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Evaluation of some novel insecticides against *Helicoverpa armigera* (Hubner) in black gram (*Vigna mungo*)

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Abstract
Black gram pod borer, *Helicoverpa armigera,* has become one of the most devastating pests that caused serious damages. For this reason, the present study was undertaken to determine the bio-efficacy of six insecticides *viz.,* indoxacarb 14.5 SC, flubendiamide 480 SC, novaluron 10 EC, carbosulfan 25 EC, λ-cyhalothrin 5 EC and cypermethrin 25 EC against pod borer, *H. armigera* in black gram. Flubendiamide 480 SC was superior in recording lower larval population followed by indoxacarb 14.5 SC. The highest grain yield (928 kg ha^{-1}) as well as cost benefit ratio (1:9.57) was obtained from the treatment flubendiamide 480 SC and followed by indoxacarb 14.5 SC. The minimum yield was obtained from the cypermethrin 25 EC (428 kg ha^{-1}). In conclusion, flubendiamide 480 SC@ 75 ml ha^{-1} proved effective treatment against *H. armigera* in black gram.

Keywords: Black gram, evaluation, *Helicoverpa armigera,* novel insecticide, pod borer and yield

1. Introduction

Black gram (*Vigna mungo* L.) is an important pulse crop and is reported to be originated in India. The nutritive value of urdbean lies in its high and easily digestible protein and contains approximately 25-28% protein, 1.0-1.5% oil, 3.5% - 4.5% fiber, 4.5-5.5%ash and 62-65% carbohydrates on dry weight basis. Globally, the production of black gram is around 8.5 million tonnes. In India total production of black gram is 1.77 million tonnes and average productivity is 500 kg ha^{-1} (Anonymous, 2011) [3]. The major urdbean growing states of the country are Maharashtra, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Tamilnadu, Karnataka and Rajasthan. Andhra Pradesh is the largest producer contributing for about 19% of the country's output, followed by Uttar Pradesh with 11% (Anonymous, 2010) [2]. Annually about 2.0-2.4 million tonnes of pulses with approximate monetary value of Rs.6000 crores are lost due to damage caused by insect pest (Reddy, 2009) [8]. The low yield of black gram in Uttar Pradesh can be attributed to many reasons, one of which includes the damage caused by insect pests. The loss in the production caused by them may reach up to 70% depending upon the severity of attack. The pod borer, *H. armigera* is considered to be important in causing economic losses to the farmer (Reddy *et al.,* 1998) [7]. The immature larvae feed and forage on crops at all stages of plant development, damaging flowers and pods. Many of the researcher's use of an indigenous materials botanicals or conventional or novel insecticides in India, but did not previously work of this black gram pest with novel chemical insecticides under agro climatic conditions in Western Uttar Pradesh. Each also opined that scientific and judicious use of novel insecticide is still the best method of plant protection.

2. Materials and Methods

The experiment was carried out during *kharif* 2012 at Crop Research Centre of S.V.P.U.A. &T., Meerut in a randomized block design with three replications with a spacing of 40 cm between rows and 15 cm between plants in a plot size of 3 x 4 meters with a distance of 100 cm between the plots and 150 cm between the replications. Black gram variety 'Shekhar 2' was used in the experiments for sowing. Whole agronomic practices were applied uniformly in the field throughout the cropping season. The insecticide spraying was done with the help of Knapsack Sprayer only when the pest population density crossed economic threshold level (ETL). Six insecticides *viz.*, Indoxacarb14.5 SC @ 500 ml. ha^{-1}, flubendiamide 480 SC @ 75 ml. ha^{-1}, novaluron 10 EC @ 750 ml. ha^{-1}, carbosulfan 25 EC @1000 ml. ha^{-1}, λ-cyhalothrin

5 EC @500 ml. ha^{-1} and cypermethrin 25 EC @ 1000 ml. ha^{-1} were evaluated along with untreated control against pod borer. The first spray was done at 50% pod initiation stage and second spray was done 10 days after first spray (DAS). Observation on larval populations were recorded from one day before, 3rd and 7th day after each spray from 10 randomly selected tagged plants per each treatment. For recording grain yield, inner rows were harvested and total weight of grains was recorded into q/ha along with increase in yield. Cost benefit ratio, net return per rupees invested, was calculated by using the following formula

$$\text{Cost: benefit ratio} = \frac{\text{Cost of increased yield}}{\text{Cost of treatment (Rs/ha)}}$$

The data recorded during the course of investigation were subjected to statistical analysis by using analysis of variance technique (ANOVA) for Randomized Block Design to compare means of different treatments as suggested by Panse and Sukhatme (1985) [10].

