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Evaluation of Coriander Extracts of Leaves and Seeds Genotypes Against The Feeding Activity of 8 Day Old Larvae *Spodoptera Litura* (Fab.)

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Abstract

Laboratory experiments were conducted to determine the antifeedant activity of leaves and seeds methanolic extracts of different genotypes of Coriander against 8 day old larvae of *S. litura.*The results revealed that all the genotypes exhibited better results in 10% concentration rather than 5%. Genotype Pant haritima was found to be most effective against *S. litura* larvae with lowest MLAC (cm^2) and showed strongly antifeedant activity. While the genotype UD-711 was found to be least effective with highest MLAC and slightly antifeedant activity. Present investigation suggest that Coriander genotype, Pant haritima is effective antifeedant for the feeding of *S. litura* larvae and can be used for the management of this pest.

Keywords: Coriander, Genotypes, Antifeedant, Leaves, Seeds and *S. litura.*

Introduction

In Agriculture production insect pests are a major constraint. As the Tobacco caterpillar, *Spodoptera litura* (Lepidoptera: Noctuidae) is a major polyphagouspest **(Pavela, 2010; Gokulakrishnan, Krishnappa & Elumalai, 2012).** This is the serious pest of various economically importantcrops such as, cotton, groundnut, chilly, tobacco, castor and pulses etc., and also developed resistance in almost commercially available chemical pesticides. **(Dhir, Mohapatra & Senapathi, 1992; Armes, Wightman, Jadhav & Ranga Rao, 1997; Niranjankumar & Regupathy, 2001).** For the management of these type of insect pests number of insecticides are used with different formulation but they cause healthhazards, environmental pollution and negative effects onnon-target organisms. So, this is the reason forincreasing concern on natural plant products thatplays a prominent role with different mode of action against insects, act as a alternatives tosynthetic pesticides but harmless to theenvironment and ecosystem **(Sharma, Kaushal, Sharma & Kumar, 2006).** Researches on potentialbotanical extracts which are safe with little or no residuesand naturally derived with minimal technology are urgentlyneeded. Natural products contain secondary plant compounds such as terpenes (monoterpenes, sesquiterpenes and triterpenes), steroid, alkaloids, phenol and cardiac glycosides showed various mode of action against insect pests. Plant extracts exhibited deleterious effects on insect physiology, behaviour and represent a potential alternative strategy for development of directional controls of pests **(Jadon, Singh & Sharma, 2013).** There are more than 2400 plant species belonging to 189 plant families which are said to be rich sources ofbioactive organic compounds **(Rao, Maheshwari & Manjula, 2005).** Many floralvolatiles have anti-microbial or anti-herbivore activity also **(Friedman, Henika & Mandrell, 2002; Hammer, Carson & Riley, 2003; Dudareva, Pichersky & Gershenzon, 2004).** So, the present study attempted to explain the efficiency of leaves and seed extracts of different genotypes of Coriander (family: Apiaceae) against the feeding activity of *S. litura.*

Methodology

Plant Material

Seedsand fresh leaves of different genotypes of Coriander were collected from Vegetable Research Centre (V.R.C) of Pantnagar and from

Kumaun hills, Uttarakhand. Out of the total seventeen genotypes collected for experimental analysis of both leaves and seeds, fifteen varieties were developed in Pantnagar Tarai area*viz:* Pant haritima, PD-21, PD-51, UD-643, UD-684, UD-699, UD-704, UD-711, UD-716, UD-720, UD-721, UD-722, UD-725, UD-727, UD-728 and two were collected from Kumaun region of Uttarakhand State *viz:*PD-52 (Pithoragarh region) and PD-53 (Berinag region),India.

Insect culture

Different developmental stages of *S. litura*were collected from Norman E. Borlaug Crop Research Centre (NEBCRC) Pantnagar, Uttarakhand. Rolling culture of test insects was maintained on castor leaves, under laboratory conditions (Temp. 28ºC and RH 88%). 8 day old larvae were taken from the second generation of insect culture, as and when required. The experiment was conducted in the Soybean Entomology Laboratory of the Department of Entomology, College of Agriculture and Department of Chemistry, College of Basic Sciences and Humanities, G.B.P.U.A & T, Pantnagar.

