Indian Journal of Entomology Online published Ref. No. e23180 DoI. No.: 10.55446/IJE.2023.1180

INSECTICIDAL POTENTIAL OF HOMEMADE NEEM EXTRACT AGAINST JASSID *AMRASCA BIGUTTULA BIGUTTULA* (ISHIDA) INFESTING OKRA

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ABSTRACT

Field experiments were conducted during 2020 and 2021 to evaluate the efficacy of homemade neem extract @ 3000, 4000 and 5000 ml along with standard insecticide imidacloprid 17.8 SL @ 100 ml (standard check)/ ha against jassid *Amrasca biguttula biguttula* in okra at the Punjab Agricultural University Regional Research Station, Gurdaspur and farmer's field at Marianwala (Batala), Punjab. The results revealed that all insecticidal treatments were very effective. Imidacloprid 17.8SL proved superior and gave maximum fruit yield followed by higher and median dose of homemade neem extract. The highest cost benefit ratio (Rs. 1: 75.74) was achieved with highest dose of homemade neem extract and closely followed by imidacloprid 17.8 SL (Rs. 1: 50.74). These were also found very safe towards predators (spider and coccinellid).

Key words: *Amrasca biguttula biguttula*, okra, homemade neem extract, neem base insecticides, midacloprid, incidence, predators, safety, yield, cost benefits

Okra *Abelmoschus esculentus* (L) Moench. is one of the predominant vegetables and a superb food to address doubling farmer's income as well as the problem of malnutrition (Abd et al., 2021; Rudra and Saikia, 2021). All its crop stages are susceptible to insect pests and >72 pests are known and these cause 35-40% yield losses (Anonymous, 2022). Amongst these the jassid *Amrasca biguttula biguttula* (Ishida) is the most destructive and causes > 50% yield loss (Sharma et al., 2018; Sharma and Singh, 2002). Its incidence affects plant growth and cause reduction in fruit numbers and quality of produce (Randhawa and Pandey, 2020). Among the various strategies adopted against pests of okra, insecticides are the first line of defence, and these help to increase the crop yield (Kumar et al., 2012; Macin-tosh, 2017). Pesticides cause both acute and long-term health impacts, and other hazards (Boedeker et al., 2020). These lead to residues in addition to problem of resistance, resurgence, environmental pollution and decimation of useful fauna and flora (Dutta, 2015). Thousands of farmers and farm labourers die every year due to unsafe use of pesticides (Mittal et al., 2021). The neem products with half the dose of conventional insecticide have resulted in more efficient control than insecticide alone, and adoption of IPM module is required. This study evaluates the efficacy of homemade neem insecticides against *A. biguttula biguttula* infesting okra.

MATERIALS AND METHODS

Fold experiments were conducted during kharif 2020 and 2021, laid out in randomized block designs with four replications and six treatments (homemade neem extract@ 3000, 4000 and 5000 ml; imidacloprid 17.8SL @ 100 ml, normal water spray @ 250 l/ ha and untreated control. The variety Punjab 7 was sown in the last week of May with spacing of 45x 15 cm with plot size of 30 m^2 with paths maintained at 1.5 and 1.0 m between replication and treatment plots as buffer. The crop was raised by following all agronomic recommendations of the Punjab Agricultural University for vegetable crops except plant protection measures (Anonymous, 2021). For preparing homemade neem extract, 4 kg terminal parts (leaves, green branches and fruits) of neem trees were boiled in 10 l of water for 30 min. The liquid was kept under shade for cooling and then filtered through muslin cloth before spraying. The insecticides were applied as foliar spray 40 days after sowing and repeated at 15 days interval**.** The water @ 250 l/ ha was used by manually operated knapsack sprayer with flat fan nozzle for insecticidal applications. For recording observations, ten plants were randomly selected/ treatment, with incidence recorded from three leaves (top, middle and lower canopy) randomly selected/ plant, a one day before followed by 1, 3, 5 and 7 days after each spray (Latif et al., 2015) following Hameed et al. (2014). The fruit yield at each picking/

ach plot was taken separately and computed to q/ ha. The economics of treatments was worked out as the cost benefit ratio (C: B). The data were subjected to ANOVA after suitable transformation.

