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"Evaluation of Pesticidal Efficacy of Botanicals Extracted from Prosopis cineraria (L.) Druce against Callosobruchus chinensis."

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Abstract

An investigation was conducted to evaluate the effect of extracts obtained from different parts of *Prosopis cineraria* on the adults of the stored grain pest *Callosobruchus chinensis*. The different plant parts (bark, fruit and leaf) were formulated as aqueous extract, ether extract and aqueous suspensions, and the effect on *C. chinensis* was studied in terms of adult mortality .The mean adult mortality ranged from 16.67 to 70%. A significantly high adult mortality of 70% was found in sets treated with 10% ether extract of bark and fruit. The adult pests were also subjected to the smoke of the different plant parts for assessing results in terms of adult mortality. The smoke of bark after 24h and of fruit after 48h was found to result in more than 50% mortality.

Key words. Callosobruchus chinensis, Prosopis cineraria, stored grain pest, biopesticides, adult mortality, smoke treatment, plant formulations.

I. INTRODUCTION.

The ill effects of heavy and indiscriminate use of pesticides are no longer hidden from public view. The adverse side effects, development of resistance in some pests and environmental and health hazards, have been of such magnitude and lasting that there has been a universal appreciation of the problem. The use of synthetic pesticides thus had to be restricted for their environmental toxicity, erosion of beneficial natural enemies and pest resurgence.

Use of plant bioproducts became an alternative, protecting nature from pesticidal pollution [Prakash et al., 1989, Tiwari et al.,1990]. Plants contain a large number of secondary metabolites and those categorized under terpenoids, alkaloids, glycosides, phenols, tannins etc. play a major role in plant defense and cause behavioural and physiological effects on insects. Over the past 50 years, more than 2000 plant species belonging to different families and genera have been reported to contain toxic principles. [Solanki and Shankar, 2001]. Fabaceae(earliar called Leguminosae), the family of genus *Prosopis* is a wide and chemically rich family . The major alkaloids present were discovered to be rotenoids, which were one of the first insecticides discovered .The family probably contains the largest number of plants, poisonous to fishes and many of the genera viz. *Butea, Millettia, Mundulea,*

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Pongamia, *Sophora* and *Tephrosia* have been recorded as poisonous to insects. *Prosopis cineraria* was selected for the present study. The tree, locally called as Jandi or Khejri holds an important place in the rural economy in the northwest region of Indian subcontinent. The genus Prosopis comprises about 44 species distributed mainly in dry regions of Southwest Asia, Africa and, predominantly America from western North America to Patagonia [Puri and Kumar, 1995]. Therefore a study was planned for assessing the efficacy of plant *P. cineraria* on the mortality of a rampant pest of the stored grains, the pulse beetle, *Callosobruchus chinensis.*

II. MATERIAL AND METHODS

A pure line culture of *C. chinensis* reared on grains of *Phaseolus mungo* was maintained in a BOD incubator maintained at 28+2^{0}C temperature and 70% relative humidity. The test plant was collected from in and around Bikaner city, Rajasthan, for this study. The formulations of bark, leaf and fruit of *P. cineraria* were used against the pest. The powdered plant parts were used in three forms viz. liquid extracts, powder suspension, and in the form of smoke by incineration.

A. Liquid formulations

The liquid extract of the plant parts were made in two media, inorganic (water) and organic (petroleum ether).

i). Aqueous extract

1g of powdered plant material was kept in a thimble. The thimble was placed in a flask containing 50 ml of distilled water and boiled till the volume reduced to 10 ml. Thus 10 percent concentration was obtained. Further dilutions were made by adding required amount of distilled water for getting lower concentrations viz. 5, 2.5 and 1 percent.

ii). Ether extract

1g of dried and powdered plant material was taken in a thimble. It was placed in a soxhlet extraction unit with petroleum ether. It was distilled in the unit. The extract so obtained was made to a fixed volume of 10 ml having concentration of 10 percent. This was used as stock solution. Further dilutions were made to have 5, 2.5 and 1 percent concentration from the stock solution.

B. Powder suspension

The powdered plant parts were weighed to get required concentration of 10, 5, 2.5 and 1 percent and suspension was prepared by adding distilled water.

C. Smoke treatment

The powdered plant material weighed as 10 g was placed in an incineration flask from which a tube led to fumigation chamber measuring 10 liters by volume.

The contents of flask were heated causing incineration of the plant material producing smoke, which was allowed to fill the chamber for 10 minutes. 50 adult insects were placed in a beaker with host grains. The beaker was covered with muslin cloth and placed in the lower chamber of fumigation chamber.

Thus four sets of experiments were laid out:

a. For aqueous extract treatment

b. For ether extract treatment

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c. For powder suspension treatment

d. For smoke treatment.

