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Bio-efficacy of different New Insecticidal Molecules and Botanicals against Hadda Beetle, *Henosapilachna vigintioctopunctata* on Brinjal

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ABSTRACT

The present study was conducted to find out the bio-efficacy of different new molecules and botanicals against Hadda beetle, *Henosapilachna vigintioctopunctata* on brinjal during *Rabi*, 2017-18 at Research Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner. The evaluation of bioefficacy of nine new molecules and botanicals against *Henosapilachna vigintioctopunctata* revealed that the treatment spinosad (0.02%) proved to be most effective in reducing the pest population followed by indoxacarb (0.001%), emamectin benzoate (0.002%) and quinalphos (0.05%). Cartap hydrochloride (0.1%) and malathion (0.1%) were in moderate in efficacy. Khimp extract (5%) proved least effective followed by garlic extract (5%) and NSKE (5%). The decreasing order of efficacy of the tested chemicals was spinosad, indoxacarb, emamectin benzoate, quinalphos, cartap hydrochloride, malathion, NSKE, garlic extract and khimp extract.

Key Words: Bio-efficacy, Botanicals, Hadda beetle, Brinjal, Spinosad, Khimp

INTRODUCTION

Brinjal (*Solanum melongena* L.) is an important vegetable crop of tropical and subtropical region. It contains good amounts of many essential B-complex groups of vitamins such as pantothenic acid (vitamin B_5), pyridoxine (vitamin B_6), thiamine (vitamin B_1) and niacin (B_3). The management of *H. vigintioctopunctata* was based on synthetic pesticides due to their quick and knock down action (Jagan Mohan, 1985; Ghosh, 1986; Samanta *et al,* 1999; Liu *et al,* 2003). The frequent and indiscriminate application of these pesticides in the vegetable fields has resulted into widespread development of resistance, undesirable effects on non-target organisms, presence of toxic residues in food, environmental and health hazards (Subramanyam and Hagstrum, 1995). The ecological factors existing in the crop eco-system play an important role in bionomics, distribution of the pest and also in its management.

MATERIALS AND METHODS

Present investigation on bio-efficacy of new insecticidal molecules / botanical against hadda beetle, *H. vigintioctopunctata* was conducted on brinjal (variety Br-112) at the Research farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Rabi*, 2017-18. The experiment was laid out in a simple randomized block design with ten treatments including control (untreated), each replicated thrice. The seedlings of brinjal were transplanted in the field in the last week of November during *Rabi,* 2017-18 in the plots measuring 3.0 x 3.0 m^2 keeping 0.60 and 0.50m row to row and plant to plant distance, respectively. The recommended package of practices was followed for raising the crop. The spraying of insecticides was done based on the status of pest population. A tentative ETL of 3-4 grubs/ adults per plant was taken for spray decision. Two sprays of each treatment were applied

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Table 1. Bio-efficacy of new insecticidal molecules and botanicals against grubs of hadda beetle, *H. vigintioctopunctata* on brinjal during *Rabi,* 2017-18 (First spray).

Sr. No.	Treatment	Conc. (%)	Mean per cent reduction in grub population				Mean
			3 DAS	7 DAS	10 DAS	15 DAS	
1	Indoxacarb 14.5 SC	0.001	74.63 (59.89)	83.46 (66.34)	77.57 (61.92)	56.97 (49.03)	73.15
2	Spinosad 45 SC	0.02	76.22 (61.09)	85.14 (68.01)	79.20 (63.22)	58.39 (49.89)	74.73
3	Emamectin benzoate 5 SG	0.002	71.68 (57.90)	80.52 (63.93)	74.63 (59.82)	54.00 (47.30)	70.20
4	Quinalphos 25 EC	0.05	70.98 (57.45)	79.66 (63.26)	73.87 (59.31)	53.64 (47.10)	69.53
5	Cartap hydrochloride 50 SP	0.1	50.96 (45.62)	59.63 (50.81)	53.85 (47.34)	35.94 (36.59)	50.09
6	Malathion 50 EC	0.1	49.70 (44.79)	58.53 (50.04)	52.64 (46.54)	34.39 (35.49)	48.81
7	NSKE*	5.0	31.27 (33.90)	40.01 (39.20)	34.18 (35.70)	15.15 (22.59)	30.15
8	Khimp (*Leptadenia pyrotechnica*) Extract	5.0	26.53 (30.77)	35.44 (36.43)	29.50 (32.72)	13.29 (20.90)	26.19
9	Garlic cloves Extract	5.0	30.15 (33.23)	38.91 (38.56)	33.07 (35.05)	14.96 (22.45)	29.27
10	Control	-	0.0	0.0	0.0	0.0	0.0
	S.Em±	-	3.23	3.40	3.25	3.29	0.0
	CD(0.05)	-	9.60	10.13	9.68	9.79	0.0

