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EFFICACY OF CERTAIN BOTANICAL INSECTICIDES AGAINST SHOOT AND FRUIT BORER, *LEUCINODES ORBONALIS* (GUENEE) ON BRINJAL (*SOLANUM MELONGENA* L.)

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ABSTRACT
Field experiments were carried out during *Rabi* season of 2013-14 on relative efficacy of different botanical products with an insecticide for shoot and fruit borer (*Leucinodes orbonalis*) of brinjal. The result showed that the four applications of Cypermethrin 0.05%, Pungam oil 2%, Nimbicidene 0.4% and Iluppai oil 2% was found at par each other most effective. Which caused lowest mean infestation of shoot damage, (5.80, 5.88, 6.86 and 7.13) per cent, and Cypermethrin 0.05% and Iluppai oil 2% fruit infestation was recorded (10.29 and 10.63) per cent. It was followed by Neem oil 2% and NSKE 5%, (9.07 and 10.26) per cent mean infestation of shoot, respectively and were at par with each other and the Nimbicidine 0.4% and Pungam oil 2% observed (11.97 and 11.98) per cent fruit damage at par each other, and followed by Neem oil 2%, NSKE 5% and garlic extract 3% were found moderately effective being (15.12, 16.45 and 18.82) per cent fruit damage, respectively.

INTRODUCTION

The eggplant or brinjal (*Solanum melongena* L.) is one of the most important solanaceous vegetables in South-East Asian countries. The major brinjal growing states in India are Andhra Pradesh, Karnataka, West Bengal, Tamil Nadu, Maharashtra, Orissa, Uttar Pradesh, Bihar and Rajasthan. Globally, India ranks second and China ranks first in the production of brinjal (57.9% of world output). In India, this crop occupies 71.13 lakh hectare area along with annual production of 135.57 (lakh tone) and productivity 19.1 MT per hectare. In Uttar Pradesh, the area under cultivation of brinjal is 3430 hectare producing 111.70 MT and the productivity is 8 MT/ha (Anonymous, 2013). Hence, it is subjected to attack by number of insect pest's right from nursery stage till harvesting (Regupathy *et al.*, 1997). Among the insect pests infesting brinjal, the major insect is the shoot and fruit borer, *Leucinodes orbonalis* (Guen.). The major constraints in economic cultivation of brinjal, insect pest infestation are a major bottleneck which poses threat for its production (Kaur *et al.,* 2014). Mall *et al.* (1992) reported that the shoot and fruit borer (on shoot) were more prevalent during vegetative phase of crop. The yield loss by this pest varied from 0.08-1.11 q/ha on the basis of inconsumable pest of damaged fruits and 0.46-3.80 q/ha when whole of the damaged fruits were taken into consideration. Singh *et al.* (2000) reported that the borer infestation was 78.66% on top shoots in vegetative phase and then shifted to flowers and fruits with infestation reaching 66.66% in fruiting phase. Several insecticides belonging to various groups such as synthetic pyrethroides, organophosphate, organochlorine and carbamate have been recommended for management of this pest in various part of country (Khaire *et al.,* 1986; Pawar *et al.,* 1987). However, their indiscriminate use have created several problems to ecosystem resulted in environmental pollution, pest resistance, pest resurgence, residual toxicity *etc*. (Kuppuswamy and Balasubramanian, 1980). Keeping in view the quantum of pesticides applied in brinjal crop in this region, the investigations were undertaken on evaluation of validity of efficacy of botanical insecticides against major insect pests of brinjal with the objective, to find out the efficacy of different botanical pesticides against shoot and fruit borer (*L. orbonalis*) of brinjal.

MATERIALS AND METHODS

The present investigation was undertaken to evaluate efficacy of botanical insecticides against shoot and fruit borer on brinjal at Central Research Farm, Sam Higginbttom Institute of Agricultural technology and Science, Alllahabad. Field trial was laid out in randomized block design (RBD) with 3 replication and 8 treatments including untreated control during *rabi* 2013-14 to evaluate the efficacy of six botanical insecticides *i.e.,* Pungum oil 2%, Ilupai oil 2%, Nimbicidene 0.4%, Neem oil 2%, NSKE 5%, Garlic extract 3%, and with compared Cypermethrin 0.05% against shoot and fruit borer on brinjal. Crop was raised in plots measuring 2 x 2 m with a spacing 75 x 60 cm between rows and plants, respectively.