Preparation of plant extracts

Green leaves were washed in running tap water, shade dried at room temperature for atleast 15 days. The dried materials were pulverized into fine powder by a grinding machine. The material was extracted by successive soakingfor a period of 72 hours each in methanol. The crude extracts thus obtained were stored in sterilized amber coloured bottles and were kept in refrigerator for further study. 1000 ppm stock solution of each methanolic leaves and seed extractswere then used to prepare 5% and 10% solutions to conduct the research work.

Feeding activity

Two concentrations (5% & 10%) of leaves and seed extracts of Coriander genotypes were tested using 'choice feeding' bioassay method. Control consisted of Ricinus*communis*leaf discs. The treated leaf discs (5 x 5 cm^2) were kept in the centre of presterilized corning glass petri dishes (dia. 9cm) containing an inner lining of moist filter paper. All the treatments were replicated three times. Prestarved (3h) and freshly moulted larvae (n=2) of same age were released in each petridish and were allowed to feed until more than 75% of the leaf disc area was eaten away in control. The observations on leaf area consumed was recorded on graph paper sheets and used for calculations of other parameters viz., Mean leaf area consumed (MLAC, cm^2), Feeding percentage(%), Antifeedant activity, Feeding inhibition (%), Preference index (C-value)and Antifeedant category.

Statistical analysis

The experiment was conducted in completely randomizeddesign (CRD) and the data was analysed by angular transformation. The means were separated by using STPR 3 programme.

Results

Leaves and seed extracts of different genotypes of Coriander were tested for their antifeedant activity against S*. litura* at two concentrations (5% and 10%). At 5% concentration of methanolic leaves extract, lowest feeding was observed with Pant haritima (8.68 cm^2) and maximum in UD-711 (17.65 cm^2) over control (MLAC=18.82 cm^2) at p=0.05. Pant haritima and UD-711 showed feeding percentage (34.72 and 70.6%), antifeedant activity (10.81 and 1.25%) and inhibition of feeding (36.87and 3.21%) respectively (Table 1, Fig. 1a).All the genotypes showed better resultat 10% concentrations (Table 1, Fig. 1b) as Pant haritima also found to be most effective as it showed minimum MLAC (5.08 cm^2) against *S. litura* at p=0.05 followed by the order UD-725 (7.07) < UD-722 (7.29) < UD-728 (8.02) < UD-721 (9.12) < PD-53 (9.21) < PD-52 (9.39) < UD-716 (10.28) < UD-643 (10.52) < UD-727 (11.00) < UD-704 (11.23) < PD-21 (11.48) < UD-720 (11.93) < UD-684 (12.06) < UD-699 (13.29) < UD-711 (13.96) < PD-51 (15.01). Pant haritima and PD-51 exhibited feeding percentage (20.32 and 60.04%), antifeedant activity (14.65 and 4.06%) and inhibition of feeding (57.49and 11.26%) respectively. On the basis of preference index Pant haritima was found to be strongly antifeedant, PD-52, PD-53, UD-643, UD-704, UD-716, UD-721, UD-722, UD-725, UD-727, UD-728, moderately antifeedant while remaining were slightly antifeedant.