Figures in parenthesis are angular transformed values, DAS = Days after spray, *Neem Seed Kernel Extract

for controlling this pest using Knap-sack sprayer, second spray was done twenty one days after first spray. The quantity of water @ 400 l/ha was used in each spray. Pre- treatment count of hadda beetle was done by counting the number of damaging stages of the insect pests *viz.,* grubs/ adults which were recorded on 5 randomly selected plants from each replication 1-day before spraying. Similarly post treatment observations were recorded after 3-, 7-, 10- and 15-days of spraying from 5 randomly selected plants from each treatment including the control. One top, one middle and one bottom leaf / plant were randomly selected for counting the population. The average of these 5 observations in each replication before and after treatment was taken for further statistical analysis to determine and compare the efficacy of pesticides used in these treatments. The data obtained 1- day before and 3-, 7-,10- and 15-days after spray were taken into consideration to find out the per cent reduction in grubs and adults of hadda beetle as per method given by Henderson and Tilton (1955) referring it to be a modification of Abbott's formula (1925). The statistical analysis (analysis of variance) of the data was carried out by transforming the per cent reduction data into angular transformation values (Gomez and Gomez, 1976).

The above botanicals locally available in the vicinity were collected in appropriate quantities and brought into the laboratory. Plant sap of collected

Table 2. Bio-efficacy of new insecticidal molecules and botanicals against grubs of hadda beetle, *H. vigintioctopunctata* on brinjal during *Rabi*, 2017-18 (Second Spray).

Sr. No.	Treatment	Conc. (%)	Mean per cent reduction in grub population				Mean
			3 DAS	7 DAS	10 DAS	15 DAS	
1	Indoxacarb 14.5 SC	0.001	71.69 (57.96)	79.04 (62.97)	69.33 (56.46)	55.79 (48.34)	68.96
2	Spinosad 45 SC	0.02	73.25 (59.07)	80.68 (64.34)	70.87 (57.51)	57.20 (49.19)	70.5
3	Emamectin benzoate 5 SG	0.002	68.73 (56.04)	76.10 (60.81)	66.37 (54.59)	52.82 (46.62)	66.00
4	Quinalphos 25 EC	0.05	68.09 (55.65)	75.32 (60.27)	65.78 (54.23)	52.48 (46.43)	65.41
5	Cartap hydrochloride 50 SP	0.1	48.07 (43.91)	55.30 (48.20)	45.76 (42.53)	34.78 (35.86)	45.97
6	Malathion 50 EC	0.1	46.76 (43.05)	54.12 (47.41)	44.40 (41.65)	33.22 (34.73)	44.62
7	NSKE*	5.0	28.35 (32.06)	35.64 (36.59)	26.02 (30.53)	13.98 (21.59)	25.99
8	Khimp (*Leptadenia pyrotechnica*) Extract	5.0	23.55 (28.73)	30.99 (33.67)	21.18 (27.02)	12.10 (19.79)	21.95
9	Garlic cloves Extract	5.0	27.23 (31.36)	34.53 (35.94)	24.89 (29.82)	13.79 (21.45)	25.11
10	Control	-	0.00	0.00	0.00	0.00	-
	S.Em±	-	2.226	3.282	3.239	3.344	-
	CD(0.05)	-	9.59	9.75	9.63	9.94	-

Figures in parenthesis are angular transformed value

DAS = Days after spray

*Neem Seed Kernel Extract

material was extracted with juice extracting machine by adding water as needed and was soaked overnight in sufficient quantity of water. Then filtered through muslin cloth and stored in capped bottles under room temperature. The volume was made up by adding the required quantity of water to get 5 per cent solution (Kumar *et al,* 2000). Sandoval at one ml per liter of spray solution was also used as surfactant.