Transplanting was done on December 10th in 2013. Crop was raised according to all recommended agronomic package of practices under irrigated condition except the plant protection measure. Four rounds of insecticidal spray of different treatment were imposed on need basis during the crop season. All the treatments were imposed by using hand compression sprayer. First spray was given 37 days after transplanting (16th January, 2014) and the remaining sprays was given at fortnightly intervals (31th January,15th February and 2nd March 2014 respectively) between each spray, depending upon adult population build up. The spraying was done during evening hours and care was taken to avoid drift of insecticides. No sprays were given in untreated control. The data on fruit damage was recorded by following the method of Ragini *et al.* (2006) and Bhushan *et al.* (2011).

$$\text{Percent shoot infestation} = \frac{\text{Number of infested shoots}}{\text{Total number of shoots}} \times 100$$

$$\text{Percent fruit infestation} = \frac{\text{Number of infested fruits}}{\text{Total number of fruit}} \times 100$$

Statistical analysis

All the data generated in the present study were subjected to statistical analysis following standard procedure (Snedecor and Cochran, 1968).The percent infestation of shoot and fruit borer population over control was worked out in order to judge and express the efficacy of the respective treatments against shoot and fruit borer infesting the crop. The data on percent infestation in shoot and fruit borer population over control were later subjected to statistical analysis. Fruits were harvested from each plot separately and yield per plant each picking was recorded in kg. Total yield was worked out by adding the yield of each picking. The yield per plot was converted to quintals per hectare. All the data were subjected to the statistical analysis following standard methods.

RESULTS AND DISCUSSION

Percent shoot infestation

All the treatments were found significantly superior over control. Cypermethrin (10.50%) was found the most effective and gave least % infestation *L. orbonalis* followed by Pungam oil, Iluppai oil, Nimbicidine, Neem oil, Nske and Garlic extract. Pooled analysis (Table 1) showed that the plots treated with Cypermethrin lowest (11.08) percent shoot infestation and it was at par with Pungam oil, Nimbicidine and Iluppai oil (12.20, 12.65 and 13.63, respectively) and followed by Neem oil, NSKE and Garlic extract (14.95, 18.05 and 18.83, respectively) shoot infestation was recorded. Pungan oil, Nimbicidine and Iluppai oil were non-significant and statistically at par with each other also Neem oil were non-significant and statistically at par with each other. NSKE and Garlic extract was found least effective among all the treatments in mean percent infestation. In this study the similar results was also correlated with the finding of Gahukar and Balpande, 1997. Pooled analysis of second spray showed that the plots treated with

Table 1: Efficacy of certain botanical insecticides against shoot and fruit borer *Leucinodes orbonalis (Guenee.)* on brinjal

Treatment	% Infestation First Spray				% Infestation Second Spray			
	3 DAS	7 DAS	14 DAS	Pooled	3 DAS	7 DAS	14 DAS	Pooled
T_1 Neem oil 2 %	15.63	15.01	14.25	14.95	14.07	10.26	9.32	11.22
T_2 NSKE 5 %	17.47	17.87	18.82	18.05	12.45	11.78	12.1	12.11
T_3 Iluppai oil 2 %	14	12.9	14	13.63	11.44	9.18	8.08	9.57
T_4 Pungam oil 2 %	13.59	12.51	10.5	12.2	11.2	4.49	3.8	6.5
T_5 Nimbicidine 0.4 %	14.17	12.04	11.73	12.65	11.46	8.01	5.9	8.46
T_6 Garlic extract 3 %	19.97	20.45	16.06	18.83	16.44	15.13	9.55	13.71
T_7 Cypermethrin 0.05 %	10.5	9.07	13.66	11.08	7.91	8.97	6.86	7.91
T_8 Untreated	28.04	27.47	31.71	29.07	30.47	31.71	28.09	30.09
Overall Mean	16.67	15.92	16.34	16.31	14.43	12.44	10.46	12.44
F- test	S	S	S	S	S	S	S	S
S. Ed. (±)	0.75	1.08	1.12	1.42	0.66	1.24	1.17	1.09
C. D. (p = 0.05 %)	1.62	2.33	2.4	3.04	1.41	2.66	2.51	2.34

Table 1: Cont.....

Treatment	% Infestation Third Spray				% Infestation Fourth Spray				Over all Infestation
	3 DAS	7 DAS	14 DAS	pooled	3 DAS	7 DAS	14 DAS	Pooled	Pooled Mean
T_1 Neem oil 2 %	12.63	5.13	3.85	7.2	4.86	3.85	0	2.9	9.07
T_2 NSKE 5 %	10	5.61	5.7	7.1	5.73	3.3	2.31	3.78	10.26
T_3 Iluppai oil 2 %	7.96	2.27	3.46	4.56	2.27	0	0	0.76	7.13
T_4 Pungam oil 2 %	5.48	5.6	1.15	4.08	2.22	0	0	0.74	5.88
T_5 Nimbicidine 0.4 %	7.85	4.56	5.46	5.96	1.15	0	0	0.38	6.86
T_6 Garlic extract 3 %	9.9	8.9	8.45	9.08	7.24	4.61	3.5	5.12	11.69
T_7 Cypermethrin 0.05 %	3.42	2.22	4.52	3.39	0	1.15	1.28	0.81	5.8
T_8 Untreated	28.46	32.56	28.95	29.99	28.86	26.56	25.32	26.91	29.02
Overall Mean	10.71	8.36	7.69	8.92	6.54	4.93	4.05	5.17	10.71
F- test	S	S	S	S	S	S	S	S	S
S. Ed. (±)	1.19	1.3	1.21	1.8	1.36	0.76	0.97	0.88	1.29
C. D. (p = 0.05 %)	2.55	2.8	2.59	3.85	2.92	1.63	2.08	1.89	2.69

