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FIELD EVALUATION OF BIORATIONAL INSECTICIDES AGAINST SHOOT AND FRUIT BORER *EARIAS VITTELLA* (FABRICIOUS) ON BHENDI

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Abstract

Conventional insecticides are being used as the major tools for management of shoot and fruit borer in bhendi. They have created many problems including insecticide resistance, toxic residues in the harvested bhendi, causing health hazards to consumers and sucking pest resurgence. In this view, mainly investigation was carried out to evaluate of commercial entomopathogens [*Beauvaria bassiana* (Biopower®), *Bacillus thuriengensis* (Dipel®)] and biopesticides (neem oil & pungam oil) against shoot and fruit borer, *Earias vittella* on bhendi. The results of field application showed maximum per cent reduction of *E. vittella* was recorded with Dipel ® 0.3% (62.15 & 63.46%) followed by neem oil (49.25 & 50.05%) and Dipel® 0.2% (42.95 & 42.42%) during *rabi* 2017 and similar trend of results were recorded in confirmatory field trail during kharif 2017 also. Overall results in both season concluded that all the treatments gave significant control of *E. vittella* and Dipel ® 0.3% was better treatment against *E. vittella* in bhendi.

Key word: Field efficacy- Dipel®, Biopower®, *Earias vittella*, bhendi, neem oil.

Introduction

Bhendi *Abelmoschus esculentus* L. Moench or okra belongs to the family Malvaceae and the origin is Africa. In India ranks first in the world with 5,784.0 thousand tones (72% of the total world production) of bhendi (FAO, 2015). It is considered a prized vegetable due to its high nutrient (Anon., 2017). The successful cultivation of bhendi crop have a many contrained, one of the important limiting factors in the cultivation of bhendi due to insect pests to attack by different species from germination to harvest (Jagtab *et al*., 2007 & Santoshkumar *et al*., 2013). There are a few insect pests such as leaf hopper, aphid, white fly, shoot & fruit borer and spider mite, which are importance in bhendi. Among them, shoot and fruit borer, *Earias vittella* Fab. considered major pest which cause severe damage to crop (Shitole and Patel, 2009) and its serious pest causing more than 50% loss in bhendi crops (Archunan *et al*., 2018) and 69% on bhendi alone in various parts of India. Shoot and fruit borer *E. vittella* is reported to cause 13.8 to 41.6 percent net yield loss in bhendi (Pazanisamy and Archunan, 2019). Conventional insecticides are being used as the major tools for management of shoot and fruit borer in bhendi. They have created problems including insecticide resistance, toxic residues in the harvested bhendi, handling hazards, health hazards to consumers and sucking pest resurgence. Hence, it has been necessary to develop an alternative approaches using biorational pesticides, keeping in this view, to evaluate different entomopathogen and biopesticides against *E,vitella* on bhendi crop under field conditions.

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Materials and Methods

This trial was laid out in randomized block design (RBD) with three replications, each in 5 × 5 m plots keeping 45 cm row to row and 30 cm plant to plant spacing and normal recommended agronomical practices were followed during the crop season. Two entomopathogen *viz*., *B. thuringiensis* (Dipel®), *B. bassiana* (Biopower®) and biopesticides along with neem oil, pungam oil were evaluated in bhendi field. *B. thuringiensis* and *B. bassiana* formulation sprayed at different concentration (0.2% and 0.3%). First sprays were conducted based on the ETL starting and second spray was applied in 10 days after first spray.

Table 1: Bio-efficacy of entomopathogen and botanicals against *E. vittella* in bhendi under field condition during *rabi* 2017 (Preliminary).

