RESEARCH ARTICLE

EVALUATION OF DIFFERENT BOTANICALS AND BIOPESTICIDES AGAINST *HELICOVERPA ARMIGERA* ON MARIGOLD

Vipin Prakash Bhagat, G.P. Painkra*, P.K. Bhagat, C.R. Gupta and K.L. Painkra

Department of Entomology, Rajmohini Devi College of Agriculture & Research Station, Ambikapur-497001 Surguja (Chhattisgarh) India

Received-07.11.2017, Revised-26.11.2017

Abstract: The different botanicals and bio-pesticides were tested against the natural incidence of the *Helicoverpa armigera* on marigold crop var. Morden during *Rabi*2016-17. The experiment was undertaken in a randomized block design (RBD) with seven treatments *viz*,HaNPV (250 LE) @ 2ml/ litre, NSKE @ (5%), *Bacillus thuringiensis* @ 2.5g/litre, Neem oil @ 4ml/litre, *Beauveria bassiana* @ 4gm/litre, Karanj oil @ 5% and Untreated control in three replications with 3 x 2.5 m^2 plots and row to spacing of 60 x 30 cm. In all two sprayings were undertaken so as to evaluate the effectiveness of the treatments and it were observed that the larval incidence at 1, 3, 5, 7 and 10 days after both spraying was lowest in plots sprayed with HaNPV. However the next best treatments in the order of effectiveness for the control of *Helicoverpa armigera* were NSKE 5%, *Bacillusthuringiensis*@ 2.5 gm/litre, Neem oil @ 4ml/litre, *Beauveriabassiana* @ 4ml/ litre, Karanj oil @ 5%.

Keyword: *Beauveria bassiana*and *Bacillus thuringiensis*, HaNPV, Marigold, NSKE

INTRODUCTION

Marigold (*Tagetes erecta* L.) is an important loose flower in Chhattisgarh and India. It is getting popular in Chhattisgarh and West Bengal. Marigold gained popularity amongst gardeners and flower dealers on account of its easy culture and wide adaptability. Its habit of free flowering, short duration to produce marketable flowers, wide spectrum of attractive colour, shape, size and good looking quality attracted the attention of flower growers. Its native place is central and South America, especially Mexico from where it spreads to different parts of the world during early parts of the 16th century, but it has adopted so well to Indian condition that it is as good as a native to India as well. The marigold rank is first of the flower cultivation in Chhattisgarh. The area of marigold is 4007 hectare, production 29270 million tons and productivity 7.30 million tons per hectare respectively in Chhattisgarh (Anonymous 2016). Marigold is one of the most important flower crop grown commercially in different parts of India. In the year 2003-2004, the estimated are under marigold in India was 17600 hectare and production 2 lacks metric tones (Anonymous, 2003). Earlier marigold was considered as pest free crop but as this is a photo-insensitive crop it is grown all-round the year.In all three seasons which led to increase of pest incidence on marigold. About 10 insect pest damaging to this crop, among which, *H. armigera* (Hubner) causes severe damage to this crop causing yield loss up to 20%. Among these, capitulum borer (*H. armigera*) is highly polyphagous with about 181 host plants including important crop plants such as pulses, cotton, vegetables, etc. (Manjunath *et al.*, 1985). The *Helicoverpa* larval economic damages marigold crop on the leaves in early stages of the crop growth and then feeds on flower buds, fruiting parts. Even one *Helicoverpa armigera* larva per capitulum could cause economic damage (Margal, 1990).Therefore to have effective control measure for capitulum borer is the need of the hour. Various control methods available are cultural management, mechanical management, botanical control, biological control and chemical control(Anonymous, 2014), although chemical control method provides immediate control but causes various environmental and health hazards. So these biological control alternatives for management of Capitulum borer *Helicoverpa armigera* were tried in the present experiment to manage the pest effectively and maximize flower yield because it was safe, economical and advocated as the first line of attack.

MATERIAL AND METHOD

The present research work was undertaken at farmers field located in Ajabnagar, Surajpur. It is situated about 5 km away from Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.). The experiment was conducted in randomized block design with seven treatments and three replications. The variety of marigold was Pusa Narangi *viz*., Morden with a spacing of 50 x 50 cm in a 3 x 2.5 m^2 plot. The dose of fertilizer at the rate of 80kg N, 80kg P, 50kg K, was given to prior to transplanting and 40kg N after sowing.

Treatment and Details of treatment

The treatments were, T_1-HaNPV (250 LE) @ 2ml/litre, T_2-NSKE @ (5%), T_3- *Bacillus thuringiensis* @ 2.5g/litre, T_4- Neem oil @ 4ml/litre, T_5- *Beauveria bassiana* @ 4gm/litre, T_6- Karanj oil @ 5%, and T_7- untreated control.