RESULTS AND DISCUSSION

The reduction in *H. vigintioctopunctata* population ranged from 26.53 to 76.22 and 23.55 to 73.25 per cent in different treatments after first and second spray of insecticides and botanicals, respectively. All the treatments were found significantly superior over untreated control. The minimum reduction was recorded in khimp extract (26.53 and 23.55%), garlic extract (30.15 and % 27.23) and NSKE (31.27 and 28.35%) treated plots which were found at par to each other, whereas, the maximum reduction was recorded in the plots treated with spinosad (76.22 and 73.25%) followed by indoxacarb (74.63 and 71.69%), emamectin benzoate (71.68 and 68.73%) and quinalphos (70.98 and 68.09%) after first and second spray, respectively however, these treatments formed a non significant group. The present results were in conformity with

Table 3. Bio-efficacy of new insecticidal molecules and botanicals against adults of hadda beetle, *H. vigintioctopunctata* on brinjal during *Rabi,* 2017-18 (First spray)

Sr. No.	Treatment	Conc. (%)	Mean per cent reduction in adult population				Mean
			3 DAS	7 DAS	10 DAS	15 DAS	
1	Indoxacarb 14.5 SC	0.001	78.25 (62.40)	86.40 (68.87)	79.93 (63.61)	53.43 (46.98)	74.50
2	Spinosad 45 SC	0.02	79.88 (63.73)	88.11 (70.92)	81.58 (65.03)	54.82 (47.80)	76.10
3	Emamectin benzoate 5 SG	0.002	75.30 (60.28)	83.47 (66.18)	76.98 (61.42)	50.46 (45.27)	71.55
4	Quinalphos 25 EC	0.05	74.54 (59.75)	82.55 (65.39)	76.19 (60.85)	50.17 (45.10)	70.86
5	Cartap hydrochloride 50 SP	0.1	54.52 (47.73)	62.52 (52.59)	56.16 (48.72)	32.47 (34.40)	51.41
6	Malathion 50 EC	0.1	53.32 (46.94)	61.48 (51.82)	55.00 (47.93)	30.86 (33.17)	50.16
7	NSKE*	5.0	34.85 (36.11)	42.93 (40.91)	36.52 (37.11)	11.65 (19.23)	31.48
8	Khimp (*Leptadenia pyrotechnica*) Extract	5.0	30.18 (33.15)	38.42 (38.23)	31.88 (34.23)	9.73 (17.34)	27.55
9	Garlic cloves Extract	5.0	33.74 (35.46)	41.83 (40.28)	35.41 (36.47)	11.45 (19.27)	30.60
10	Control	-	0.00	0.00	0.00	0.00	-
	S.Em±	-	3.26	3.57	3.30	3.48	-
	CD(0.05)	-	9.71	10.61	9.81	10.34	-

Figures in parenthesis are angular transformed values

DAS = Days after spray

*Neem Seed Kernel Extract

that of Singh *et al* (2009) who found spinosad and indoxacarb significantly superior over rest of the treatments in reducing *H. vigintioctopunctata.* The other treatments resulted in the middle order in exhibiting the *H. vigintioctopunctata* reduction. The decreasing trend of efficacy of the tested treatments was found to be in the order of spinosad, indoxacarb, emamectin benzoate, quinalphos, cartap hydrochloride, malathion, NSKE, garlic extract and khimp extract (Table 1, 2).

