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EVALUATION OF INSECTICIDES AGAINST LEPIDOPTERAN PESTS OF OKRA

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ABSTRACT

Field experiment for the evaluation of insecticides was conducted at the Agricultural Research Station, S D Agricultural University, Ladol during kharif 2018- 2020. Results revealed that least fruit damage caused by *Earias vitella* F (9.84%) and *Helicoverpa armigera* Hübner (12.86%) was observed with emamectin benzoate 5SG at 0.0025%. Emamectin benzoate 5SG at 0.0025% gave maximum fruit yield and incremental cost benefit ratio. The pesticide residue analysis with emamectin benzoate 5SG at 0.0025% showed that the residues were below limit at 5 days after the spray. Also, only below MRL residue (0.223 ppm) of spinosad 45SC at 0.0169% was observed.

Key words: Okra, pests, *Helicoverpa armigera*, *Earias vitella*, emamectin benzoate, spinosad, yield, pesticide residue analysis, MRL, yield, cost benefits

Okra *Abelmoschus esculentus* L. Moench belongs to the family Malvaceae is grown in 509 thousand ha in India with a production of 6095 thousand mt (Anonymous, 2018). The cultivation of okra has many constraints, of which losses due to insect pests attack is important (Jagtab et al., 2007). As many as 72 pests are known on okra (Srinivasa and Rajendran, 2003). Among them, shoot and fruit borer, *Earias vitella* (F.) and fruit borer *Helicoverpa armigera* (Hubner) are major pests (Shitole and Patel, 2009), and cause >50% loss (Archunan et al., 2018). Insecticides are still largely in use against these pests. Conventional insecticides like endosulfan (Shivalingaswamy et al., 2008; Rath and Mukherjee, 2009), malathion and hostothion (Kumar and Gill, 2010),chlorpyriphos (Kuttalam et al., 2008), phosalone and quinalphos (Anonymous, 2011), and fenvalerate, methomyl, azinphos methyl, carbaryl and pyrethrin/ rotenone (Anonymous, 2012) had been used in management of lepidopteran pests on vegetable crops. In recent times, some new insecticide molecules offer multiple advantages in terms of greater levels of safety, better performance and reduced environmental impact (Visnupriya and Muthukrishnan, 2020). Therefore, this study was undertaken with the objectives to investigate the persistence toxicity of some novel insecticides against *E. vitella* and *H. armigera* under field conditions in okra.

MATERIALS AND METHODS

Field evaluation of insecticides was conducted at the Agricultural Research Station, S D Agricultural University, Ladol (23.638460° N, 72.705492° E) during kharif- 2018, 2019 and 2020. The variety Gujarat Anand Okra-5 was planted following all the agronomic practices as per package of practices for vegetables crops. The experiment was laid out in randomized block design (RBD) with eleven treatments including untreated control. Each treatment was replicated thrice. The treatments include: emamectin benzoate 5SG @ 250 ml (T1); spinosad 45SC @ 112.5, 150 and 187.5 ml (T2, T3 and T4, respectively); thiodicarb 75WP @ 375, 500 and 625 ml (T5, T6 and T7, respectively); novaluron 10EC @ 562.5, 750 and 937.5 ml/ ha (T8, T9 and T10, respectively); and untreated control (T11). For sprays 500 l of water/ ha was used with manually operated knapsack sprayer. Before each spray five plants were selected randomly/ plot and observations on *E. vitella* and *H. armigera* were made from selected plants. Two sprays were given at 15 days interval starting from initiation of damage. Fruit damage by *H. armigera* and *E. vitella* at harvest was recorded by counting total and damaged fruits before and after each spray. Yield data on different pickings was used to work out cumulative yield/ plot and converted to ha basis. Incremental cost benefit ratio of treatments was also worked out. Pesticide residue analysis was done for the two effective treatments, emamectin benzoate 5SG 0.0025% and spinosad 45SC 0.0169% at BioScience Research Centre, SDAU, Sardarkrushinagar using QUECHERs method. Thirteen fresh fruit samples of okra (including control) were collected after the last (2nd) spray of insecticides at 0 day (2 hrs after the spray), 1, 3, 5, 7 and 10 days after the spray. All data were statistically subjected to ANOVA through SPSS Computer program (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) Significance of differences between the treatment means were compared by DNMRT at $p \leq 0.05$.