For the first three treatments, 5 g of host grains were taken and treated with 1 ml of the specific extract. Five pairs of one day old test insects were released into each experimental set of different doses viz. 10, 5, 2.5 and 1 percent. For the study each experimental set was taken in three replicas. For the smoke treatment only one dose was applied.

III. Recording of Observations

The following aspects were studied:

A. Adult mortality (Percent)

The total number of adult insects surviving after the treatment was recorded for three days after infesting

with insects. The percent mortality was then calculated**.**

B. Adult mortality by smoke treatment (Percent)

The smoke produced by different plant powders was used to fumigate the insects and mortality was observed after 24 and 48 hours of treatment.

IV. RESULTS AND DISCUSSIONS

During the present study the mean percent adult mortality was observed to be 22.03% in normal sets, while in control sets treated with distilled water and ether it was 22.49 and 29.45% respectively. In the treatment of *P. cineraria*, the mean adult mortality ranged from 16.67 to 70%. A significantly high adult mortality of 70% was found in sets treated with 10% ether extract of bark and fruit. Significantly high mortality of more than 50% was also found when pest insects were treated with 10% suspensions and 5% ether extract of bark and fruit, 5 and 10% aqueous extracts of leaf, 2.5 and 5% aqueous suspensions of fruit and 2.5% ether extract of bark.

The present findings are supported by earlier works of Mala & Solayappan, 2001 who conducted experiments on certain plant extracts including *P. juliflora* ,which is a related species of P*rosopis* against the early shoot borer *Chilo infuscatelus* and found that it caused significantly high mortality of 2nd and 3rd instar larvae after 24h.

Rajappan et al,2000 also studied the effect of leaf extract of *P. juliflora* and found it to be effective in reducing the population of green leaf hopper *Nephotettix virescens* in both the nursery and the main field. The methanolic and aqueous extracts of the stem bark of *P. cineraria* were found to exhibit moderate antibacterial activity [Velmurugan et al.,2010]. *P. cineraria* root extract have also exhibited analgesic activity [Kumar et al., 2011].

Smoke treatment

The results of smoke treatment of different plant parts of the plant on mortality of *C.chinensis* have been presented in Table II. The results are in conformation with earlier work of Ghei , 2001 who observed that smoke of pods of *Tephrosia, Trigonella and Crotolaria* was effective in causing significantly high mortality (66.66 – 100%) of *C. chinensis*

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and Gupta, 2004 who studied the efficacy of *Solanum nigrum, S. surattense* and *Withania sominifera* and found that the fruit of *S. nigrum* resulted in maximum adult mortality (85%) of *C.chinensis* after 24 hours. More than 60% adult mortality was observed when the insects were treated with the smoke of leaves of *S. surattense*, root, stem and leaves of *S. nigrum* and root of *W. somnifera* after 48 hours.

IV CONCLUSIONS

On the basis of results obtained and its comparison with normal and control it could be deduced that concentrated extracts of parts of *P.cineraria* can significantly control the infestation by *C.chinensis.* Smoking the warehouses with leaves and fruit of the plant can effectively reduce infestation by causing adult mortality.

Table I. Adult mortality (%) in *C. chinensis* under different treatment of bark of *P. cineraria*

	Normal	Control	1% Bark	2.5% Bark	5% Bark	10% Bark
Aqueous extract	22.03±0	22.49±0	30±0	40±0	36.67±5.7	53.33±5.7
Ether extract	22.03±0	29.45±0	43.33±5.7	50±0	53.33±11.5	70±0
Aqueous suspension	22.03±0	22.49±0	33.33±0	33.33±5.7	33.33±11.5	53.33±5.7

Table II. Adult mortality (%) in *C. chinensis* under different treatment of fruit of *P. cineraria*

	Normal	Control	1% Fruit	2.5% Fruit	5% Fruit	10% Fruit
Aqueous extract	22.03±0	22.49±0	40±0	43.33±5.7	46.67±11.5	56.67±5.7
Ether extract	22.03±0	29.45±0	43.33±5.7	46.67±5.7	56.67±5.7	70±10
Aqueous suspension	22.03±0	22.49±0	40±10	50±0	53.33±5.7	63.33±5.7

Table III. Adult mortality (%) in *C. chinensis* under different treatment of leaf of *P. cineraria*

	Normal	Control	1% Leaf	2.5% Leaf	5% Leaf	10% Leaf
Aqueous extract	22.03±0	22.49±0	27.78±9.6	44.44±9.6	61.11±9.6	66.67±0
Ether extract	22.03±0	29.45±0	22.22±9.6	22.22±9.6	16.67±0	38.89±9.6
Aqueous suspension	22.03±0	22.49±0	16.67±0	22.22±9.6	22.22±9.6	38.89±9.6

Table IV. Adult mortality (%) in *C. chinensis* under smoke treatment of parts of *P. cineraria*

	24h	48h
Bark	50.00	60.00
Fruit	20.00	54.00
Leave	20.00	34.00

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