After seven days of first application, the maximum reduction was recorded in plots treated with spinosad (85.14 and 80.68%) followed by indoxacarb (83.46 and 79.04%), emamectin benzoate (80.52 and 76.10%), quinalphos (79.66 and 75.32%) after first and second spray, respectively which was found significantly superior over rest of the treatments. Verma *et al* (2010) also reported spinosad 45 SC to be ineffective against hadda beetle since the population of this insect was at par with those in the untreated control. The minimum reduction in *H. vigintioctopunctata* population was recorded in plots treated with khimp extract, garlic extract and NSKE however, these treatments were found at par with each other. Similar observations have also been recorded by Mane and Kulkami

Table 4 Bio-efficacy of new insecticidal molecules and botanicals against adults of hadda beetle, *H. vigintioctopunctata* on brinjal during *Rabi*, 2017- 18 (Second spray).

Sr. No.	Treatment	Conc. (%)	Mean per cent reduction in adult population				Mean	Mean Yield q/ ha
			3 DAS	7 DAS	10 DAS	**15 DAS**		
1	Indoxacarb 14.5 SC	0.001	77.07 (61.56)	84.93 (67.57)	78.75 (62.75)	53.99 (47.31)	73.68	303
2	Spinosad 45 SC	0.02	78.69 (62.85)	86.63 (69.39)	80.39 (64.11)	55.98 (48.45)	75.42	307*
3	Emamectin benzoate 5 SG	0.002	74.13 (59.49)	81.99 (65.04)	75.81 (60.61)	51.30 (45.74)	70.80	298
4	Quinalphos 25 EC	0.05	73.38 (58.99)	81.10 (64.31)	75.03 (60.08)	49.91 (44.95)	69.85	291
5	Cartap hydrochloride 50 SP	0.1	53.36 (47.04)	61.08 (51.70)	55.01 (48.03)	34.28 (35.16)	50.93	286
6	Malathion 50 EC	0.1	52.14 (46.24)	60.00 (50.93)	53.82 (47.23)	34.24 (35.74)	50.05	279
7	NSKE*	5.0	33.69 (35.40)	41.47 (40.05)	35.35 (36.41)	16.84 (22.91)	31.83	273
8	Khimp (*Leptadenia pyrotechnica*) Extract	5.0	28.99 (32.39)	36.93 (37.33)	30.69 (33.48)	13.88 (21.70)	27.62	268
9	Garlic cloves Extract	5.0	32.57 (34.74)	40.37 (39.42)	34.24 (35.76)	15.98 (23.34)	30.79	270
10	Control	-	0.00	0.00	0.00	0.00	-	261
	S.Em±	-	3.251	3.479	3.277	3.313	-	2.4
	CD(0.05)	-	9.66	10.34	9.74	9.85	-	7.3

Figures in parenthesis are angular transformed values

DAS = Days after spray

**Neem Seed Kernel Extract*

(2010) who reported that NSKE was most effective treatment against *H. vigintioctopunctata.* The other treatments of cartap hydrochloride and malathion were in the middle order of efficacy. Kodandaram *et al* (2014) revealed that cartap hydrochloride was effective treatment in reducing the population of *H. vigintioctopunctata.* The decreasing pattern of the efficacy was found to be in order of spinosad, indoxacarb, emamectin benzoate, quinalphos, cartap hydrochloride, malathion, NSKE, garlic extract, and khimp extract (Table1, 2). The efficacy and superiority of emamectin benzoate observed during the present study was in similar line with the results obtained by Kodandaram *et al* (2014) who reported that emamectin benzoate recorded higher efficacy on grubs and adults *H. vigintioctopunctata.* These results were in agreement to that of Sharma and Kaushik (2010) who observed cartap hydrochloride was the most effective treatment for the controlling *H. vigintioctopunctata*. The decreasing order of *H. vigintioctopunctata* reduction was observed in the treatments are spinosad, indoxacarb, emamectin benzoate, quinalphos, cartap hydrochloride, malathion, NSKE, garlic extract, khimp extract(Table 1,2). The present finding were in agreement with the finding of Chandranath and Katti (2010) who have mentioned that using NSKE for the control of *H. vigintioctopunctata* in field condition were highly effective, and could be a good alternative to chemical insecticides.