For methanolic seed extracts (5%)Pant haritima and UD-711 were also showed minimum and maximum MLAC (cm^2) 7.97 and 17.09respectively over control (18.80) against *S. litura* at p=0.05. Feeding percentage, antifeedant activity and inhibition of feeding for Pant haritima and UD-711 were (31.88%, 11.56%; 40.46%) and (68.36%, 1.84%, 4.76%) respectively (Table 2, Fig. 2a). With increase in concentration at 10% (Table 2, Fig. 2b) all the plant extracts were found to be more effective than 5% concentration. MLAC for Pant haritima and PD-51 were found to be 4.20 cm^2 and 14.79cm^2 respectively over control following the order Pant haritima (4.20) < UD-725 (6.99) <UD-722 (7.04) < UD-728 (7.52) < PD-53 (8.92) < PD-52 (8.98) < UD-721 (9.00) < UD-643 (9.89) < UD-716 (10.00) < UD-727 (10.78) <UD-720 (10.79) < UD-704 (10.87) < PD-21 (11.20) < UD-684 (11.96) < UD-699 (13.17) UD-711 (13.24) < PD-51 (14.79). Feeding percentage, antifeedant activity and inhibition of feeding for Pant haritima and PD-51 were 16.80%, 59.16%; 15.58%, 4.30% and 63.48%, 11.94 respectively. On the basis of preference index, both methanolic leaves and seeds extract of Pant haritima and PD-51 were found to be strongly and slightly antifeedant respectively. On thebasis of preference index Pant haritima and UD-725 were strongly antifeedant, PD-21, PD-52, PD-53, UD-643, UD-704, UD-716, UD-720, UD-721, UD-722, UD-727, UD-728 moderately antifeedant while remaining were slightly antifeedant.Hence, Pant haritima is effective antifeedant for the feeding of the S.*litura* larvae and can be used for the management of this pest.

Discussions

Discovery of novel toxins and antifeedants from plant extracts has been recently reported as a potential method for the development of "ecologically safe pesticides" **(Wheeler, Isman, Sanchez-Vindas & Arnason, 2001).** Higher antifeedant index generally

indicate decreased rate of feeding. Antifeedant is a chemical that inhibits the feeding without killing the insect pests directly, while it remains near the treated foliage and dies through starvation **(Yasui, Kato & Yazawa, 1998; Pavunraj, Baskar & Ignacimuthu, 2012)**. According to **Isman, 2002,** the concept of using insect antifeedants as crop protectants is intuitively attractive. For most antifeedants, the mode of action are directed at the taste cells.There are ample discoveries for screening crude plant extracts for biological activity as botanical insecticides against lepidopterans. Results obtained from the leaf disc bioassays may be more reliable because the quality of plant's surface plays a crucial role in determining the acceptance or avoidance **(Chapman & Bernays, 1989; Lin, Binder & Hart, 1998)**. Crude extracts from the leaf, stem, root and seeds of various plant species have been reported to possess antifeedant, insecticidal, and growth inhibitory properties **(Ekesi, 2000).** These results suggest that there may be different compounds in extracts possessing different bioactivities, particularly antifeedant and toxicity of insect pests.Many researchers have reported crude extracts on S. *litura* **(Raja, Jeyasankar, Jeyakumar & Ignacimuthu, 2005; Kamaraj, Rahuman & Bagavan, 2008).**It was interesting to note from the present study that methanolic extract of Coriander leaves and seeds genotypes were effective as antifeedantagainst *S. litura*. Therefore, the present investigation clearly suggests the usage of plant.

Table1 Effect of Coriander genotypes leaf extracts on feeding of 8d old larvae of tobacco caterpillar, *Spodoptera litura* (Fab.)

