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Short Communication

Effect of formulations of *Solanum surratense* (Family: Solanaceae) an Indian desert plant on oviposition by the pulse beetle *Callosobruchus chinensis* Linn.

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The pulse beetle *Callosobruchus chinensis* Linn. (Coleoptera: Bruchidae) is one of the major pests infesting stored pulses and is distributed worldwide. Plants and plant products possessing insecticidal properties have been used as an alternative to control the infestation caused by this pest. The present study was undertaken to study the effect of different formulations viz., aqueous suspension, aqueous extract and ether extracts of 10, 5, 2.5 and 1% concentrations of various parts (root, stem, leaf, fruit) of plant *Solanum surratense* (family:Solanaceae) on egg laying by the pulse beetle *C. chinensis* Linn.. A significant reduction in the oviposition (eggs laid per pair) of insects was observed in various experimental sets. It went down to 2 - 5 eggs /pair in sets treated with 10% aqueous extract and aqueous suspension of fruits. It can therefore be suggested that the plant under study is potent enough against *C. chinensis* and can be at least partially substituted as against synthetic pesticides.

Key words: *Callosobruchus chinensis*, *Solanum surratense*, oviposition, formulations, extracts

INTRODUCTION

Protection of stored pulses against insect pests is one of the major problems all over the world. Conventional methods have been used for long including the use of chemicals to control insects. Plants having insecticidal and repellent properties have been traditionally used by people all over the world and today emphasis is again shifting to this option in view of hazards of chemical pesticides.

Callosobruchus chinensis Linn. (Coleoptera: Bruchidae) is one of the major pests infesting stored pulses. The eggs are laid on the host grains; the larvae bore inside and after feeding and pupating emerge out as adults leaving behind damaged hollow seed-grains. Plant family Solanaceae is a wide and chemically rich family and has been reported to contain gluco-alkaloids viz., solanine, solanidine, nicotine, somniferine, somnifernine, somnine, withananine, withanine, withananinine, volatile oil, tannin and considerable amount of potassium nitrate (Chopra et al., 1965). They also reported the roots to contain two saponoids, dulcamaric acid, dulcamaretinic acid and a gluco-alkaloid solaceine. Plant *Solanum surratense* belonging to this family and found in the desert was therefore selected to study its efficacy against *C. chinensis*. Earlier Muthukrishnan et al. (1999) screened *S. surratense* and *Solanum trilobatum* for their insecticidal activities. Effect of the plant extracts of *S. surratense* on the fecundity and fertility of mosquitoes have also been studied by Muthukrishnan and Pushpalatha (2001). Therefore the present work was undertaken with this plant.

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MATERIALS AND METHODS

The pulse beetle *C. chinensis* was raised on green gram *Vigna radiata* in incubators maintained at 28 $\pm$ 2^{o}C and 70% RH. The plant was collected from Bikaner and its vicinity lying between 23 3' to 30 12' N latitudes and 69 30' to 78 17'E longitudes. The plants were cleaned and shade dried after separating different parts viz. roots, stems, leaves and fruits selected for the study. The plant derivatives were applied in three forms namely aqueous suspendsion soxhleted aqueous extract and ether (Assay 74.12) extracts of 10, 5, 2.5 and 1% dose concentrations. The suspension was prepared by adding GDW to weighed dried plant part powder.

The aqueous extracts were prepared by keeping required amount of powdered plant material in a thimble placed in a flask containing measured amount of GDW and boiled till the volume was reduced to half the initial volume. Ether extraction was done employing soxhlet extraction method. For comparison normal (un-

Table 1. Eggs laid (No./pair) by the pulse beetle *C. chinensis* after different treatments

Normal	Control	Aqueous Extract	1%Root	1%Stem	1%Leaf	1%Fruit
43.80±0.00	41.60±0.00		31.26±0.11	30.26±0.11	26.33±0.11	19.26±0.11
			2.5% Root	**2.5% Stem**	**2.5% Leaf**	**2.5% Fruit**
			29.73±0.11	28.46±0.41	24.40±0.34	15.26±0.11
			5% Root	**5% Stem**	**5% Leaf**	**5% Fruit**
			25.66±0.11	25.93±0.11	19.86±0.11	8.40±0.00
			10% Root	**10% Stem**	**10% Leaf**	**10% Fruit**
			22.33±0.11	21.86±0.11	14.66±0.11	2.26±0.11
43.80±0.00	41.60±0.00	**Aqueous suspension**	**1% Root**	**1% Stem**	**1% Leaf**	**1% Fruit**
			31.80±0.00	30.06±0.11	23.60±0.20	18.60±0.00
			2.5% Root	**2.5% Stem**	**2.5% Leaf**	**2.5% Fruit**
			29.06±0.11	29.26±0.11	19.53±0.11	14.46±0.11
			5% Root	**5% Stem**	**5% Leaf**	**5% Fruit**
			20.20±0.20	27.40±0.34	16.26±0.11	7.20±0.00
			10% Root	**10% Stem**	**10% Leaf**	**10% Fruit**
			19.53±0.11	23.33±0.11	9.53±0.11	4.53±0.11
43.80±0.00	39.00±0.00	**Ether extract**	**1% Root**	**1% Stem**	**1% Leaf**	**1% Fruit**
			29.60±0.00	24.13±0.11	31.73±0.11	20.53±0.46
			2.5% Root	**2.5% Stem**	**2.5% Leaf**	**2.5% Fruit**
			26.13±0.11	20.53±0.46	28.46±0.11	13.40±0.20
			5% Root	**5% Stem**	**5% Leaf**	**5% Fruit**
			24.00±0.00	19.06±0.23	26.26±0.11	9.73±0.11
			10% Root	**10% Stem**	**10% Leaf**	**10% Fruit**
			20.60±0.00	16.20±0.20	20.66±0.23	5.40±0.00