RESULTS AND DISCUSSION

Data on fruit damage (%) by *H. armigera* and *E. vitella* summarized in Table 1 show non-significant differences among treatments before spray. Data on fruit damage (%) at harvest after both the sprays and pooled analysis were found significant during kharif 2018, 2019 and 2020. Pooled mean of all three years revealed significantly least fruit damage (12.86%) with emamectin benzoate 5SG, 0.0025% and it was found significantly superior against *H. armigera*. Emamectin benzoate inhibits muscle contraction, causing a continuous flow of chlorine ions in the GABA and H-Glutamate receptor sites (Fanigliulo et al., 2009). The present results corroborate with those of Murugraj et al. (2006) on emamectin benzoate with larval population of *H. armigera.* Kanna et al. (2005) reported superiority of emamectin benzoate over lamda-cyhalothrin and spinosad against *H. armigera*. Fanigliulo et al. (2009) compared emamectin benzoate with spinosad and indoxacarb, and observed good control of *H. armigera* by emamectin benzoate. Emamectin benzoate is more potent on *Spodoptera littoralis* than lufenuron or spinosad (El Sayed and El-Sheikh, 2015). Data on fruit damage (%) by *E. vitella* at harvest after both the sprays and pooled analysis were found significant in kharif 2018, 2019 and 2020. Data on pooled mean revealed significantly the least total fruit damage (9.84%) with emamectin benzoate 5SG at 0.0025% at par with spinosad 45SC at 0.0169% (13.43%).

These results agree with those of Dhaker et al. (2017)

Table 1. Efficacy and economics of insecticides against *H. armigera* and *E. vitella* in okra

S. No.	Treatments	Fruit damage (%)				Yield	Gross realization (Rs.)	Cost of inputs	Net realization (Rs.)	BCR
		H. armigera		*E. vitella*						
		Before spray	After two spray	Before spray	After two spray					
T_1	Emamectin benzoate 5SG 0.0025%, 5 g	29.18 (24.05) *	20.89^{g} (12.86)	25.90 (19.17)	18.18^{c} (9.84)	14444^{a}	173333	47330	126003	2.66
T_2	Spinosad 45SC 0.0101%, 2.25ml	29.75 (24.65)	24.58^{ef} (17.40)	25.83 (19.14)	25.07^{ab} (18.02)	12865^{b}	154378	49405	104973	2.12
T_3	Spinosad 45SC 0.0135%, 3 ml	29.56 (24.63)	23.87^{ef} (16.47)	25.95 (19.46)	23.29^{ab} (15.73)	12930^{b}	155157	50830	104327	2.05
T_4	Spinosad 45SC 0.0169%, 3.75ml	29.58 (24.39)	22.87^{f} (15.18)	25.64 (18.83)	21.38^{bc} (13.43)	14030^{a}	168357	52255	116102	2.22
T_5	Thiodicarb 75WP 0.0563%, 7.5g	27.94 (22.11)	27.60^{bcd} (21.68)	25.96 (19.32)	24.31^{ab} (17.30)	12009^{bc}	144103	47980	96123	2.00
T_6	Thiodicarb 75WP 0.0750%, 10 g	28.66 (23.12)	26.61^{cd} (20.20)	26.21 (19.79)	24.91^{ab} (17.83)	12259^{b}	147104	48930	98174	2.01
T_7	Thiodicarb75WP, 0.0938%, 12.5g	30.02 (25.39)	25.75^{de} (19.08)	26.27 (19.78)	24.53^{ab} (17.26)	12407^{b}	148889	49880	99009	1.98
T_8	Novaluron 10EC 0.0113%, 11.25ml	30.07 (25.15)	29.42^{b} (24.25)	25.50 (18.70)	25.50^{ab} (18.62)	11048^{c}	132574	48730	83844	1.72
T_9	Novaluron 10EC 0.0150%, 15 ml	30.55 (26.35)	29.15^{b} (23.84)	26.59 (20.25)	25.23^{ab} (18.18)	11165^{c}	133979	49930	84049	1.68
T_{10}	Novaluron 10EC 0.0188%,18.75ml	29.54 (24.74)	28.39^{bc} (22.66)	25.88 (19.33)	25.60^{ab} (18.70)	11138^{c}	133656	51130	82526	1.61
T_{11}	Untreated Control	30.60 (25.98)	31.96^{a} (28.11)	28.48 (22.84)	27.75^{a} (21.72)	8864^{d}	106363	44250	62113	1.40
S. Em (±)		1.20	0.623	1.12	0.538	349				
CD (p=0.05)		NS	1.744	NS	1.506	983				
CV (%)		13.86	9.99	14.66	9.59	9.64				
Y x T		NS	NS	NS	NS	NS				