S.No	Leaves	Conc.	MLAC (cm2)	Feeding percent	Antifeedant activity	Feeding Inhibition	Preference Index	Antifeedant category
1.	Pant haritima	10	5.08	20.32	14.65	57.49	0.43	Strongly
		5	8.68	34.72	10.81	36.87	0.63	Moderately
2.	PD-21	10	11.48	45.92	7.82	24.22	0.76	Slightly
		5	15.54	62.16	3.50	9.55	0.90	Slightly
3.	PD-51	10	15.01	60.04	4.06	11.26	0.89	Slightly
		5	17.00	68	1.94	5.08	0.95	Slightly
4.	PD-52	10	9.39	37.56	10.05	33.43	0.67	Moderately
		5	11.27	45.08	8.05	25.09	0.75	Moderately
5.	PD-53	10	9.21	36.84	10.24	34.28	0.66	Moderately
		5	11.39	45.56	7.92	24.59	0.75	Moderately
6.	UD-643	10	10.52	42.08	8.85	28.29	0.72	Moderately
		5	13.94	55.76	5.20	14.90	0.85	Slightly
7.	UD-684	10	12.06	48.24	7.21	21.89	0.78	Slightly
		5	16.80	67.2	2.15	5.67	0.94	Slightly
8.	UD-699	10	13.29	53.16	5.89	17.22	0.83	Slightly
		5	16.02	64.08	2.98	8.04	0.92	Slightly
9.	UD-704	10	11.23	44.92	8.09	25.26	0.75	Moderately
		5	14.59	58.36	4.51	12.66	0.87	Slightly
10.	UD-711	10	13.96	55.84	5.18	14.83	0.85	Slightly
		5	17.65	70.6	1.25	3.21	0.97	Slightly
11.	UD-716	10	10.28	41.12	9.10	29.35	0.71	Moderately
		5	13.55	54.2	5.62	16.28	0.84	Slightly
12.	UD-720	10	11.93	47.72	7.34	22.41	0.78	Slightly
		5	15.00	60	4.07	11.30	0.89	Slightly
13.	UD-721	10	9.12	36.48	10.34	34.72	0.65	Moderately
		5	12.04	48.16	7.23	21.97	0.78	Slightly
14.	UD-722	10	7.29	29.16	12.29	44.16	0.56	Moderately
		5	9.34	37.36	10.10	33.66	0.66	Moderately
15.	UD-725	10	7.07	28.28	12.52	45.38	0.55	Moderately
		5	9.00	36	10.47	35.30	0.65	Moderately
16.	UD-727	10	11.00	44	8.34	26.22	0.74	Moderately
		5	14.10	56.4	5.03	14.34	0.86	Slightly
17.	UD-728	10	8.02	32.08	11.51	40.24	0.60	Moderately
		5	10.00	40	9.40	30.60	0.69	Moderately
Control			18.82	-	-	-	-	Preferred
Cd value			.503	-	-	-	-	-
Sem±			.178	-	-	-	-	-
f-value			**	-	-	-	-	-

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Table2 Effect of Coriander genotypes seed extracts on feeding of 8d old larvae of tobacco caterpillar, *Spodoptera litura* (Fab.)

S.No	Seeds	Conc.	MLAC (cm2)	Feeding percent	Antifeedant activity	Feeding Inhibition	Preference Index	Antifeedant category
1.	Pant haritima	10	4.20	16.8	15.58	63.48	0.37	Strongly
		5	7.97	31.88	11.56	40.46	0.60	Moderately
2.	PD-21	10	11.20	44.8	8.12	25.33	0.75	Moderately
		5	15.11	60.44	3.95	10.88	0.89	Slightly
3.	PD-51	10	14.79	59.16	4.3	11.94	0.88	Slightly
		5	16.65	66.6	2.31	6.06	0.94	Slightly
4.	PD-52	10	8.98	35.92	10.49	35.35	0.65	Moderately
		5	10.75	43	8.6	27.24	0.73	Moderately
5.	PD-53	10	8.92	35.68	10.55	35.64	0.64	Moderately
		5	11.00	44	8.34	26.17	0.74	Moderately
6.	UD-643	10	9.89	39.56	9.52	31.06	0.69	Moderately
		5	12.39	49.56	6.85	20.55	0.79	Slightly
7.	UD-684	10	11.96	47.84	7.31	22.24	0.78	Slightly
		5	15.28	61.12	3.77	10.33	0.90	Slightly
8.	UD-699	10	13.17	52.68	6.02	17.61	0.82	Slightly
		5	15.90	63.6	3.11	8.36	0.92	Slightly
9.	UD-704	10	10.87	43.48	8.47	26.73	0.73	Moderately
		5	13.90	55.6	5.24	14.98	0.85	Slightly
10.	UD-711	10	13.24	52.96	5.95	17.35	0.83	Slightly
		5	17.09	68.36	1.84	4.76	0.95	Slightly
11.	UD-716	10	10.00	40	9.4	30.56	0.69	Moderately
		5	12.29	49.16	6.96	20.94	0.79	Slightly
12.	UD-720	10	10.79	43.16	8.56	27.07	0.73	Moderately
		5	14.92	59.68	4.16	11.51	0.88	Slightly
13.	UD-721	10	9.00	36	10.47	35.25	0.65	Moderately
		5	11.79	47.16	7.49	22.92	0.77	Slightly
14.	UD-722	10	7.04	28.16	12.56	45.51	0.54	Moderately
		5	9.13	36.52	10.33	34.62	0.65	Moderately
15.	UD-725	10	6.99	23.96	13.68	51.67	0.48	Strongly
		5	8.72	34.88	10.77	36.63	0.63	Moderately
16.	UD-727	10	10.78	43.12	8.57	27.11	0.73	Moderately
		5	13.57	54.28	5.6	16.16	0.84	Slightly
17.	UD-728	10	7.52	30.08	12.04	42.86	0.57	Moderately
		5	9.03	36.12	10.43	35.11	0.65	Moderately
Control			18.80	-	-	-	-	Preferred
Cd value			.523					
Sem±			.185					
f-value			**					