Treatment	Dose per litre	PTC	Percent of mortality over control							
			First spray				Second spray			
			3 DAT	7 DAT	10 DAT	Mean	3 DAT	7 DAT	10 DAT	Mean
T1- Dipel 0.2%	0.2%	8.33	47.21(43.40)^{b}	42.95(40.93)^{b}	38.69(38.45)^{b}	42.95	47.31(43.45)^{bc}	46.67(43.08)^{b}	33.28(35.22)^{bc}	42.42
T2- Dipel 0.3%	0.3%	10.33	67.77(55.43)^{a}	62.32(52.15)^{a}	56.37(48.66)^{a}	62.15	72.05(58.09)^{a}	62.40(52.19)^{a}	55.95(48.42)^{a}	63.46
T3- Biopower 0.2%	0.2%	8.67	22.95(28.57)^{d}	21.68(40.92)^{c}	19.10(25.84)^{c}	21.24	27.67(31.77)^{c}	23.55(28.89)^{c}	20.71(26.96)^{d}	23.97
T4- Biopower 0.3%	0.3%	9.33	45.16(41.56)^{bc}	41.78(51.15)^{b}	39.57(38.97)^{b}	42.79	46.60(43.05)^{bc}	40.62(39.58)^{b}	35.67(36.67)^{bc}	40.96
T5- Neem oil 3%	3%	8.0	42.79(40.85)^{bc}	60.65 (43.42)^{ab}	44.33(41.74)^{ab}	49.25	47.42(43.52)^{b}	61.40(51.59)^{a}	41.33(40.01)^{ab}	50.05
T6- Pungam oil 3%	3%	7.67	40.28(39.37)^{c}	41.72(40.23)^{b}	40.41(39.47)^{b}	40.80	38.30(38.22)^{c}	39.96(39.18)^{b}	36.58(37.21)^{bc}	38.28
T7- Untreated check		8.33	0.00(0.29)^{e}	0.00(0.29)^{d}	0.00(0.29)^{d}	0.00	0.00(0.29)^{d}	0.00(0.29)^{d}	0.00(0.29)^{e}	0.00
SE(d)			1.528	1.592	1.561		2.416	2.324	1.589	
CD (0.05%)			3.331	3.468	3.401		5.263	5.064	3.463	

PTC = Pre – treatment Count, DAT = Days after treatment.

* Mean of three replications, Figures in parentheses are arcsine (x + 0.5) transformed values, means in column followed by a common letter are not significantly different at the 5 per cent level (DMRT) .

Table 2: Bio-efficacy of entomopathogen and botanicals against *E. vittella* in bhendi under field condition during kharif 2017 (Confirmatory).

Treatment	Dose per litre	PTC	Percent of mortality over control							
			First spray				Second spray			
			3 DAT	7 DAT	10 DAT	Mean	3 DAT	7 DAT	10 DAT	Mean
T1- Dipel 0.2%	0.2%	10.3	44.23(41.68)^{bc}	43.13(41.05)^{b}	36.89(37.38)^{c}	41.41	48.16(43.95)^{bc}	37.21(37.58)^{c}	37.13(37.54)^{c}	40.83
T2- Dipel 0.3%	0.3%	8.67	70.13(56.89)^{a}	63.99(53.13)^{a}	56.02(48.47)^{a}	63.38	68.30(55.76)^{a}	61.41(51.60)^{a}	53.67(47.11)^{a}	61.13
T3- Biopower 0.2%	0.2%	9.67	27.47(31.57)^{e}	21.64(27.62)^{c}	17.26(24.55)^{d}	22.12	27.28(41.43)^{d}	21.23(27.40)^{d}	19.15(25.94)^{e}	22.55
T4- Biopower 0.3%	0.3%	8	53.74(47.16)^{b}	48.43(44.10)^{b}	40.00(39.23)^{c}	47.39	49.39(44.65)^{b}	44.80(42.01)^{b}	38.34(38.25)^{c}	44.17
T5- Neem oil 3%	3%	9.33	47.50(43.67)^{c}	60.47(51.05)^{a}	46.74(43.13)^{b}	51.57	47.75(43.65)^{bc}	60.41(51.02)^{a}	46.00(42.71)^{b}	51.38
T6- Pungam oil 3%	3%	10	38.90(38.58)^{d}	42.23(40.52)^{b}	39.26(38.78)^{c}	40.13	42.32(40.58)^{c}	44.47(41.82)^{b}	29.48(32.81)^{d}	38.75
T7- Untreated check	-	8.33	0.00(0.29)^{f}	0.00(0.29)^{d}	0.00(0.29)^{e}	0.00	0.00(0.29)^{e}	0.00(0.29)^{e}	0.00(0.29)^{f}	0.00
SE(d)			1.628	1.721	1.394		1.647	1.549	1.510	
CD (0.05%)			3.546	3.749	3.037		3.589	3.375	3.307	

PTC = Pre – treatment Count, DAT = Days after treatment.

