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BIORATIONAL MANAGEMENT OF MAJOR CHEWING PESTS OF OKRA

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ABSTRACT

Field experiments were conducted to evaluate the efficacy of microbial agents, and neem based and biorational insecticides against major lepidopteran pests of okra, viz., shoot and fruit borer *Earias vitella* (F) and leaf roller *Haritalodes derogata* (F) during summer and kharif 2022. The experiment was laid out in randomized block design (RBD) with nine treatments and three replications. Results indicated that spinosad 45SC was the most effective with highest marketable yield. Thus, spinosad 45SC can be used for the effective management of *E. vitella* and *H. derogate* in okra.

Key words: Shoot and fruit borer, leaf roller, spinosad 45SC, emamectin benzoate 5SG, okra, insecticides, *Earias vitella*, *Haritalodes derogata*, safety, IPM

Okra *Abelmoschus esculentus* (L.) Moench, also referred as bhindi or lady's finger; it is cultivated worldwide in tropical, subtropical, and warm temperate areas (Thara et al., 2019). India is the largest producer of okra with over 60% of global production recording approximately 6 mt/ year (Arya at al., 2021). Several biotic and abiotic factors are responsible for its low yield. Among them, insect pests are important (Tanni et al., 2019). Up to 72 insect species had been identified on okra (Rao and Rajendran, 2003). The larvae of *Earias vitella* (Lepidoptera: Nolidae) is one of the most serious and destructive pest attacking both shoots and fruits (Kumar et al., 2014). Caterpillars bore into shoot tip, bud, flower and developing fruit causing death of shoot and premature flower and fruit drop. Infested fruits become unfit for consumption with reduced market value (Dash et al., 2020). The damage by *E. vitella* to shoots and fruits may vary from 21.33 to 43.99% and 21. to 51.3%, respectively (Singh et al., 2007). The larvae of *Haritalodes derogata* (Lepidoptera: Crambidae) feeds on leaves from the edges to midrib reducing the area available for photosynthesis (Kedar et al., 2014). Lack of technical knowhow in the application, conventional insecticides fails to provide satisfactory control. Inadvertent use of these creates imbalance in ecosystem and causes adverse health impacts (Panbude et al., 2019). Biorational insecticides made from natural products such as animals, plants, microbes and minerals or their derivatives have enough scope. Their use for the control of insect pests has increased dramatically in recent years, increasing their popularity and market share. The present study evaluates the efficacy of biorational insecticides against *E. vitella* and *H. derogata* on okra.

MATERIALS AND METHODS

Field experiments were conducted in the Instructional Farm- Karuvachery, College of Agriculture, Padanakkad, Kasaragod district, Kerala during two seasons viz., summer (January to May) and kharif (June to September) in 2022. Land was prepared by ploughing followed by application of lime and farm yard manure (FYM). Okra seeds of "Salkeerthi" variety were sown in pro trays. After 10 days, seedlings were transplanted into the microplots of size 2.4 × 1.95 m^2 in main field with the spacing of 60 × 45 cm which were provided shade using coconut fronds to avoid transplanting shock from the scorching sun. Basal dose of NPK (55, 35 and 70 kg/ ha) fertilizers were applied prior to transplanting as specified in the KAU, Package of practice recommendations: Crops 2016 (POP, KAU). Treatments were applied at recommended dose using a knapsack sprayer after 30^{th}, 45^{th} and 65^{th} day after sowing. Polyethene sheets were used while spraying to prevent treatment chemicals drifting from one plot to the other. Observations on insect pests were recorded at weekly intervals corresponding to standard weeks and precount was recorded one day prior to spraying. Observations were recorded from randomly four tagged plants in each replication avoiding border rows. The experiment was laid out in randomized block design (RBD) with nine treatments replicated thrice. The data obtained were subjected to square root transformation and ANOVA. Online statistical tool GRAPES (General R-shiny based Analysis Platform Empowered by Statistics) was used.

RESULTS AND DISCUSSIONS

The treatments viz., *Bt* formulation 2×10^9cfu/ ml (10 ml/ l of water), azadirachtin 1% (2 ml/ l of water), neem oil, garlic, soap based formulation (6 g/ l of water), emamectin benzoate 5SG (0.4 g/ l of water), pyridalyl 10EC (1.5 ml/ l of water), flonicamid 50 WG (0.6 g/ l of water), spinosad 45SC (0.4 ml/ l of water), malathion 50EC (2 ml/ l of water) were evaluated during summer and kharif season. Data was collected one day before treatment (DBT) and subsequently on 7th and 14th day after treatment given in Table 1 reveal that treatment T_7 (spinosad 45SC @ 0.4 ml/ l) was the most effective against larvae of *E. vitella*. The infestation was brought down to zero after three sprays. Similar findings were reported by Rawat et al. (2020) where spinosad 45SC was found to be the most effective in reducing damage by *E. vitella*. Spinosad treated plots recorded lowest population (0.04) of *E. vitella* as well as lowest percentage of shoot and fruit damage (0.00 and 3.33%, respectively). The present findings are in line with those of (Yadav et al., 2017; Choudhury et al., 2021) on spinosad 45SC. This was followed by treatment T_4 (emamectin benzoate 5SG @ 0.4 g/ l of water). The findings of Saha et al. (2014); and Patel et al. (2022) confirmed the present findings with respect to spinosad 45SC and emamectin benzoate 5SC. Venkanna et al. (2015) indicated that spinosad 45EC was the most effective followed by emamectin benzoate 5SG against *E. vitella* on okra. The larvae of *H. derogate* were found to infest the crop only during kharif. The data revealed that treatment T_7 (spinosad 45SC @ 0.4 ml/ l) was the most effective as the mean larval count and leaf damage was brought down up to zero after three sprayings. Mishra et al. (2015) coroborates with the present findings that spinosad 45SC was the most effective against *H. derogate*. Nayak et al. (2015) showed the efficacy of spinosad 45SC against leaf roller larvae.