The data (Table 4) revealed that all the treatments gave significantly higher yield over control. The maximum yield of brinjal was obtained from the plots treated with spinosad (307 q/ha) followed by indoxacarb (303 q/ha), emamectin benzoate (298 q/ha) and quinalphos (291 q/ha) and these were found statistically at par to each other. The next best treatments were cartap hydrochloride (286 q/ha) and malathion (279 q/ha). The minimum yield of brinjal was obtained from the treatment of khimp extract (268 q/ha) followed by garlic extract and NSKE (273 q/ha) (Table 4). The order of effectiveness of insecticides on the basis of brinjal yield was found to be spinosad, indoxacarb, emamectin benzoate, quinalphos, cartap hydrochloride, malathion, NSKE, garlic extract and khimp extract.

CONCLUSION

The treatment spinosad (0.02%) proved to be most effective in reducing the pest population followed by indoxacarb (0.001%), emamectin benzoate (0.002%) and quinalphos (0.05%). Khimp extract (5%) proved least effective followed by garlic extract (5%) and NSKE (5%). All the new molecules and botanicals increased the marketable yield of brinjal significantly over the control. The maximum brinjal yield was recorded in the plots treated with spinosad.

REFERENCES

Abdul Afiq M J, Abdul Rahman R, Che Man Y B, AL-Kahtani H A and Mansor T S T (2013). Date seed and date seed oil. *Int Food Res J* **20**(5): 2035- 2043.

Abbott W S (1925). A method of computing the effectiveness of an insecticide. *J Econ Ento* **18:** 265-267.

Chandranath H T and Katti P (2010). Management of Epilachna beetle on ashwagandha. *Karnataka J Agric Sci* **23** (1): 171.

Ghosh M R (1986). Results of preliminary trial on control of pest complex of brinjal. *Pestology* **10**(1): 25.

Gomez K A and Gomez A A (1976). Problem data. *Statistical Proc Agric Res* (2^{nd} Ed.), John Wiley and Sons, New York, 272-315.

Henderson C F and Tilton E W (1955). Tests with acaricides against the brow wheat mite. *J Econ Ento* **48:**157-161.

Jagan Mohan N (1985). Control of *Epilachna* and fruit borer on brinjal. *Pesticides* **19**(7): 32-33.

Kodandarm M H, Haldar J and Rai A B (2014). New insecticides molecules and entomopathogens against hadda beetle, *Henosepilachna vigintioctopunctata* (Fab.) infesting vegetable cowpea. *Indian J Pl Prot* **42**(4): 333-337.

Kumar A R V, Jayappa J and Chandrashekra K (2000). Relative insecticidal value: An index for identifying neem trees with high insecticidal yield. *Curr Sci* **79** (10): 1474-1478.

Liu D Q, Wang S M, Xin S R and Li S Y (2003). A study on efficacy of different insecticides on control on egg plant, *Henosepilachna vigintioctopunctata* (Fab). *Agric Universitatis Jeangxiensis* **25**(4): 574-576.

Mane P D and Kulkami S N (2010). Bio-efficacy of neem products against *Epilachna vigintioctopuncatata* Fab. on brinjal. *Green Farming* **1**(3): 330.

Samanta A, Roy P, Das A K, Majumdar D and Somchoudhary A K (1999). Bioefficacy of a new formulation of quinalphos against insect pests of brinjal. *J Interacademicia,* **31**(1): 49-52.

Sharma S S and Kaushik H D (2010). Effect of spinosad and other insecticides against pest complex and natural enemies on eggplant (*Solanum melongena* L). *J Ento Res* **34**(1): 39-44.

Singh P K, Singh A K, Singh H M, Kumar P and Yadav C B (2009). Insect pest of spine gourd (*Momordica dioica* Roxb.) and efficacy of some insecticides against the epilachna beetle, *Henosepilachna vigintioctopunctata* (F.). *J Pest Manage Econ Zool* **17**(1): 85-91.

Subramanyam B and Hagstrum D W (1995). Resistance Measurement and Management. In: *Integrated management of insects in stored products*. Marcel Dekker, New York, 331-397.

Verma K S, Kanwar R, Chandal R S and Kumar S (2010). Efficacy of Insecticides and biopesticides against *Henosepilachna vigintioctopunctata* (F.) on bitter gourd in Himachal Pradesh. *J Pest Manage Econ Zool* **18**(1/2):31-36.

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