3. Results and Discussion

Data recorded in kharif 2012 presented in Table-1 revealed that at 50% of pods initiation stage *H. armigera* (Hubner) has reached the ETL level. The comparative efficacy of six different insecticides tested for management of pod borer in black gram crop was highly significant whereas the yield data is presented in Table-2.

3.1 Effect on larval population at First Spray

Before spray of test chemicals in *Kharif* 2012 the larval population was non-significant (Table-1).

3.1.1 Larval population at 3 DAS: The results presented in Table-1 revealed that the flubendiamide 480 SC is the most effective insecticide among all the insecticides tested at 3 days after application of first spray in controlling the pod borer on black gram crop, followed by indoxacarb 14.5 SC and novaluron. The reduction of larval population was recorded with flubendiamide 480 SC (0.33 larvae/ten plants), followed by indoxacarb 14.5 SC (0.67 larvae/ten plants) and novaluron (1.00 larvae/ten plants). The higher larval population was recorded in treatment cypermethrin 25 EC (3.67 larvae/ten plants) at 3 DAS.

3.1.2 Larval population at 7 DAS: The results presented in Table-1 revealed that the flubendiamide 480 SC (0.67 larvae/ten plants) is the most effective among all the treatments in controlling the pod borer on black gram crop, followed by indoxacarb 14.5 SC (1.33 larvae/ten plants) and novaluron (2.00 larvae/ten plants) at 7 DAS.

3.2 Effect on larval population at Second Spray

3.2.1 Larval population at 3 DAS: The results of second spray (Table-1) showed that the flubendiamide 480 SC was also more effective in respect of reducing the larval population of pod borer when compared with other insecticides tested at 3 days, followed by indoxacarb 14.5 SC, novaluron 10 EC and carbosulfan 25 EC. The higher reduction of larval population was recorded with flubendiamide 480 SC (0.67 larvae/ten plants), followed by indoxacarb 14.5 SC (1.33 larvae/ten plants), novaluron 10 EC (0.99 larvae/ten plants) and carbosulfan 25 EC (2.33 larvae/ten plants). The maximum number of larvae (6.33 larvae/ten plants) was observed in untreated control.

3.2.2 Larval population at 7 DAS: The results of second spray (Table-1) showed that the flubendiamide 480 SC (0.00 larvae/ten plants) was complete control pod borer, *H. armigera* where nil larval population at 7 days, followed by indoxacarb 14.5 SC (0.67 larvae/ten plants). The higher larval population of *H. armigera* (4.33 larvae/ten plants) was recorded in treatment cypermethrin 25 EC (4.33 larvae/ten plants) at 7 DAS. The results are in conformity by Ameta and Bunker (2007) [1] and Kumar and Shivaraju (2009) [6] who reported that flubendiamide spray were the most effective against pod borer, *H. armigera*. Gowda (2005) [5] reported that flubendiamide 20WG (RIL-038) at 25g a.i/ha was found to be effective in managing the rice stem borer, *Scirpophaga incertulas* Walker.

3.3 Grain yield

The highest yield of black gram 9.28 q/ha was recorded in flubendiamide 480 SC@ 75 ml ha^{-1} followed by indoxacarb14.5 SC @ 500 ml. ha^{-1}, novaluron 10 EC @ 750 ml. ha^{-1}, carbosulfan 25 EC @1000 ml. ha^{-1}, λ-cyhalothrin 5 EC @500 ml. ha^{-1} and cypermethrin 25 EC @ 1000 ml. ha^{-1} 8.13, 7.64, 7.18, 6.47 and 4.28 q/ha, respectively (Table-2). The contrasting results are observed by Sreenivas *et al*. (2008) [9], who reported that the highest fruit yield of 2512 kg ha^{-1} was recorded from the plots where flubendiamide 480 SC was applied to control pod borer of black gram. These results are in conformity with those of Deshmukh *et al*. (2010) [4] and Kumar and Shivaraju (2009) [6]. Maximum net income Rs. 29946/ha and cost benefit ratio 1:9.57 was found in case of flubendiamide 480 SC@ 75 ml ha^{-1} because of its low cost and highest yield. It was followed by indoxacarb14.5 SC @ 500 ml. $ha^{-1}$with net income of 24794 Rs/ha and cost benefit ratio 1:8.29. The present results are in agreement with findings of Deshmukh *et al*. (2010) [4], Kumar and Shivaraju (2009) [6], who reported that the insecticide flubendiamide has a high efficacy on target insects, including *H. armigera*, while maintaining little effect on beneficial insects.

