

Comparative Efficacy of Certain Botanicals and Bioagents against Pod Borer, *Helicoverpa armigera* (Hubner) on Field Bean, *Lablab purpureus* (L.)

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Abstract The occurrence of pod borer commenced from 6th standard week (February second week) with an average population of 0.25 larvae/ plant. The pod borer population increased and gradually reached its peak level of 1.35 larvae/plant in 9th standard week (Feb last week) there after declined trend was observed. It was observed that the occurrence of *H.armigera* might be due to congenial weather factor like temperature, wind velocity, humidity, and sunshine hours prevailed during the investigation. It was observed that the temperature between 25-35°C favored the multiplication of pod borer whereas, more than 35°C might be attributed to decline of the population. Among the treatments NSKE found superior over all the treatments after first and second sprays, respectively. Among the bioagents HaNPV found superior over other insecticides. Highest population reduction of 15.4% was observed with NSKE. Minimum pod damage was observed NSKE which is followed by Emamectin benzoate 5SG, HaNPV 250LE/ha, neem oil, pongamia seed extract

(5 ml/lit), GCKE 0.5%, *Bacillus thuringiensis* @ 1kg/ha. Highest cost benefit ratio was recorded in NSKE (1 : 2.42) and proved to be effective among the treatments.

Keywords Field bean, *Helicoverpa armigera*, Management.

Introduction

Lablab purpureus (L.) known as field bean and hindi name is Sem *Dolichos* bean, Hyacinth bean or the Kanada name is avare kai. Field bean is one of the most ancient crops among cultivated plants. In India, it is being cultivated in Karnataka, Tamil Nadu, Andhra Pradesh, Kerala and Assam. In Karnataka, *Dolichos* bean is cultivated in 0.77 lakh hectares with an annual production of 0.17 lakh tonnes with productivity rate of 183 kg/ha [1]. In field bean recorded as many as 55 species of insects pests and one species of mite feeding on the crop from seedling stage till harvest of the crop. Among them, the pod borers are considered to be the most devastating pests causing pod loss to the tune of nearly 54% (20 q/ha). The damage due to pod borers alone was estimated to be 80% the damage even up to 90-95%. The field

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bean includes pod borer complex of *Helicoverpa armigera* (Hubner), *Adisura atkinsoni* (Moore), *Maruca testulalis* (Geyer), *Etiella zinckenella* (Treitschke), *Sphenar chescafffer* (Zeller), *Exelastis atomosa* (Walshingham), *Callosobruchus chinensis* (Linnaeus) and *Lampides boeticus* (Linnaeus) [2].

Materials and Methods

Studies on the comparative efficacy of botanicals and bioagents against pod borer, *Helicoverpa armigera* (Hubner) on field bean *Lablab purpureus* (L.) during *kharif* season of 2013-2014 at the research farm of Sam Higginbottom Institute of Agriculture Technology & Science, (Deemed-to-be-university), Allahabad. The experiment was laid out in randomized block design with eight treatments replicated thrice in 4m² plot size. This investigation was carried out on Long green a field bean variety. All the recommended agronomic practices were followed to raise the crop. Four botanicals, two bioagents and one chemical insecticide were evaluated against the field bean pod borer, *Helicoverpa armigera*. The treatments were imposed by using hand sprayer @ 400-500 liters of spray solution/hectare depending on stage of the crop. The crop received two sprays, the first being given when the damage crossed economic threshold while, the second spray was imposed 20 days after first spray. The observation of damaged pods and total pods was recorded on 5 randomly selected plants in each plot.

The first and second spray where as, the post-treatment observations were made on 3rd, 7th and 14th day after each spray and analyzed statistically for variance to compare the treatment means.

Results and Discussion

The occurrence of field bean pod borer, *H. armigera* commenced from 6th standard week (February second week) with an average 0.25 larvae/plant [3]. The pod borer population increased and gradually reached peak level of 1.35 larvae/plant at 9th standard week [4]. Thereafter, declined trend was observed conducted to study the incidence of the pod borer in field bean commenced from second week of February i.e. in the early part of 1st fortnight of February [5]. The larval population started increasing and reached its maximum during 4th week of March. These findings are in close association with as well [6]. The occurrence of *H. armigera* might be due to congenial weather factors like temperature, wind velocity, humidity, and sunshine hours prevailed during the investigation. It was observed that the temperature between 25-35°C favored the multiplication of field bean pod borer whereas, more than 35°C might be attributed to decline of the population.

Efficacy of certain botanicals and bioagents insecticides

All the treatments were found to be significantly

Table 1. Efficacy of botanicals and bioagents against field bean pod borer *H. armigera* during *kharif* season, 2013-2014 (1st spray) . Figures in parentheses are arcsin transformed values.