RESULTS AND DISCUSSION

The incidence of *A. biguttula biguttula* prior and 1, 3, 5 and 7 days after every spray is given in Table 1; these reveal uniform distribution in all the experimental plots prior to insecticidal spray, but there was significant ($p<0.05$) difference with treatments, with pooled data showing that 1, 3,5 and 7 days after insecticidal application, the incidence was 1.92, 2.03, 2.57 and 2.99 when sprayed with imidacloprid 17.8 SL; 1.34, 2.19, 2.88 and 3.55 with homemade neem extract @ 5000 ml/ ha. Thus, imidacloprid resulted in higher reduction (75.71 %) followed by highest (5000 ml), median (4000 ml) and lowest (3000 ml) dose of homemade neem extract (71.12, 69.67 and 61.78%, respectively) and it was at par. The natural enemies (spiders and lady bird beetles) remained very-very low in these, there was no significant effect of the treatments on these. There was a significant increase in green fruit yield (74.21-96.20 q/ ha) with maximum being with imidacloprid; however, it was at par with that of homemade neem extract. Maximum cost: benefit ratio (1: 72.30) was achieved with 5000 ml/ ha of homemade neem extract followed by imidacloprid (1:50.74) (Table 1). Thus, homemade neem extract is as effective as imidacloprid, and provides the best alternative. These findings are in accordance with those of Aziz et al. (2019) with foliar applications of 2% neem seed extract. Hafeez et al. (2015) observed that application of neem leaf extracts (neem oil) @ 4 & 5 % and lamdacyhalothrin @ 825 ml/ ha significantly decreased whitefly and jassid. Nderitu et al. (2008) compared the efficacy of soil application of neem cake @ 200 kg/ ha with foliar application of neem seed kernel extract, neem oil, Amrutguard, neem leaf decoction etc., and observed that the integrated neem cake treatments plus endosulfan and chlorpyriphos performed better. Mandal et al. (2006) also showed the efficacy of neem products. Thus, homemade neem extract @ 4000 and 5000 ml/ ha could be used in reducing the jassid incidence in okra, as these were found very safe towards the natural enemies (spiders and coccinellids).

ACKNOWLEDGEMENTS

The authors thank the Director, PAU Regional Research Station, Gurdaspur and Head, Department of Entomology, PAU Ludhiana for providing facilities.

AUTHOR CONTRIBUTION STATEMENT

Dr. H S Randhawa: The experiments were conducted at PAU Regional Research Station, Gurdaspur and at farmer's fields; the manuscript was written and submitted to the journal. Dr R S Chandi and Dr Amandeep Kaur : Designed & planned experiment, given technical advice and other experimental inputs, analysed the data.

FINANCIAL SUPPORT

Director PAU Regional Research Station Gurdaspur and Head Department of Entomology PAU Ludhiana.

Dr. B S Dhillon (Director of the Station): Provided financial support, man power and vehicle to conduct experiments at farmer's fields.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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Table 1. Field efficacy of insecticidal treatments against and predatorsin okra crop

Treatment No.	Insecticide	Dose/ ha (ml)	Mean incidence of *A. biguttula biguttula*/ plant at indicated days after second spray																	
			2020						2021						Pooled					
			BF	1	3	5	7	ROC (%)	BF	1	3	5	7	ROC (%)	BF	1	3	5	7	ROC (%)
T1	Homemade neem extract	3000	5.73 (2.95)	3.00 (2.00)	3.17 (2.21)	3.82 (2.20)	4.57 (2.63)	62.27	5.92 (2.63)	3.33 (2.09)	3.20 (2.23)	3.90 (2.21)	4.82 (2.40)	61.29	5.83 (2.60)	3.17 (2.02)	3.18 (2.05)	3.85 (2.20)	4.71 (2.38)	61.78
T2		4000	5.61 (2.57)	1.95 (1.71)	2.83 (1.96)	3.47 (2.11)	3.61 (2.15)	70.24	5.59 (2.56)	1.98 (1.75)	2.06 (1.15)	3.57 (2.11)	3.85 (2.18)	69.09	5.60 (2.57)	1.97 (1.70)	2.45 (1.85)	3.52 (2.13)	3.75 (2.16)	69.67
T3		5000	5.40 (2.53)	1.35 (1.53)	2.62 (1.90)	2.84 (1.96)	3.47 (2.11)	71.37	5.20 (2.48)	1.32 (1.47)	1.76 (1.51)	2.92 (1.193)	3.63 (2.11)	70.86	5.30 (2.49)	1.34 (1.51)	2.19 (1.77)	2.88 (1.95)	3.55 (2.14)	71.12
T4	Imidacloprid 17.8 SL	100	5.91 (2.85)	2.40 (1.85)	2.38 (1.79)	2.51 (1.87)	2.90 (1.97)	76.10	2.40 (1.84)	1.44 (1.57)	1.67 (1.89)	2.62 (1.90)	3.07 (1.99)	75.32	4.16 (2.25)	1.92 (1.70)	2.03 (1.69)	2.57 (1.87)	2.99 (1.97)	75.71
T5	Control (water spray)	-	11.81 (3.58)	14.45 (3.92)	13.41 (3.79)	10.51 (3.39)	11.15 (3.48)	8.03	11.23 (3.50)	12.47 (3.66)	13.17 (3.66)	10.88 (3.45)	11.74 (3.62)	5.63	11.52 (3.55)	13.46 (3.82)	13.29 (3.80)	10.70 (3.45)	11.45 (3.54)	6.83
T6	Control (Unsprayed)	-	11.47 (3.53)	15.17 (4.02)	13.74 (3.84)	11.37 (3.52)	12.12 (3.62)	-	10.67 (3.38)	13.13 (3.76)	13.67 (3.78)	11.75 (3.57)	12.44 (3.65)	-	11.07 (3.49)	14.15 (3.91)	13.71 (3.87)	11.56 (3.56)	12.28 (3.65)	-
CD (P=0.05)			NS	(0.17)	(0.25)	0.50	0.79		1.70	0.14	0.17	0.44			0.15	0.11	0.10	0.23	0.55	

