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Efficacy of Some Indigenous Pesticidal Plants Against Pulse Beetle, *Callosobruchus chinensis* (L.) On Green Gram

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Abstract: The effect of indigenous pesticidal plants viz., *Prosophis* sp., *Nerium* sp., *Ocimum* sp., *Acalypha* sp., *Catheranthus* sp. and *Vitex* sp. were tested against pulse beetle *Callosobruchus chinensis* (L.) in green gram. Leaf extracts of all the plants caused significant ovipositional deterrent effect against pulse beetle. Five percent leaf extract of *Vitex* sp. was the most effective in inhibiting the oviposition (26.6 eggs/female) as that of 79.4 eggs/female in untreated control. At 5% level, leaf extract of *Vitex* sp. caused maximum reduction in egg viability (61.7%) followed by *Catheranthus* sp. leaf extract (56.7%). The egg viability gradually decreased with the increase in dose level of each treatment. *Vitex* sp. treated seeds at 5% level caused maximum reduction in adult emergence (85.0%) followed by *Catheranthus* sp. (83.7%), *Acalypha* sp. (73.3%), *Nerium* sp. (70.0%), *Ocimum* sp. (68.7%) and minimum reduction was recorded in case of *Prosophis* sp. (68.0%). No adverse effect was observed on the germination of green gram up to 90 days after treatment.

Key words: *Callosobruchus chinensis*, pesticidal plants, ovipositional deterrent

INTRODUCTION

In India, Pulses are the important source of protein with the protein content ranging from 20 to 40%. The full yield potential of pulses is seldom realized due to various constraints such as pests, diseases, moisture extremes high temperature and lack of technology for post harvest handling, processing and utilization. Though a number of insect pest of different groups cause varying degrees of losses to pulses, bruchids with cosmopolitan distribution affect both qualitative and quantitative losses to pulses right from field to storage. Among bruchids the genus *Callosobruchus*, includes a number of economically important species of which *C. chinensis* cause considerable damage on the green gram, *Vigna radiata* (L.).

The initial infestation starts in the field itself, where female insect lays eggs on the green pods, grubs feed on the pod cover and remain concealed inside the developing seeds. when such seeds are harvested and stored, the pest population increases rapidly and results in total destruction within a short duration of 3-4 months (Rahman and Talukder, 2006) reported 8.5% loss in pulses during post harvest handling and storage in India. These losses can be managed by using insecticides, pulse beetle *C. chinesis* being a stored product pest, chemical means of management is not advisable. Therefore the botanical pesticides are the next best alternate method to contain the pest. Besides neem, intensive research work has not been conducted on the insecticidal properties of other plants. There is meager information on the ovipostional deterrancy of pesticidal plants against pulse beetle (Niber *et al*., 1992; Weaver *et al*., 1995; Xie *et al*., 1995; Ghoswal *et al*., 2004). Therefore the attempts were made to screen some of the indigenous plants with a view to explore insecticidal properties against pulse beetle.

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MATERIALS AND METHODS

The present study was conducted under laboratory condition in the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India during the year 2001-2002. The pulse samples are sterilized at 50°C for 1 h. All insect cultures were maintained under controlled condition in the laboratory at a temperature of (30±1°C) and relative humidity (70±5%) and all the experiment were conducted under the same condition.

Preparation of Leaf Extracts

Methanol leaf extract was prepared using Soxhlet extraction method. The freshly collected leaves were air dried and made into fine powder, each leaf sample were extracted separately at 50°C for 8 h in 300 mL of the above solvent. The extract thus obtained was filtered through a sterilized Whatmann No. 1 filter paper. Later they were evaporated to obtain concentrated slurry. Now the extract thus obtained was made to different dose levels (i.e.)1, 3 and 5%, respectively with acetone.

