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REPELLENT BIOACTIVITIES OF SOME PLANT EXTRACTS ON PULSE BEETLE, *CALLOSOBRUCHUS CHINENSIS* LINN. (COLEOPTERA : BRUCHIDAE)

NALINI S. DWIVEDI*, P. C. TRIVEDI, S. C. DWIVEDI and SEEMA GARG****
Department of Botany, University of Rajasthan, Jaipur-302004, India.
*Department of Botany, Vedic Kanya P.G. College, Jaipur, India.
**Department of Zoology, University of Rajasthan, Jaipur-302004, India.

Six plant sp. viz. *Lawsonia inermis, Cassia alata, Withania somnifera, Ricinus communis, Parthenium hysteophorus* and *Tridex procumbens* extracts were used in acetone and pet ether solvents to test their repellency against *Callosobruchus chinesis* and significancy was checked by using X^2-test. The beetles were found most susceptible to pet ether exract exhibiting 70% repellency. Further. *L. inermis, C. alata, W. somnifera* in acetone and *P. hysterophorus* in pet ether solvent gave significant results showing 68.57, 61.1, 53.33 & 543.54% repellent action. Rest of the extracts were found non-significant statistically.

Keywords : Botanical insecticides; *Callosobruchus chinensis;* Repellent action.

Introduction

Plant extracts are nowadays widely recommended as repellents as these are pungently odorous. Furthermore, the low toxicity of botanical insecticides makes processing and application of the product inexpensive. In many cases, the materials are locally available and affordable[1]. In contrast, conventional synthetic insecticides require special safety procedure and equipment during production and application. These are expensive and have in many cases only produced moderate results along with major ecological damage[2].

Although a lot of plant products have exhibited repellent action against different insect pests[3-8]. Still the search for new safer and more effective repellents of plant origin is in ample scope. Hence, in present study, some foliage extracts in different solvents were tested for their repellent activity on pulse beetle, *Callosobruchus chinensis*, a major pest of all the pulses in storage which causes substantial damage.

Material and Methods

Insect : Adults of *Callosobruchus chinensis* Linn. were used in this study. Newly emerged adults were obtained from laboratory culture maintained at 28±2°C temp. and 60±10% relative humidity. Beetles were reared in the sterilized jars containing cowpea seeds.

Extraction of plant extracts : Leaves of the aboriginal plant sp. viz. *Lawsonia inermis* (Linn.), *Cassia alata* (Linn.), *Withania somnifera* (Dunal), *Ricinus communis* (Linn.), *Parthenium hysterophorus* (Linn.) and *Tridex procumbens* (Linn.) were collected from Botany Department of University of Rajasthan, Jaipur, to test the repellency action, if any. Plant extracts were prepared in acetone and pet ether solvents using soxhlet extraction method; 30 gms of powdered leaf material was extracted for 8 hours in 300 ml of respective solvent. Final extract was filtered and kept in refrigerator as stock solution (100%).

Repellency Tests : Repellent action of different leaf extracts was tested following Read *et. al.*[9], using a 'Y' shaped olfactometer, having 3 arms, i.e. (a) Base arm, (b) Control arm and (c) Experimental arm. 3 replications were run for each experiment. In each set of experiment, a piece of sponge soaked in 1 ml of plant extract was placed in experimental arm, whereas control arm contained soaked sponge piece in the same amount of solvent. 15 freshly emerged adult were released in the centre of the alfactometer through the base arm. After 30 minutes, the no. of individuals in different arms were counted and percent repellency was calculated using the formula suggested by Granett *et al.*[10].

$$\text{Percent repellency} = \frac{\text{Insects in control arm-Insect in experimental arm}}{\text{Insect in control arm}} \times 100$$

The repellency data were statistically analyzed by calculating standard deviation (S.D.) and X^2, chi square test[11].

Table 1. Repellent action of leaf extracts in acetone and pet ether to *C. chinensis* infesting cowpea.