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AUTHOR CONTRIBUTION STATEMENT

BR Designed the research and provided guidance.

Table 1. Efficacy of different insecticides against *E. vitella* and *H. derogate* in okra during summer and kharif season 2022

Treatments	1 DBT		7 DAFS				7 DASS					7 DATS				
	E. vitella		*E. vitella*		*H. derogate*		*E. vitella*			*H. derogate*		*E. vitella*			*H. derogate*	
	NOL*	PSD*	NOL*	PSD*	NOL*	NORL*	NOL*	PSD*	PFD*	NOL*	NORL*	NOL*	PSD*	PFD*	NOL*	NORL*
Bt formulation	0.16	3.10	0.16	3.78^{bc}	0.76^{bc}	0.76^{ab}	0.12^{cd}	3.06^{c}	12.10^{cd}	0.82^{bc}	0.82^{bc}	0.20^{bc}	0.46^{b}	11.66^{cd}	0.70^{b}	0.70^{b}
Azadirachtin 1%	0.29	4.51	0.29	6.95^{ab}	0.76^{bc}	0.76^{ab}	0.25^{bcd}	6.69^{bc}	18.05^{bc}	0.94^{ab}	0.94^{ab}	0.37^{b}	2.20^{b}	15.83^{bcd}	0.82^{ab}	0.82^{ab}
Neem oil, garlic soap-based formulation	0.54	8.01	0.54	11.67^{a}	0.76^{bc}	0.76^{ab}	0.45^{ab}	17.02^{a}	17.22^{bc}	0.90 ^{bc}	0.90^{abc}	0.33^{b}	2.30^{b}	22.77^{b}	0.82^{ab}	0.82^{ab}
Emamectin benzoate 5 SG	0.08	2.83	0.08	3.54^{bc}	0.70^{c}	0.70^{b}	0.08^{cd}	1.70^{c}	7.50^{d}	0.70^{c}	0.70^{c}	0.16^{bc}	0.75^{b}	7.50^{de}	0.70^{b}	0.70^{b}
Pyridalyl 10 EC	0.20	2.38	0.20	3.56^{bc}	0.70^{c}	0.70^{b}	0.16^{cd}	4.44^{bc}	13.88^{cd}	0.76^{bc}	0.76^{bc}	0.25^{bc}	1.40^{b}	16.38^{bc}	0.76^{b}	0.76^{b}
Flonicamid 50 WG	0.25	1.51	0.25	5.58^{bc}	0.81^{abc}	0.81^{ab}	0.29^{abc}	7.84^{abc}	23.33^{b}	0.82^{bc}	0.82^{bc}	0.29^{b}	1.96^{b}	20.83^{b}	0.82^{ab}	0.82^{ab}
Spinosad 45 SC	0.16	2.99	0.16	0.92^{c}	0.70^{c}	0.70^{b}	0.00^{d}	0.00^{c}	7.50^{d}	0.70^{c}	0.70^{c}	0.04^{c}	0.00^{b}	3.33^{e}	0.70^{b}	0.70^{b}
Malathion 50 EC	0.16	3.18	0.16	5.44^{bc}	0.86^{ab}	0.86^{a}	0.16^{cd}	4.94^{bc}	13.88^{cd}	0.76^{bc}	0.76^{bc}	0.20^{bc}	0.24^{b}	15.00^{bcd}	0.76^{b}	0.76^{b}
Absolute control	0.37	6.32	0.37	11.7^{a}	0.91^{a}	0.86^{a}	0.54^{a}	13.79^{ab}	70.83^{a}	1.11^{a}	1.07^{a}	0.79^{a}	5.51^{a}	74.99^{a}	0.91^{a}	0.91^{a}
C.D. (0.05%)	N S	N S	N S	5.98	0.12	0.11	0.28	9.80	9.04	0.21	0.21	0.21	1.38	8.89	0.12	0.12

*Mean of three replications, DBT- Day before spraying, DAFS- Days after first spray, DASS- Days after second spray, DATS- Days after third spray, NOL- Number of larvae, PSD- Percentage shoot damage, PFD- Percentage fruit damage, NORL- Number of rolled leaves, N S- Non significant.

BSG Conducted experiments, analyzed the data and prepared the manuscript. KMS and ASS corrected manuscript. MMP provided guidance with respect to data analysis.

CONFLICT OF INTEREST

No conflict of interest

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