*Figures in parentheses arc sin transformed values; Means with letter(s) in common not significant by DNMRT (p=0.05); Emamectin benzoate 5SG 0.0025% (4400 Rs/ kg); Spinosad 45 SC 0.0101% (19000 Rs/ l); Thiodicarb 75 WP 0.0563% (3800 Rs/ kg); Novaluron 10 EC 0.0113% (3200 Rs/ kg); Labour charge (220 Rs); Price of okra fruit/ kg (12 Rs/ kg) and Javed et al. (2018) on emamectin benzoate 5SG. Devi et al. (2015) and Yadav et al. (2017) revealed that emamectin benzoate 12 g a.i./ ha provided the best fruit protection against *E. vitella* on okra followed by spinosad 12.5% SC. Naveena et al. (2015) also obtained similar results with emamectin benzoate 5WG @ 7.50 g a.i/ha. Mane (2007), Dhar and Bhattacharya (2015) and Pachole et al. (2017) reported that spinosad at 45SC was the most effective against *E. vitella.* Effect of treatments on okra yield was found significant, and emamectin benzoate gave significantly higher yield (14444 kg/ha), at par with spinosad 45SC (14030 kg/ha). Economics of insecticides computed considering prevailing market price of okra and treatments including labour charges revealed that BCR was maximum of Rs. 126003 with ICBR of 1:2.66 in the treatment of emamectin benzoate followed by spinosad with Rs.116102, and ICBR of 1:2.22 (Table 1). These findings are in accordance with the results of Parmar and Borad (2009) on emamectin benzoate against *H. armigera.* Kuttalam et al. (2008) also reported similarly as that of Kumar et al. (2016) with spinosad. Pachole et al. (2017) revealed that spinosad 45SC was the best against *E. vitella* on okra and most economical. Results of pesticide residue analysis revealed that the most effective emamectin benzoate 5SG at 0.0025% showed the residues below quantification limit at five days after spray; and it was 0.223 ppm with spinosad 45SC at 0.0169%. These are below MRL.

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AUTHOR'S CONTRIBUTIONS

MMP: Performed field trials, analysed and interpreted the data of the work and prepared the original manuscript; RKS: Conducted field trials, analysed the data, reviewed and edited the writing, JRP: Assisted in conduction of field trials, analysed the data. MJJ: analysed the data, reviewed and edited the manuscripts. The authors read and approved the final manuscript.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

REFERENCES

Anonymous. 2011. Annual Report: Asian Vegetable Research and Development Centre (AVRDC), Shenhua, Taiwan. 741 pp.

Anonymous. 2012. All India Coordinated Cotton Improvement Project, Annual Report, 2011-12.

Anonymous. 2018. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Government of India, Gurgaon. 164 pp.

Archunan, K, Pazhanisamy M, Sathya S. 2018. Influence of weather factors on incidence of shoot and fruit borer (*Earias vittella* Fab.) on bhendi. Journal of Horticultural Biotechnology Science 4: 30-34.

Devi L, Tushar M, Ghule M L, Chatterjee A, Senapati K. 2015. Biorational management of shoot and fruit borer of okra (*Earias vittella* Fabricius) and their effect on insect predators. Environment and Ecology 33(3): 1052- 1054.

Dhaker R, Rana B S, Pinjara I M, Purushan G S, Nagar R. 2017. Bio-efficacy of synthetic insecticide and biopesticide for the management of shoot borer and fruit borers of okra. Journal of Entomology and Zoology Studies 5(3):169-172.

Dhar T, Bhattacharya S. 2015. Efficacy of imidacloprid and spinosad against pest complex of okra and tomato. International Journal of Bio-Resource, Environment and Agricultural Sciences 1(3): 126-131.

El-Sayed A, El-Sheikh. 2015. Comparative toxicity and sublethal effects of emamectin benzoate, lufenuron and spinosad on *Spodoptera littoralis* Boisd. (Lepidoptera: Noctuidae). Crop Protection 67: 228-234.

Fanigliulo A, Sacchetti M. 2008. Emamectin benzoate: new insecticide against *Helicoverpa armigera*. Communications in Agricultural and Applied Biological Sciences 73(3): 651-653.