S. No.	Plant sp.	Percent no. of insects in control arm		Percent no. of insects in treated arm		% Repellency	
		Acetone	PE	Acetone	PE	Acetone	PE
1.	*Lawsonia inermis*	25	30	10	30		
		35	50	10	10		
		40	20	15	20	68.57	35.29
		40	40	5	20		
		35	30	15	30		
		35±5.47S	34±10.19	11±3,74	22±7.48		
			NS	NS	NS		
2.	*Cassia alata*	30	30	30	25		
		35	25	5	10		
		40	25	15	20	61.11	27.58
		40	25	15	25		
		35	30	5	25		
		36±3.74	27±8.71	14±9.16	21±5.83		
			NS	NS	NS		
3.	*Withania somnifera*	55	30	15	25		
		40	30	30	30		
		45	20	30	30	53.33	37.50
		50	15	15	40		
		35	40	25	25		
		45±8.06 S	27±8.71	21±7.07	30±5.47		
			NS	NS	NS		
4.	*Parthenium*	25	60	15	25		
		10	55	20	30		
		15	50	25	25	5.26	54.54
		20	60	10	25		
		25	50	20	25		
		19±5.83	55±4,47	18±5.09	25±3.16		
		NS	NS	NS	NS		
5.	*Ricinus communis hytserophorus*	5	50	25	15		
		15	55	25	15		
		15	50	25	10	-	70.00
		30	45	15	20		
		20	50	20	15		
		17±8.12	50±3.16	22±4	15±3.16		
		NS	NS	NS	NS		
6.	*Tridex procumbens*	15	25	25	10		
		20	30	25	5		
		30	25	20	15	-	44.00
		25	20	20	25		
		20	25	20	15		
		22±5.09	25±3.16	22±2.44	14±6		
		NS	NS	NS	NS		

$X^2 = \frac{(O-E)^2}{E}$ where, O = Observational Value, E = Expected value

$S.D. = \frac{d^2}{N-1}$ where d= X-X (X=mean)

Results and Discussion

The data tabulated (Table 1) shows the repellent action of different leaf extracts in acetone and pet ether solvents. Out of plant sp. tested, maximum repellent action was observed in pet ether extract of *Ricinus communis* leaves recording 70% repellency. Only 15% beetles were found in experimental arm whereas 50 percent extract explored nil repellent activities as more no. of adults were found in experimental arm than the control arm.

Effect of *L. inermis, C. alata, W. somnifera* and pet ether extract of *P. hysterophorus,* in term of repellency the pulse beetle was found to be statistically significant at 0.001 level of probability (X^2-test) accounting 68.57, 61.11, 53.33 & 54.54 percent repellency. After the application of these extracts, only 11,14, 21 & 25 percent insects moved in experimental arm whereas there were 35, 36, 45 & 55 percent in control arm respectively.

Other leaf extracts could not record promising repellent action against pulse beetle; differences between the beetles in control arm and experimental arm was not statistically significant.

Thus, the percentage repellency of different plant extracts in decreasing order can be summarized as followed :

R. communis (PE) > *L. inermis* (A) > *C. alata* (A) > P. hysterophorus (PE) > *W. somnifera* (A) >*T. procumbens (PE)* > *W. somnifera (PE)*> *L. inermis (PE)* > *C. alata (PE)* > *P. hysterophorus (A)* > *R. communis (A), T. procumbens (A).*

Repellent action of six plant sp. in acetone and pet ether solvents were assessed against *Callosobruchus chinensis.* Out of which, *R. communis* and *P. hysterophorus* in pet ether and *C. alata, L. inermis* and *W. somnifera* in acetone were found to possess recommendable repellent potential.

Rich glycosidal contents of *Cassia, Lawsonia* and *Withania* can be assigned for their repellent action. Similar results have been found in other glycosides rich plant sp. i.e. *Ageratum conyzoides* against pulse beetle[12]. Aromatic compounds such as gallic acid, naphthalene, naphtha guine of leaves of *Lawsonia* isolated by Nakhla *et. al.*[13], can also be responsible for its repellent action. The same is observed in the study by Gunda Rao and Majumdar[14] in which high repellency (above 80%) of aromatic substances rich plants such as cardamom, kalwanji, almond, anisson, ginger, kasturi and turmeric have been reported to adults of *Tribolium castaneum.*

Repellent propeties of *R. communis* can be attributed to its alkaloid contents (ricinine) identified by Kwon *et al.*[15]. Observations of Bowery *et al.*[16], Palaniswamy and Wise[17] support the present findings with *Ricinus,* who also screened potent repellent action of this plant sp. against *Sitophilus oryzae* and *Phyllotreata curcifera* respectively.

In other study, Dwivedi and Garg[18] used *P. hysterophorus* as potent repellent against rice moth. However, they recorded the acetone extract more effective than its pet ether counterpart.

Future studies need to concentrate on isolation and bioassay of actual active compounds of plant sp. tested in present study, which are responsible for their repellent activities.

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