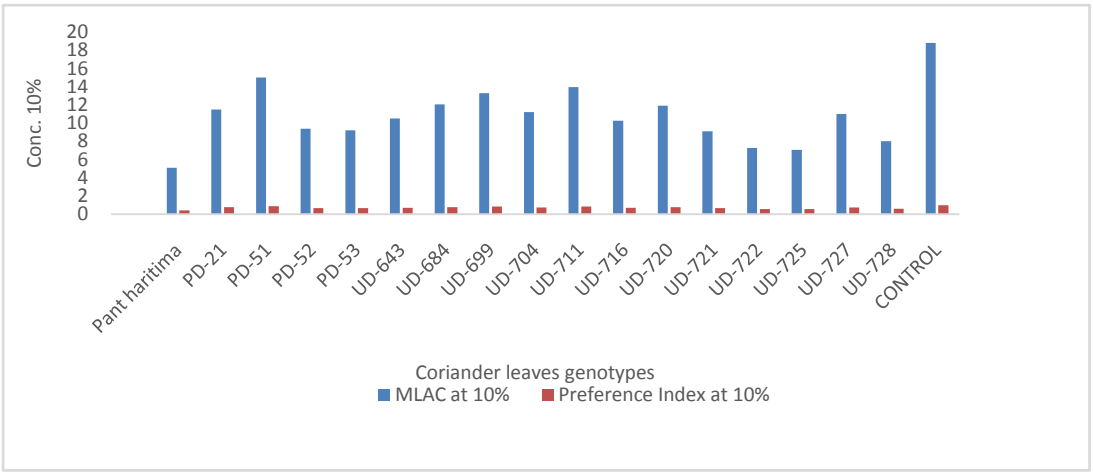

Fig 1a: MLAC and Preference Index of Coriander leaves genotypes at 10% conc.

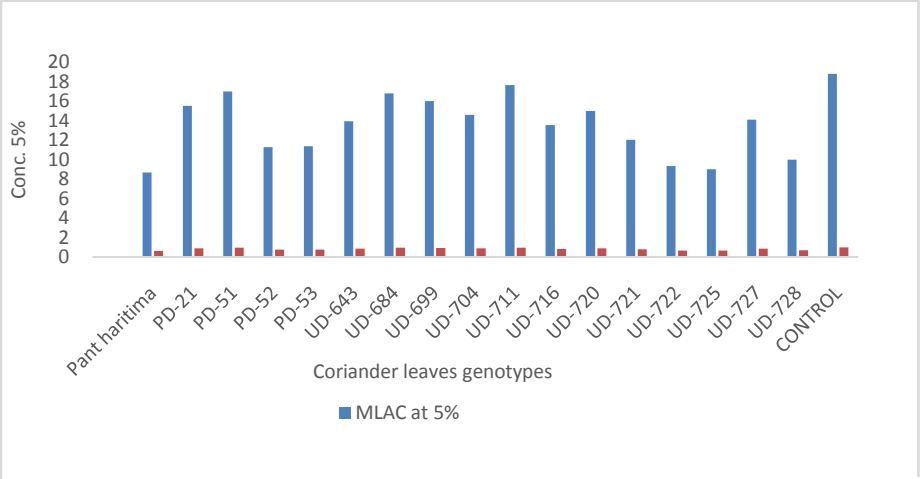

Fig 1b: MLAC and Preference Index of Coriander leaves genotypes at 5% conc.