Ten pairs of one or two days old adults of *C. chinensis* were released in each jar (11 × 9 cm) containing 100 g of sterilized green gram samples. The jars were sealed and a maximum of seven days were allowed for mating and oviposition. The samples were treated with *Prosophis juliflora*, *Nerium oleander*, *Ocimum sanctum*, *Acalypha indica*, *Catheranthus roseus* and *Vitex negundo* leaf extracts and were tested at different doses viz., 1, 3 and 5% per 100 g of seeds. A control was also maintained by mixing the seeds with acetone. The treatments were replicated thrice. The observations were made on the ovipositional deterrancy, egg viability, adult emergence and germination of green gram seeds were assessed by the following method given by Bhargava and Meena (2002), Talukder and Howse (2005) and Rahman and Talukder (2006). The data were subjected to analysis of variance.

RESULTS AND DISCUSSION

Effect on Oviposition

In the present study, the effect of different pesticidal plants on the oviposition of test insect (Table 1) revealed that there was significant reduction in egg laying at the dose level of 1% in *C. roseus* extract (35.0) treatment which was at par with *O. sanctum* extract (35.5) followed by *V. negundo* extract (36.9), *A. indica* extract (38.8), *N. oleander* extract (44.6) and *P. juliflora* extract (52.5). The egg laying capacity gradually decreased with increase in the treatment dose level of each leaf extract. The maximum reduction in the egg laying was noticed with *V. negundo* extract at 5% level when only 26.6 eggs were found to be laid by the beetle on the treated seeds as against 79.4 eggs in control. These findings are in accordance with Bhargava and Urs (1992), Niber *et al*. (1992), Elhag (2000), Kim *et al*. (2003), Park *et al*. (2003) and Ghoswal *et al*. (2004), who found that the reduction in egg laying of pulse beetle was significantly high. When the seeds were treated with various pesticidal plant extract and also similar trend was noticed in case of some vegetable oils too. The results revealed that

Table 1: Effect of some pesticidal plants on the oviposition of *C. chinensis*

Leaf extract/ Treatment doses (%)	*Prosophis juliflora*	*Nerium oleander*	*Ocimum sanctum*	*Acalypha indica*	*Catheranthus roseus*	*Vitex negundo*	Mean
1	52.5	44.6	35.5	38.8	35.0	36.9	40.6
3	43.7	39.6	33.5	35.1	33.9	32.0	36.5
5	41.1	35.0	34.7	29.5	25.9	26.6	32.7
Mean	45.8	39.7	34.6	34.5	32.8	32.1	
Control (Acetone)	79.4						
	SEM ±	CD (5%)	CV%				
Leaf Extract (LE)	0.6	1.7	4.8				
Treatment Doses (TD)	0.4	1.2					
LE×TD	1.1	2.9					

Values are mean of three replications

the ovipositional deterrent effect of various pesticidal plants at different dose level was very effective against pulse beetle on green gram. These findings are in conformity with those of Dohray *et al*. (1990), Mulatu and Gebremedhin (2000) and Rahman and Talukder (2006).

Effect of Leaf Extract on Egg Viability

All the doses of leaf extract were found significantly superior in reducing the egg viability. Ten pairs of adult beetles were covered with a perforated lid for the next seven days allowing them for mating and egg laying (Table 2). The treatment of *V. negundo* extract proved most effective in reducing the egg viability followed by *C. roseus*, *A. indica*, *O. sanctum*, *N. oleander* extracts and finally by *P. juliflora* extract. Very little work on the effect of pesticidal plants on the egg viability of pulse beetle is available. However Dohray *et al*. (1990), Weaver *et al*. (1995) and Mulatu and Gebremedhin (2000) found significant effect on the egg viability *C. chinensis* when they were released on seed treated with plant extracts at different doses which is in accordance with the present study.

Effect of Leaf Extracts on Adult Emergence

The data shown in Table 3 revealed that the effect of leaf extracts on adult emergence of pulse beetle shows a significant reduction among the treatments and their respective doses. The maximum reduction in the adult emergence was observed in the treatments of *V. negundo* extracts followed by *C. roseus*, *A. indica*, *O. sanctum* and *N. oleander* extracts and the least was recorded in case of *P. juliflora* extract. The reduction in adult emergence increased with the increase in dosage of each treatment. The present observations are in agreement with those of Weaver *et al*. (1995), Xie *et al*. (1995), Lale and Mustapha (2000) and Tapondjou *et al*. (2002).