Preparation of spray solution

The spray solution of desired concentration was freshly prepared every time at the site of experimentation just before the starting of spraying

*Corresponding Author

operations. The quantity of spray material required for coverage of crop was gradually increased as the crop advanced in age. The spray solution of a desired concentration was prepared by adopting the following formula:

$$V = \frac{C \times A}{\% \text{ a.i.}}$$

where,
V= volume / weight of insecticides or biopesticides in ml/ gm.
C= concentration required.
A= quantity of spray solution required in ml.
% a.i. = percentage of active ingredient in product.

Methods of recording observations

Five plants were selected randomly from the net plot of each treatment in each replication. They were properly labeled. The observations on total number of larvae were recorded on each leaf from top, middle and bottom canopy and capitulum of the observation plants. The ETL of pest (1 larva leaf^{-1}) was considered as optimum pest and pre count was recorded. The observations on population of larvae were also recorded at one, three, five, seven and ten days after application of treatment. Then the data were converted into mean values using square root transformation.

RESULT AND DISCUSSION

The results obtained during the course of experimentations are presented in Table 1 and 2 and Figure 1 and 2, under all the treatments were significantly superior in reducing larval population over untreated control at all the days of observations after first and second sprays. However, the incidence of larva on marigold observed lowest in treatment T_1-HaNPV (250 LE) 2ml/litre at one, three, five, seven and ten days after first and second application of treatment followed by NSKE @ 5%, *Bacillus thuringiensis* @ 2.5g/litre,Neem oil @ 4ml/litre, *Beauveria bassiana* @ 4gm/litre, and Karanj oil @ 5%. Highest larval population was recorded in untreated control.

Present results were discussed in the light of following workers. Jagdish *et al.* (2010) recorded the influence of six bio-pesticides in comparison profenophos 0.05 %, endosulphan 35 EC and untreated control against *Helicoverpaarmigera* and *Spodoptera litura*, reported that NSKE 5% and Profenophos 0.05 % were most effective in obtaining larval mortality of *Helicoverpa armigera* and were statistically on par with each other. Kati (2010) evaluated *B. bassiana* SC formulation @ 250 mg/L, DOR *Bacillusthuringiensis* (*Bt*) formulation @ 2.5 g/L, HaNPV (DOR isolate) @ 2 x 108 POBs/mL Commercial neem formulation 0.5 %, NSKE 5 %, PSE 5%, Profenophos 0.05 % and untreated control in three replications against *Helicoverpa armigera* in field condition and reported that profenophos @ 0.05% at 3 and 7-days after first application and second application of treatment was most effective which was followed by HaNPV reducing head borer infestation and maximizing seed yield. Mane *et al.* (2013) evaluated *Beauveria bassiana* SC formulation, Neem formulation, HaNPV and other biopesticides in comparision with quinalphos 25 EC and profenophos 50EC @ 0.05 % and untreated control against *Helicoverpaarmigera* in field condition and reported that Profenophos @ 0.05% at 3 and 7- days after first application and second application of treatment was most effective which is followed by HaNPVin reducing head borer infestation and maximizing seed yield and these treatments where at par with each other.

Table 1. Evaluation of different botanicals and biopesticides against *Helicoverpa armigera* after First Spray

Tr. No.	Treatment	Dose	Pre-treatment larval population/plant	Mean larval population of per plant at days after first spray					Overall Mean
				1st	3rd	5th	7th	10th	
T_1	HaNPV 250LE	2ml/lit.	2.00 (1.58)*	1.40 (1.38)	0.93 (1.20)	0.67 (1.08)	0.20 (0.83)	0.13 (0.79)	0.66
T_2	NSKE (5%)	50ml/lit	1.93 (1.56)	1.53 (1.43)	1.13 (2.73)	0.87 (1.17)	0.60 (1.05)	0.27 (0.87)	0.88
T_3	*Bacillus thuringensis*	2.5g/lit	1.73 (1.49)	1.53 (1.43)	1.20 (2.20)	1.07 (1.25)	0.73 (1.11)	0.47 (0.98)	1.00
T_4	Neem oil	4ml/lit	1.80 (1.52)	1.47 (1.40)	1.27 (2.80)	1.13 (1.28)	0.93 (1.20)	0.73 (1.11)	1.10
T_5	*Beauveria bassiana*	4g/lit	1.93 (1.56)	1.60 (1.45)	1.40 (1.47)	1.20 (1.30)	1.00 (1.22)	0.80 (1.14)	1.20
T_6	Karanj oil (5%)	50ml/lit	1.80 (1.52)	1.67 (1.47)	1.47 (3.73)	1.27 (1.33)	1.07 (1.25)	0.87 (1.17)	1.27
T_7	Control	-	2.07 (1.60)	2.20 (1.64)	2.40 (7.60)	2.53 (1.74)	2.60 (1.76)	2.87 (1.83)	2.52
SE(m)			0.15	0.11	0.11	0.12	0.10	0.09	
CD5%			0.44	0.35	0.33	0.35	0.32	0.28	

