Evaluation of Efficacy of Formulations of Plant Prosopis Juliflora against Callosobruchus Chinensis Linn

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Abstract - An investigation was conducted to evaluate the efficacy of extracts obtained from different parts (bark, leaf and fruit) of P.juliflora against C.chinensis. A significant mortality of the insect, up to 66.67%, was obtained in some cases. The adult pests were also subjected to smoke of the different plant parts for assessing results in terms of adult mortality. Here also fruit and leaf formulations were able to cause 70% mortality. Similar encouraging results were found when different plant parts were used as egg laying deterrents (reduced to 6 no. /pair as against a normal of 42.33 no. / pair). Some treatments were capable of lengthening the period of insect development by as much as 10 days. Significant results were obtained for managing adult emergence from host grains were in best case scenario it dropped from 93% to 56%.

Keywords: Biopesticides, C.chinensis, P.juliflora, adult mortality, egg laying, rate of development, adult emergence, plant extracts.

GJSFR-C Classification: FOR Code: 060703, 060704

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Evaluation of Efficacy of Formulations of Plant Prosopis Juliflora against Callosobruchus Chinensis Linn

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Abstract - An investigation was conducted to evaluate the efficacy of extracts obtained from different parts (bark, leaf and fruit) of P. juliflora against C. chinensis. A significant mortality of the insect, up to 66.67%, was obtained in some cases. The adult pests were also subjected to smoke of the different plant parts for assessing results in terms of adult mortality. Here also fruit and leaf formulations were able to cause 70% mortality. Similar encouraging results were found when different plant parts were used as egg laying deterrents (reduced to 6 no./pair as against a normal of 42.33 no./pair). Some treatments were capable of lengthening the period of insect development by as much as 10 days. Significant results were obtained for managing adult emergence from host grains were in best case scenario it dropped from 93% to 56%.

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I. INTRODUCTION

In recent years there has been a growing concern towards the environmental hazards such as toxicity, erosion of beneficial natural enemies and pest resurgence caused by synthetic pesticides. Use of plant bioproducts became an alternative, protecting nature from pesticidal pollution (Prakash et al., 1989, Tiwari et al., 1990). The efforts have been applauded by all, and the efficacy of botanicals has been found against stored grain pests (Rao et al., 1990, Prakash et al., 1990). They are broad spectrum in pest control, safe to apply, unique in action, and can be easily processed and used. A number of plants have been identified for their pesticidal activities. 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 & Shanker, 2001). Therefore a study was planned for assessing the efficacy of plant Prosopis juliflora on the various life-cycle aspects of 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°C temperature and 70% relative humidity. The test plant was collected from in and around Bikaner city for the study carried out during the period of 2005-2007. The formulations of bark, leaf and fruit of P. juliflora 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 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.

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:

- For powder suspension treatment
- For aqueous extract treatment
- For ether extract treatment
- 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 the 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.

- **Adult mortality by smoke treatment (Percent)**
  
The smoke produced by different plant powders was used to fumigate the insects and mortality was noted after 24 and 48 hours of treatment.

- **b) Egg laying (No. /pair)**
  
The egg laying or fecundity was calculated by counting the total number of eggs laid per pair of adult insects after three days of introduction of the adult into the treated sets.

- **c) Rate of development (days)**
  
The time taken for the development of adult from the day of egg laying till emergence was recorded as rate of development. This was further averaged to get a single value.

- **d) Adult emergence (Percent)**
  
The total number of adults which emerged was recorded and percent adult emergence was calculated as:

\[
\text{Percent adult emergence} = \frac{E}{T} \times 100
\]

Where,

- \(E\) : Total no. of adults emerged
- \(T\) : Total no. of eggs laid

The experiments were set in three replicas and were compared with control and normal, where control included grain treated with the particular solvent.