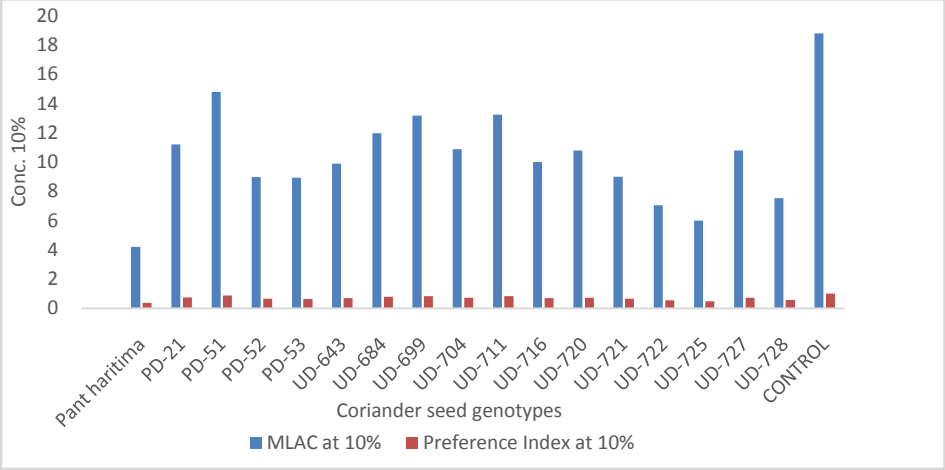

Fig 2a: MLAC and Preference Index of Coriander seed genotypes at 10% conc.

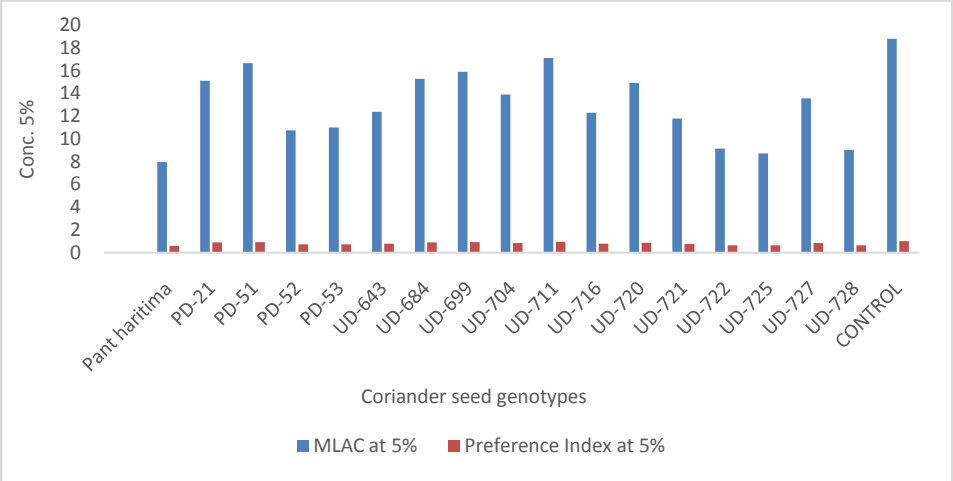

Fig 2b: MLAC and Preference Index of Coriander seed genotypes at 5% conc.

Conclusion

In present investigation it was concluded that at 5% and 10% concentration, both methanolic leaves and seeds extract of Pant haritima was found to be most effective antifeedant against *S. litura*and with increase in concentration (i.e. 10%) activity of Pant haritima increased from moderately to strongly.

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