Values given are Mean± S.D.

treated) and controls sets (blank solvents), were also kept under observation. A single pair of freshly emerged adult male and female insect (which show sexual dimorphism and can easily be identified) was released in muslin cloth covered beakers containing weighed green gram grains and treated with different dose concentrations used by applying the extract and stirring the beakers mechanically. Each experimental set comprised of ten replications. Observations were recorded up to three days of treatment. For statistical analysis ANOVA and t-test were applied which was done manually.

RESULTS AND DISCUSSION

The results of various formulations on the oviposition (egg laying) by the pulse beetle have been presented in Table 1. The observations revealed that there was significant reduction in the number of eggs laid per pair of the insect when treated with different formulations. A very significant reduction ($p<0.01$) of less than 20 eggs/pair was observed in sets treated with 1, 2.5, 5 and 10% aqueous extract, 1, 2.5, 5 and 10% aqueous suspension and 2.5, 5 and 10% ether extract of fruit, 5 and 10% aqueous extract 2.5, 5, 10 % aqueous suspension of leaf, and 5 and 10% ether extract of stem of the plant under study. Maximum reduction of only 2.66 eggs per pair was observed in the sets treated with 10% aqueous extract of fruit and minimum reduction of 31.80 eggs per pair as compared to normal and control was observed in sets treated with 1% aqueous suspension of root. The findings suggest that the concentration of the toxic compounds which impairs egg laying by the insect is highest in fruits followed by leaf, stem and root; fruit formulations being the most effective.

Earlier Kamakshi et al. (2000) also reported significant reduction in the number of eggs laid by *Callosobruchus maculatus* when treated with *Mentha arvensis*, *Sesbania glandiflora* and *Ocimum sanctum*. Delobel and Malonga (1987) observed no or very few eggs laid by *Caryedon serratus* when treated with powder of *Nicotiana tabacum*. Prakash and Rao (1989) observed reduced oviposition by *C. chinensis* when leaves of *Vitex negundo* were admixed with grains of black gram. Similar observations were also made by Miah et al. (1993) on chickpea. Dwivedi and Kumari (2000) also observed reduced oviposition when the grains were treated with *Ipomea palmata* leaf extracts. Neem was found to impair oviposition in *C. chinensis* by Mathur et al. (1985). A complete prevention of egg-laying by *C. analis* was observed when the grains were treated with seed powder of custard apple, black pepper, leaves of mint, and peel of orange by Juneja and

Patel (1994). Leaf extracts of *Fagonia cretica* were found to bring down egg laying in *C. chinensis* by Mann (1997).

When results were analyzed to compare the effect of extracts it was noted that the sets treated with aqueous suspension was found to be most effective followed by ether and aqueous extract. Further, maximum significant reduction in egg laying was observed when treated with 10% formulations, although 5% were also effective. According to Dwivedi and Maheshwari (1997) acetone extracts of croton and petroleum ether extracts of *Verbesina encelioides* and *Occidentalis* were found to exhibit ovipositional deterrent activity against *C. chinensis* in stored cowpea. Pandey et al. (1986) observed various plants diluted in benzene and mixed with green gram seeds to be very repulsive and a potent oviposition inhibitor for *C. chinensis*. These findings suggest that solvent also plays a significant role. Olaifa and Erhun (1988) reported that although low concentrations of the powder of *Piper guineense* significantly reduced the oviposition by *Callosobruchus maculatus*, a complete suppression of oviposition was found at a higher concentration of 42%. Ghei (2001) in her reports found that 10% aqueous suspension of roots and leaves of plant *Tephrosia purpurea* reduced the average number of eggs laid per pair to 6.66. These earlier findings are in conformation with the present study where 10% concentrations were found to be effective as compared to lower ones in bringing down the egg laying by the pest insect.

It can therefore be suggested that the plant under study is potent enough against *C. chinensis* and can be at least partially substituted as against synthetic pesticides.

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