Observation on larval population was made on five randomly selected plants from each treatment one day before and 3, 7 and 10 days after treatment. Based on the larval number at each spray application, per cent reduction in larval population by using the mean of the 3, 7 and 10 days after spray both first and second round of spray application (Pazhanisamy and Hariprasad**,** 2014). Percentages were transformed into arcsine values and subjected to statistical analysis.

Results and Discussion

Season I

The results of field trials were conducted to study during *rabi* 2017 and kharif 2017 are presented in Table 1 & 2. In *rabi* 2017 revealed that the mean per cent reduction in larval population was ranging from 19.10 to 67.77%. At three days after treatment (first spray), the maximum per cent reduction in larval population was recorded with Dipel® 0.3% (67.77%) followed by Dipel® 0.2% (47.21%) and Biopower® 0.3% (45.16%) was on par with neem oil 3% (42.79%). The present finding supported with Kharbade *et al*. (2003) reported less shoot and fruit damage (13.51 and 15.83%) on bhendi by *E. vittella* due to application of *B. thuringiensis* Kurstaki.

The maximum per cent reduction in larval population was recorded in Dipel® 0.3% (62.32% & 56.37%) at 7 and 10 DAT, respectively. The present finding supported by Mishra and Mishra **(**2002) who revealed lowest fruit borer incidence (8.6% on weight basis) in Biotox (*B. thuringiensis* sub sp. *thuringiensis* Serotype) treated bhendi crop. The biopesticides *B. thuringiensis* is moderately effective when compared with the biorational insecticides spinetoram, emamectin benzoate, spinosad and chlorfenapyr reported by Ghosal *et al*., (2013). The neem oil 3% also proved on effective treatment against *E. vittella* larval population (60.65% & 44.33%) followed Dipel® 0.2% (42.95% & 38.69%) on par with Biopower® 0.3% (41.78% & 39.57%), pungam oil 3% (41.72% & 40.41%), whereas the treatment of Biopower® 0.2% was found less larval mortality at 7 & 10 DAT. These findings are confirmatory with Padwal *et al*., (2014) and Kumar (2013) also reported that neem oil was effectively considered as pest management option to reduce *E. vittella* population and increase okra productivity and it is eco-friendly, no residual effect and not caused hazardous effect to environment.

Season II

The second confirmatory field experiment conducted during kharif 2017 is presented Table 2 showed that three days after first spray maximum per cent reduction in larval population was recorded in Dipel® 0.3% (*B. thuringiensis)* (70.13%) followed by Biopower® (*B. bassiana*) 0.3% (53.74%). However, Biopower® (*B. bassiana*) 0.2% (27.47%) recorded less mortality. This finding agreement with Ghosal *et al*. (2013) reported that biopesticide *B. thuringiensis* is moderately effective when compared with the biorational insecticides. Similarly, Husseini *et al*., 2012 reported the effect of *B. t. kurstaki* was significantly higher mortality of *E. insulana* at highest tested concentration (10.24 x 106 I.U./ml). At 7 & 10 DAT, in Dipel® 0.3% recorded significantly more larval mortality (63.99% & 56.99%) followed by neem oil 3% (60.47% & 46.74%), Biopower® 0.3% (48.43% & 40.00%) and Dipel® 0.2% (43.13% & 36.89%). These findings are similar with the results of Sun *et al*., (2001) and Karthikeyan and Selvanarayanan (2011) reported that different concentration of *B. Bassiana* recorded the highest mortality of *H. armigera*. Similarly, *Beauveria bassiana* had strong efficacy in controlling okra jassid followed by Neem oil, Buprofezin and Emamectin benzoate in comparison to control (Akramuzzaman *et al*., 2018). The moderate per cent reduction in larval population was shown with pungam oil 3%. Similar trend in the per cent reduction in larval population was noticed during second spray of both seasons against shoot and fruit borer *E. vittella* on bhendi.

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