Table 2: Infestation of *Leucinodes orbonalis* at various picking stages on weight basis

S. No.	Treatment	Percent Infestation 1st picking	2nd picking	3rd picking	4th picking
T_1	Neem oil 2 percent	18.20	17.42	15.08	9.78
T_2	NSKE 5 percent	21.11	16.62	16.37	11.70
T_3	Iluppai oil 2 percent	15.84	11.06	7.29	8.31
T_4	Pungan oil 2 percent	16.91	14.21	8.13	8.66
T_5	Nimbicidine 2 percent	13.14	14.39	11.08	9.28
T_6	Garlic extract 2 percent	20.83	19.85	18.81	14.19
T_7	Cypermethrin 0.05 percent	10.41	11.21	10.03	9.52
T_8	Control (Water spray)	30.65	38.07	40.80	39.27
	Overall Mean	18.38	17.85	15.95	13.84
	F- test	S	S	S	S
	S. Ed. (±)	1.19	1.10	1.03	0.89
	C. D. (p = 0.05 %)	2.55	2.35	2.21	1.90

Pungam oil lowest (6.50) percent shoot infestation and it was at par with Cypermethrin (7.91) and Nimbicidine (8.46) and followed by Illuppai oil, Neem oil, NSKE and Garlic extract (9.57, 11.22, 12.11 and 13.71) shoot infestation was recorded respectively. Cypermethrin and Nimbicidine were non-significant and statistically at par with each other also Iluppai oil were non-significant and statistically at par with each other. Illuppai and neem oil were non-significant were non-significant and statistically at par with each other. NSKE and Garlic extract was found least effective among all the treatments in mean percent infestation. In this study the similar results was also correlated with the finding of Gahukar and Balpande, 1997; Raja *et al.,* 1998 and Sangappa, 1999.

Pooled analysis of third spray showed that the plots treated with Cypermethrin lowest (3.39) percent shoot infestation and it was at par with Pungam oil (4.08), Illuppai oil (4.56), Nimbicidine (5.96), NSKE (7.10) and Neem oil (7.20) and followed by Garlic extract (9.08) per cent shoot infestation was recorded respectively, Nimbicidine NSKE and Neem oil were non-significant and statistically at par with each other also Garlic extrect were non-significant and statistically at par with each other. Illuppai and neem oil were non-significanwere non-significant and statistically at par with each other. In this study the similar results was also correlated with the finding of Raja *et al.,* 1998 and Sangappa, 1999. The above same pattern of result was also found in fourth spray of botanical pesticides.

Result of overall pooled of four sprays (Table 1) revealed that the lowest percent shoot infestation (5.80) observed in plots treated with Cypermethrin and it was at par with Pungam oil (5.88), Nimbicidine (6.86) and Illuppai oil (7.13). The moderate effective was found in treatment Neem oil (9.07) and NSKE (10.26) and highest shoot infestation was recorded Garlic extract (11.69) least effective.

Percent fruit damage

The minimum percent fruit infestation of (10.41) was recorded with cypermethrin 0.05 percent followed by Nimbicidine 0.4, Iluppai oil 2, Pungam oil 2t, Neem oil 2, Garlic extract 3, NSKE 5 percent and control with 13.14,15.84, 16.91, 18.20, 20.83, 21.11 and 30.65 percent infestation, respectively at 1st picking stage. At 2nd picking stage the minimum infestation (11.06 %) was recorded in treatment Iluppai oil 2 percent followed by cypermethrin 0.05, Pungam oil 2, Nimbicidine 0.4, NSKE 5, Neem oil 2 and Garlic extract 3 percent and untreated with 11.21, 14.21, 14.39, 16.62, 17.42, 19.85 and 37.07 percent infestation, respectively. At 3rd picking stage the minimum infestation (7.29 %) was recorded in Iluppai oil 2 percent followed by treatments Pungam oil 2, Cypermethrin 0.05, Nimbicidine 0.4, Neem oil 2, NSKE 5, Garlic extract 3 percent and control with 8.13, 10.03, 11.08, 15.08, 16.37, 18.81 and 40.80 percent infestation, respectively. During the final picking stage the least infestation (8.31 %) was recorded with treatment Iluppai oil 2 percent followed by treatments Pungam oil 2, Nimbicidine 0.4, Cypermethrin 0.05, Neem oil 2, NSKE and Garlic extract 3 percent and control with 8.66, 9.28, 9.52, 9.78, 11.70, 14.19 and 39.27 percent infestation, respectively (Table 2). In this study the similar results was also correlated with the finding of Gahukar and Balpande 1997; Raja *et al.,* 1998 and Sangappa 1999.

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