvicidal, pupicidal and adulticidal effects, (behaving like general toxicants) against the flesh fly, *S. haemorrhoidalis*. In our experiments also found that the mortality was significantly different in each extracts than the control and also water extracts of *C. procera* became more effective as the concentration was increased so the mortality was dose dependent. Further fields' studies are needed for the confirmation of the present findings.

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