Tr. No.	Treatments	Percentage infestation reduction in pod damage			Mean
		3 DAS	7 DAS	14 DAS	
T ₁	NSKE	18.78 (25.681)	9.91 (18.349)	16.75 (24.159)	15.41
T ₂	Emamectin benzoate 5SG	17.21 (24.510)	6.42 (14.677)	16.08 (23.641)	13.23
T ₃	HaNPV	16.85 (24.235)	9.03 (17.488)	14.71 (22.553)	13.53
T ₄	Neem oil	14.57 (22.569)	7.44 (16.525)	14.35 (22.423)	12.12
T ₅	Pongamia	14.73 (22.439)	8.09 (15.829)	14.55 (22.260)	12.46
T ₆	Chilli garlic kerosene extract	13.40 (22.521)	7.63 (17.287)	13.48 (23.366)	11.50
T ₇	Bacillus thuringiensis	14.67 (21.473)	8.83 (16.035)	15.73 (21.540)	13.08
T ₀	Control	13.40 (21.473)	7.63 (16.035)	13.48 (21.540)	11.50
	Overall mean	19.17	12.49	18.61	
	F-test	S	S	S	
	SEd (±)	6.012	4.010	3.671	
	CD (p=0.05)	12.746	8.501	7.783	

Table 2. Efficacy of botanicals and bioagents against field bean pod borer *H. armigea* during *kharif* season, 2013-2014 (2nd spray). Figures in parentheses are arcsin transformed values.

Tr. No.	Treatments	Percentage infestation reduction in pod damage			Mean
		3 DAS	7 DAS	14 DAS	
T ₁	NSKE	10.81 (19.19)	17.29 (24.57)	11.61 (19.92)	13.24
T ₂	Emamectin benzoate 5 SG	10.22 (18.64)	16.2 (23.734)	6.14 (20.676)	10.85
T ₃	HaNPV	10.9 (19.278)	15.05 (22.82)	6.5 (21.549)	10.82
T ₄	Neem oil	8.29 (16.734)	10.75 (19.14)	4.15 (22.037)	7.73
T ₅	Pongamia seed extract	8.84 (16.398)	14.21 (22.04)	4.15 (21.974)	9.067
T ₆	Chilli garlic kerosene extract	7.97 (17.297)	14.09 (22.14)	3.08 (21.941)	8.38
T ₇	<i>Bacillus thuringiensis</i>	9.12 (17.577)	14.56 (22.43)	2.67 (21.965)	8.783
T ₀	Control	10.9 (19.278)	15.05 (22.82)	6.5 (22.111)	10.82
	Overall mean	13.29	18.23	8.74	
	F-test	S	S	S	
	SEd (±)	0.810	2.883	4.744	
	CD (p=0.05)	1.718	6.112	10.057	

superior over control. NSKE was more effective in reduction pod damage percentage of 15.4% [7]. NSKE gave the highest percentage of pod damage reduction and Emamectin benzoate 5 SG was found to be next effective treatment (13.23%) [8]. Emamectin benzoate proved to be the best after NSKE in reducing number of larvae on the basis of 3 DAS, 7 DAS, 14 DAS data.

Cost benefit ratio

Among all treatments higher cost benefit ratio was obtained from NSKE treated plots is 1 : 2.42 and yield and cost ratio (C : B ratio) was also found maximum in the NSKE treated plots suggesting that these integrated pest management components can be in-

corporated in the management [9]. The NSKE treated plot with higher had higher C : B ratio yield.

Economics of various treatments

The data in respect of agronomical practices were same for all treatments i.e., 1,74,464.42/ha cost benefit ratio is influenced by various treatments. Highest cost benefit ratio of 1 : 2.42 was recorded in NSKE and proved to be effective among all the treatments. However, Emamectin benzoate recorded second highest C : B ratio of 1 : 2.25 followed by HaNPV (1 : 2.10), neem oil (1 : 1.27), *Bacillus thuringiensis* (1 : 1.79) and GCKE (1 : 0.89) pongamia seed extract (1 : 1.43), control (1 : 0.67).

Table 3. Economics of field bean pod borer management using botanicals and bioagents.

Tr. No.	Treatments	Cost of yield (Rs/q)	Total cost of yield (Rs/ha)	Common cost (Rs/ha)	Treatment cost (Rs/ha)	Total cost (Rs/ha)	Net returns (Rs/ha)	C : B ratio
T ₁	NSKE	4643	6,03,590	1,74,464.42	2000	1,76,464.42	427125.58	1 : 2.42
T ₂	Emamectin benzoate 5 SG	4643	5,75,732	1,74,464.42	2440	176904.42	39887.50	1 : 2.25
T ₃	HaNPV	4643	5,47,874	1,74,464.42	2050	176514.42	371359.58	1 : 2.10
T ₄	Neem oil	4643	5,47,874	1,74,464.42	1550	176014.42	223383.58	1 : 1.27
T ₅	Pongamia seed extract	4643	4,27,156	1,74,464.42	1100	175564.42	251591.58	1 : 1.43
T ₆	Chilli garlic kerosene extract	4643	3,34,296	1,74,464.42	2405	176869.42	157426.58	1 : 0.89
T ₇	<i>Bacillus thuringiensis</i>	4643	4,92,158	1,74,464.42	1800	174264.42	315893.58	1 : 1.79
T ₀	Control	4643	2,92,509	1,74,464.42	—	174464.42	118044.58	1 : 0.67

Conclusion

From the critical analysis of the present findings it can be concluded that field bean pod borer population increased with increasing maximum temperature, minimum temperature, morning and evening relative humidity and decreased with increasing maximum temperature above 35°C, wind velocity and sunshine hours. Insecticides like NSKE and Emamectin benzoate can be suitably incorporated in integrated pest management schedule against *Helicoverpa armigera* as an effective tool as their recommended field doses are very low. Emamectin is a low toxicity level insecticide. The plant products also achieve certain range of mortality but are less effective when compared to new insecticide molecules because they are highly specific, low dose and effective. Comparatively bioagents the chemical like Emamectin showing the good results in experiment. Overall the experiment was adopted in ecofriendly pest management strategies.

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