### III. RESULTS AND DISCUSSIONS

- **a) Adult mortality**
  
The percent adult mortality in *C. chinensis* in the sets treated with formulations of *P. juliflora* ranged from 16.67 to 66.67%. The highest adult mortality of 66.67% of the test insect was observed in sets treated with 10% ether extract of leaf. The present findings are supported by earlier works of Mala & Solayappan (2001) who conducted experiments on certain plant extracts including *P. juliflora* against the early shoot borer *Chilo suppressalis* and found that it caused significantly high mortality of 2nd and 3rd instar larvae after 24h. Significant antibacterial activity of aqueous extract of *P. juliflora* on phytopathogenic Xanthomonas campestris has earlier been reported by Satish et al. (1999). 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.

- **b) Effect of smoke treatment**
  
A significantly high mortality of more than 50% was also recorded in sets treated with 5 and 10% formulation of leaf. Highest bruchid mortality of 70% resulted after 48 h with treatment of smoke of fruit and leaf of *P. juliflora*, while the smoke of bark of the same plant resulted in lowest mortality of only 14%. The results are in conformation with earlier work of Ghei (2001) who observed that smoke of pods of *Tephrosia, Trigonella* and *Crotalaria* was effective in causing significantly high mortality (66.66 – 100%) of *C. chinensis* and Gupta (2004) who studied the efficacy of *S. nigrum*, *S. surattense* and *W. somnifera* 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.

- **c) Egg laying**
  
The oviposition by the test insect in the normal sets was 42.33 eggs/pair. In control sets formulated with distilled water it was 41.22 while it was 40.33 with those formulated with ether. Minimum egg laying by *C. chinensis* (6 eggs/pair) was found in sets treated with 10% aqueous extract of bark, while 10% formulations of bark, fruit, leaf, 5% aqueous extract of bark and leaf and 5% aqueous suspension of fruit were found to moderately reduce egg laying to about 6 to 20 eggs/pair and these were significantly different from normal (42.33 eggs/pair). The results obtained during the present study are in conformation with the works of Kamakshi et al. (2000) who reported significant reduction in the number of eggs laid by *C. maculatus* when treated with Mentha arvensis, Sesbania glandiflora and Ocimum sanctum as compared to control. Tinzaara et al. (2006) tested the potential of certain botanicals on Cosmopolites sordidus and found that oviposition was significantly low on corns treated with *M. azedarach*, Tagetes spp. and *R. communis*.

- **d) Rate of development**
  
The perusal of the results show that the mean rate of development of *C. chinensis* in normal sets was
26 days while in control sets treated with distilled water it was 27 days and in those treated with ether it was 28 days.

The maximum time taken for development (38.67 days) of C.chinensis was recorded from the sets treated with 10% formulation of bark. 5% formulations of bark and 5 and 10% ether extracts of leaf also delayed the development by 10 days. Similar results were obtained when the efficacy of different concentration of commercial neem based insecticide ‘Nimbicidine’ was evaluated against T. castaneum by Das et al. (2006) who observed significant reduction in growth with lengthened developmental period.

e) Adult emergence

During the present study, adult emergence in normal sets was recorded as 96%. Control sets formulated with distilled water showed 95% while those formulated with ether showed 93% emergence of the bruchid. The percent adult emergence of the test insect in sets formulated with extracts of P. juliflora ranged from 56.81% (in 10% ether extract of bark) to 94.33% (in 1% aqueous suspension of fruit).

Sets treated with 5 and 10% aqueous extract and 10% aqueous suspension of bark was also found to have significant effect in controlling the bruchid emergence. Present findings are supported by earlier work by Mbaiguinam et al. (2006) where total emergence of adults of C. maculatus was found to be reduced significantly when treated with extracts of A. indica, R. communis, T. nerifolia, Balanites aegyptiaca, Moringa oleifera and Kaya sanegalensis. A significant reduction in progeny emergence of S. zeamais and C. maculatus was observed by Udo et al. (2004) when treated with formulations of Z. xanthoxyloides.

On the basis of results obtained and its comparison with normal and control it could be deduced that concentrated extracts of parts of P. juliflora 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. Concentrated aqueous extract of bark can be mixed with pulses as deterrents of egg laying.

References Références Referencias

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