*Figure in parentheses are square root $\sqrt{x + 0.5}$ Transformed value

Table 2. Evaluation of different botanicals and biopesticides against *Helicoverpa armigera* after second spray

Tr. No.	Treatment	Dose	Pre-treatment larval population/plant	Mean larval population of per plant at days spray					Overall Mean
				1st	3rd	5th	7th	10th	
T_1	HaNPV 250LE	2ml/lit.	1.73 (1.49)*	1.33 (1.35)	0.87 (1.17)	0.47 (0.98)	0.13 (0.70)	0.07 (0.75)	0.57
T_2	NSKE (5%)	50ml/lit	1.73 (1.49)	1.40 (1.38)	1.13 (2.73)	0.67 (1.08)	0.47 (0.98)	0.20 (0.84)	0.77
T_3	*Bacillus thuringensis*	2.5g/lit	1.87 (1.54)	1.53 (1.43)	1.20 (2.20)	0.87 (1.17)	0.60 (1.05)	0.33 (0.91)	0.90
T_4	Neem oil	4ml/lit	1.80 (1.92)	1.67 (1.47)	1.47 (2.80)	1.13 (1.28)	0.87 (1.17)	0.67 (1.08)	1.16
T_5	*Beauveria bassiana*	4g/lit	1.60 (1.45)	1.47 (1.40)	1.33 (1.47)	1.00 (1.22)	0.80 (1.14)	0.60 (1.05)	1.04
T_6	Karanj oil (5%)	50ml/lit	1.73 (1.49)	1.53 (1.42)	1.47 (3.73)	1.27 (1.33)	0.93 (1.19)	0.80 (1.14)	1.20
T_7	Control	-	1.80 (1.52)	1.93 (1.56)	2.20 (7.60)	2.47 (1.72)	2.53 (1.74)	2.80 (1.82)	2.38
SE(m)			0.11	0.10	0.08	0.09	0.10	0.09	
CD5%			0.32	0.30	0.25	0.26	0.30	0.26	

*Figure in parentheses are square root $\sqrt{x+0.5}$ Transformed value

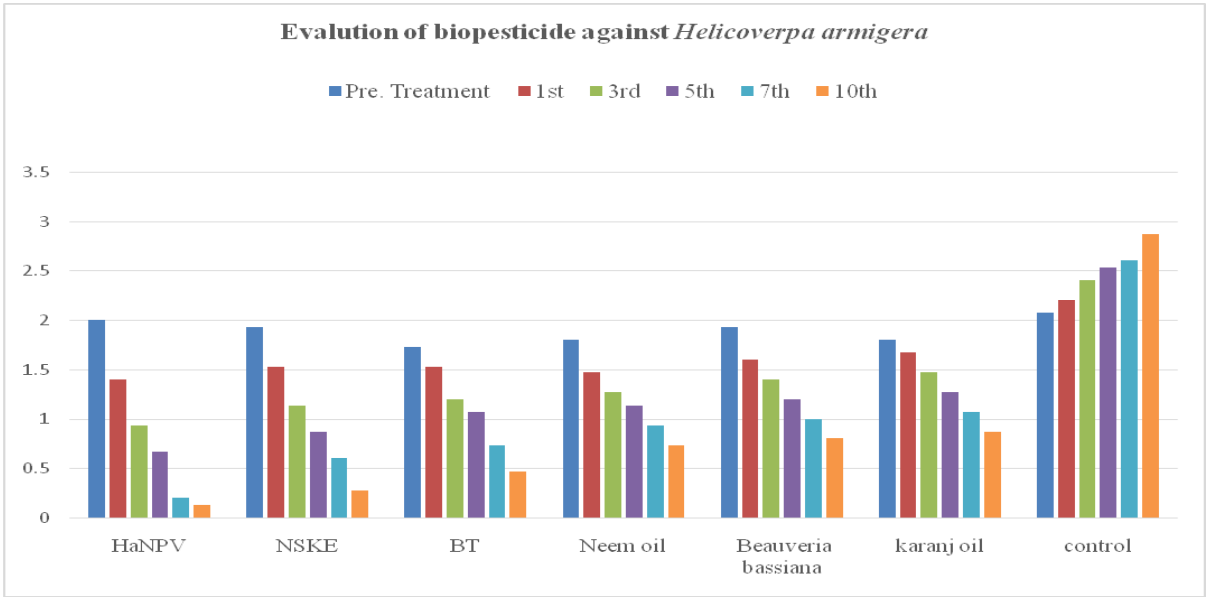

Fig 1. Evaluation of botanicals and bio-pesticides against *Helicoverpa armigera* after first spray