Table 1: Effect of different treatments on the number of larval population against *H. armigera*

Treatments	Dose	Mean no. of larvae/10 plants				
		One day before spray	First spray		Second spray	
			3 DAS	7 DAS	3 DAS	7 DAS
Indoxacarb 14.5 SC	500 ml/ha	4	0.67*	1.33	0.33	0.67
Novaluron 10 EC	750 ml/ha	4.33	1	2	0.99	1.33
Flubendiamide 480 SC	75 ml/ha	4.67	0.33	0.67	0	0
Lambda cyhalothrin 5 EC	500 ml/ha	4.33	3	4.33	3.33	4
Carbosulfan 25 EC	1000 ml/ha	5	2.33	3	2.33	2.67
Cypermethrin 25 EC	1000 ml/ha	4.67	3.67	4.67	4	4.33
Untreated control		5	5.67	6.33	7.67	8
S. Ed. ±		1.425	0.858	0.592	0.381	0.746
C.D. 5%		N.S.	2.67	1.84	1.18	2.32

DAS = Days after spraying; * Average of three replications

Table 2: Cost: benefit ratio of different treatments

Treatment	Dose	Yield (q/ha)	Increase in yield over control (q/ha)	Value of increase yield (Rs/ha)	Cost of treatment (Rs/ ha)	Net profit (Rs/ ha)	Cost benefit ratio
Indoxacarb 14.5 SC	500 ml/ha	8.13	6.04	27784	2990	24794	1:8.29
Novaluron 10EC	750 ml/ha	7.64	5.55	25530	3394	22136	1:6.52
flubendiamide 480 SC	75 ml/ha	9.28	7.19	33074	3128	29946	1:9.57
Lambda cyhalothrin 5 EC	500 ml/ha	6.47	4.38	20148	2785	17363	1:6.23
Carbosulfan 25 EC	1000 ml/ha	7.18	5.09	23414	2904	20510	1:7.06
Cypermethrin 25 EC	1000 ml/ha	4.28	2.19	10074	1720	8354	1:4.85
Control		2.09	-	-	-	-	-

Average market price of black gram Rs 4600/quintal, Cost of labour @ Rs 120/day, Charge of sprayer @ Rs 40/day, Mention the price of each insecticide used (Rs/ha)

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5. References
1. Ameta OP, Bunker GK. Efficacy of flubendiamide against fruit borer, *Helicoverpa armigera* in tomato with safety to natural enemies. Indian Journal of Plant Protection. 2007; 35(2):235-237.
2. Anonymous. The Hindu business Line Yes Bank Knowledge initiative on Food and Agribusiness agriculture pulses commodity. Articles 17, 2007.
3. Anonymous. Production and Productivity Pulses Development Schemes (ZPD Kanpur). 2011, 1-5. www.agropedia.
4. Deshmukh SG, Sureja BV, Jethva DM, Chatar VP. Field efficacy of different insecticides against *Helicoverpa armigera* (Hubner) infesting chickpea. Legume Research. 2010; 33(4):269-273.
5. Gowda J. Bioefficacy of flubendiamide 20WG (RIL-038) against rice stem borer, *Scirpophaga incertulas* (Wlk.). Pestology. 2005; 29:19-20.
6. Kumar CTA, Shivaraju C. Evaluation of newer insecticide molecules against pod borers of black gram. Karnataka Journal of Agricultural Sciences. 2009; 22(3):521-523.
7. Reddy CN, Singh Y, Singh VS. Pest complex and their succession on pigeon pea variety. Indian Journal Entomology. 1998; 60(4):334-338.
8. Reddy AA. Pulses production technology: Status and way forward. Economic Political Weekly. 2009; 44(52):73-80.
9. Sreenivas AG, Hosamani AC, Bheemanna M, Suresh BK, Shivaleela, Patil BV. Efficacy of flubendiamide 480 SC against chilli fruit borer complex. Pesticide Research Journals. 2008; 20(2):243-246.
10. Panse VG, Sukhatne PV. Statistical methods for agricultural workers. ICAR, New Delhi, 1985, 381.