Table 2: Effect of some pesticidal plants on the egg viability of *C. chinensis*

Leaf extract/ Treatment doses (%)	Reduction in egg viability (%) *Prosophis juliflora*	*Nerium oleander*	*Ocimum sanctum*	*Acalypha indica*	*Catheranthus roseus*	*Vitex negundo*	Mean
1	28.4 (32.1)	33.3 (35.3)	31.6 (34.2)	36.6 (37.2)	40.0 (39.2)	45.0 (42.1)	35.8 (36.7)
3	36.6 (37.3)	40.0 (39.2)	41.7 (40.2)	40.0 (39.2)	43.3 (41.1)	45.0 (45.0)	41.9 (40.3)
5	43.3 (41.2)	48.3 (44.0)	50.0 (45.0)	50.0 (45.0)	56.7 (48.8)	61.7 (51.8)	51.7 (46.0)
Mean	36.1 (36.9)	40.5 (39.5)	41.1 (39.8)	42.2 (40.5)	46.6 (43.1)	52.2 (46.3)	
Control (Acetone)	6.5 (14.8)						
	SEM ±	CD (5%)	CV%				
Leaf Extract (LE)	0.6	1.8					
Treatment doses (TD)	0.5	1.3	4.9				
LE×TD	1.1	3.1					

Values are mean of three replications; data in parentheses are angular transformed values

Table 3: Effect of some pesticidal plants on the adult emergence of *C. chinensis*

Leaf extract/ Treatment doses (%)	Reduction in adult emergence (%) *Prosophis juliflora*	*Nerium oleander*	*Ocimum sanctum*	*Acalypha indica*	*Catheranthus roseus*	*Vitex negundo*	Mean
1	43.3 (41.2)	44.0 (41.6)	50.0 (45.0)	53.3 (46.9)	56.7 (48.8)	68.0 (55.6)	52.6 (46.5)
3	60.0 (50.8)	58.0 (49.6)	60.8 (51.2)	66.0 (54.3)	68.7 (56.0)	73.4 (58.9)	64.5 (53.5)
5	68.0 (55.6)	70.0 (56.8)	68.7 (56.0)	73.3 (58.9)	83.7 (66.2)	85.0 (67.3)	74.8 (60.1)
Mean	57.1 (49.2)	57.3 (49.3)	59.8 (50.7)	64.2 (53.4)	69.7 (57.0)	75.5 (60.6)	
Control (Acetone)	12.6 (20.8)						
	SEM ±	CD (5%)	CV%				
Leaf Extract (LE)	0.5	1.4					
Treatment Doses (TD)	0.4	1.0	3.0				
LE×TD	0.9	2.4					

Values are mean of three replications; data in parentheses are angular transformed values

Effect of Leaf Extract on Germination

The effect of leaf extract on seed germination of green gram seeds revealed that no significant harmful effect was observed after 0, 60 and 90 days after treatment. It indicated that there was no adverse effect any dose of the leaf extract on the germination of green gram at any interval. The similar result was recorded by Raja *et al*. (2001) and Raghvani and Kapadia (2003) in pigeon pea.

The study concluded that *V. negundo* and *C. roseus* extract exhibits significant results whereas *A. indica* and *O. sanctum* extract shows moderate pesticidal effect and finally *N. oleander* and *P. juliflora* extract express least effect against pulse beetle *C. chinensis* on green gram. The highlight of my research is solely done for the benefit of the traditional farmers, whereas they may mix the *V. negundo* and *C. roseus* extracts with their pulse seeds to protect them from the pulse beetle attack completely.

The presence of toxicant or growth inhibitors in these pesticidal plants is strongly indicated and merits focused further investigations including identification and isolation of the respective pesticidal bio- molecule is the future thrust area were the researchers have to focus their concentration in these emerging traditional knowledge field is a great task.

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