No.	Mean natural enemies' count/ plant at indicated days after second spray																							
	2019-20								2020-21								Pooled							
	Spider				Lady bird beetles				Spider				Lady bird beetles				Spider				Lady bird beetles			
	BF	3	5	7	BF	3	5	7	BF	3	5	7	BF	3	5	7	BF	3	5	7	BF	3	5	7
T1	0.90	0.90	0.77	0.87	0.97	0.84	0.97	1.04	1.07	1.06	0.83	0.94	1.11	0.98	0.12	1.24	0.99	0.98	0.80	0.91	1.04	0.91	0.55	1.14
T2	0.44	0.87	0.94	0.80	0.90	0.90	0.77	0.54	0.56	1.03	1.02	0.87	1.05	1.11	0.88	0.65	0.50	0.95	0.98	0.84	0.98	1.01	0.83	0.60
T3	1.03	0.50	0.70	0.63	0.67	0.78	0.83	0.37	1.22	0.63	0.76	0.69	0.79	0.79	0.96	0.47	1.13	0.57	0.73	0.66	0.73	0.79	0.90	0.42
T4	0.40	0.54	0.63	0.93	0.73	0.54	0.73	0.27	0.52	0.90	0.68	1.01	0.85	0.35	0.87	0.35	0.46	0.72	0.66	0.97	0.79	0.45	0.80	0.31
T5	1.60	0.77	0.57	1.47	1.50	1.03	0.63	0.83	0.52	0.91	0.61	1.59	1.68	1.19	0.75	0.98	1.06	0.84	0.59	1.53	1.59	1.11	0.69	0.91
T6	0.37	1.08	1.04	0.79	1.18	0.81	0.81	1.18	1.64	0.56	1.15	0.33	0.66	0.97	0.96	1.34	1.01	0.82	1.10	0.56	0.92	0.89	0.89	1.26
CD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	N S	NS	NS	NS	NS	NS	NS	N S	NS	NS	NS	NS

Treatment No.	Yield (q/ ha)			Additional yield over control	Income from additional yield (Rs ha^{-1})	Cost of spray (spray material + labour) (Rs ha^{-1})	Net returns over control (Rs ha^{-1})	C : B Ratio
	2020	2021	Pooled					
T1	84.13 (9.20)	89.16 (9.49)	86.65 (9.35)	12.44	24880	520	24360	1:46.85
T2	85.67 (9.30)	90.80 (9.58)	88.23 (9.45)	14.02	28040	545	27495	1:50.45
T3	92.33 (9.66)	97.86 (9.99)	95.10 (9.80)	20.89	41780	570	41210	1:72.30
T4	93.40 (9.71)	99.00 (9.94)	96.20 (9.86)	21.99	43980	850	43130	1:50.74
T5	73.88 (8.60)	78.44 (8.84)	76.16 (8.70)	4.40	4900	450	4450	1:9.89
T6	72.07 (8.55)	76.36 (8.78)	74.21 (8.67)	-	-	-	-	-
CD (p=0.05)	(0.79)	(0.77)	(0.51)	-	-	-	-	-

BF: Before spray; ROC: Reduction over control, Ffigures in parentheses square root transformations; NS: Non significant; BF= Before spray; C : B = Cost Benefit ratio; Figures in parentheses square root transformations

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(Manuscript Received: February, 2023; Revised: March, 2023
Accepted: March, 2023; Online Published: March, 2023)
Online First in www.entosocindia.org and indianjournal.com Ref. No. e23180