Jagtab C R., Shetgar S S, Nalwandikar P K. 2007. Fluctuation in population of lepidopterous pest infesting okra in relation to weather parameters during *Khari*f. Indian Journal of Entomology 69(3): 218-220.

Javed M, Majeed M Z, Sufyan M, Ali S, Afzal M. 2018. Field efficacy of selected synthetic and botanical insecticides against lepidopterous borers, *E. vittella* and *H. armigera* (Lepidoptera: Noctuidae) on okra (*A. esculentus* (L.) Moench). Pakistan Journal of Zoology 50(6): 2019-2028.

Kanna S, Bekaran C S, Raghupathy A, Stanly J. 2005. Field efficacy of emamectin benzoate 5% SG against tomato fruit borer, *Helicoverpa armigera* (Hubner). Pestology 29: 21- 24.

Kumar P, Singh D V, Dabas J P S, Sachan K, Kumar M. 2016. Assessment of the efficacy and economic of insecticides and bio-pesticides against major insect pests of okra (*Abelmoschus esculantus*). International Journal of Agricultural Science 8: 2050-2052.

Kumar S, Gill C K. 2010. Incidence of tomato leaf curl virus in relation to whitefly, *Bemisia tabaci* (Gennadius) population in different insecticidal treatments on tomato crop. Journal of Insect Science 23(3): 327-331.

Kuttalam S, Boomathi N, Kumar B V, Kumaran N, Rajathi D S. 2008. Field efficacy of emamectin benzoate 5 SG against okra fruit borer, *Earias vittella* (Fab.). Pestology 32(3): 40-43.

Kuttalam S, Vinothkumar B, Kumaran N, Boomathi N. 2008. Evaluation of bio efficacy of flubendiamide 480 SC against fruit borer *Helicoverpa armigera* in tomato. Pestology 32(3): 13-16.

Mane S A. 2007. Bioefficacy of some newer insecticides against fruit borer (*Earias vittella* (Fab.)] on okra [*A. esculentus* (L.) Moench]. Ph. D. dissertation submitted to Marathwada Agricultural University, Parbhani, (M.S.) India.

Murugaraj P, Nachiappan R M, Selvanarayanan V. 2006. Effiacy of Emamectin benzoate (proclaim 05 SG) against tomato fruit borer, *Helicoverpa armigera* (Hubner). Pestology 30(1): 11-16.

Naveena R, Shabbir K, Hosamani A C. 2015. Management of okra fruit borers, *E. vittella* (F.) and *H. armigera* (Hub.) using new molecule of insecticides. Trends in Biosciences 8(16): 4369-4373.

Pachole S H, Thakur S, Simon S. 2017. Comparative bioefficacy of selected chemical insecticides and biorationals against shoot and fruit borer, (*E. vittella* Fabricius) on okra [*A. Esculentus* (L.) Moench]. Journal of Pharmacognosy and Phytochemistry 6(4): 1836- 1839.

Parmar K D, Borad P K. 2009. Bio-efficacy of some newer insecticides against *H. armigera* (Hubner) Hardwick infesting okra. Pesticide Research Journal 21(1): 55-57.

Rath L K, Mukherjee S K. 2009. Field evaluation of some biopesticides alone and in alternation with endosulfan against tomato fruit borer. Journal of Plant Protection and Environment 6(2): 102-104.

Shitole T D, Patel I S. 2009. Seasonal abundance of sucking pests and their correlation with weather parameters in cotton crop. Pestology 33: 38-40.

Shivalingaswamy T M, Kumar A, Satpathy S, Rai A B. 2008. Efficacy of indoxacarb against tomato fruit borer, *Helicoverpa armigera* Hubner. Pestology 32(8): 39-41.

Srinivasa R, Rajendran R. 2003. Joint action potential of neem with other plant extracts against the leaf hopper *Amrasca devastans* (Distant) on okra. Pest Management and Economic Zoology 10: 131-136.

Visnupriya, M. and Muthukrishnan, N. (2020). Persistence toxicity and field evaluation of Spinetoram 12 SC against *Spodoptera litura* Fabricius on okra. International Journal of Plant Protection 13(1): 18-23.

Yadav S K, Kumar S, Kumawat K C, Deshwa H L, Kumar S, Manohar S V S. 2017. Bioefficacy of newer and biorational insecticides against shoot and fruit borer, *Earias* spp. on okra. International Journal Current Microbiology Applied Sciences 6(7): 1035-1044.

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