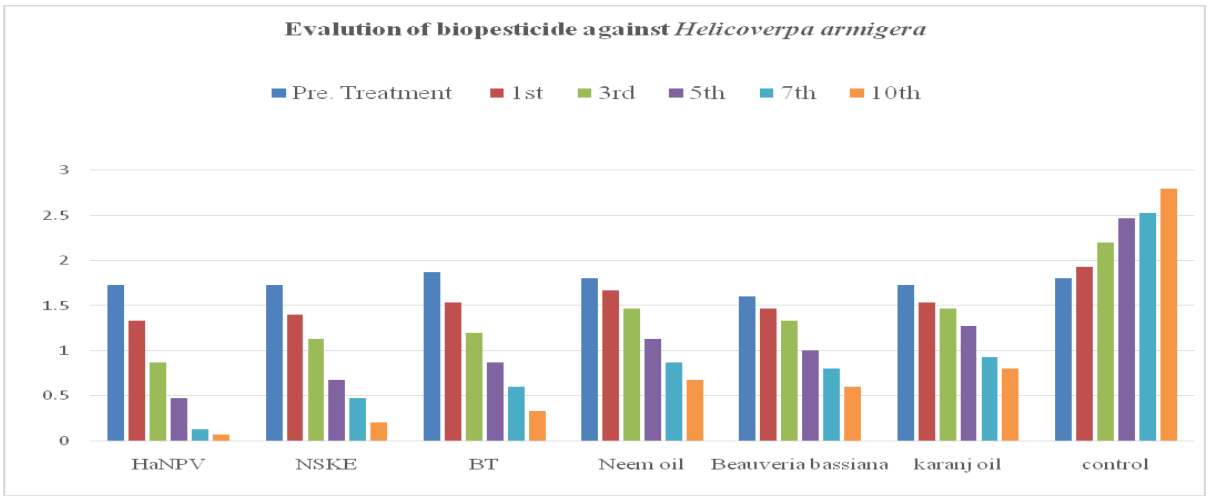

Fig 2. Evaluation of botanicals and bio-pesticides against *Helicoverpa armigera* after second spray

CONCLUSION

Among the seven treatments the best treatment was recorded T_1 HaNPV 250LE followed byT_2 NSKE 5%, T_3 *Bacillus thuringiensis*,T_4 Neem oil, T_5 *Beauveria bassiana* and T_6 karanj oil was least effective against *Helicoverpa armigera* in marigold .

REFERENCES

Anonymous (2003). Directorate of Horticulture, Ministry of India.

Anonymous (2014). Pest of sunflower –Insect Pest-Captulum borer, Oilseeds Agropedia.

Anonymous (2016). Directorate of Horticulture, Ministry of Chhattisgarh. pp. 07.

Manjunatha, T.M., Bhatnagar, V.S., Pawar C.C. and Sitanatham, S. (1985). Economic importance of *Heliothis*spp. in India and an assessment of their natural enemies and host plants. In: proceedings of biological control of *Heliothis*: Increasing effectiveness of natural enemies New Delhi, India,11-15 Nov.,1985. PP. 197- 228.

Margal, S. M. (1990). Studies on estimation of losses in sunflower cultivars due to *Helicoverpa armigera* Hub. (Lepidoptera: Noctuidae) and possible occurrence of biotypes. Ph. D thesis, University of Agricultural Sciences, Bangalore, 146 PP.

Jagadish, K. S. Y., Shadakshari, G., Puttarangaswamy, K. T., Karuna, K., Geetha, K. N. and Nagarathna. T.K. (2010). Efficacy of some biopesticides against defoliators and capitulum borer, *Helicoverpa armigera* Hub. In sunflower, *Helianthus annuus* L. *Journal of Biopesticides* 3(1): 379-381.

Kati (2010). Annual report of sunflower, In Annual Workshop held at TNAU, Coimbatore by Directorate of Oilseeds Research, Hyderabad. PP.208-214.

Mane, P.N., Rathod, P.K., Balode, K.L. and Deshmukh, S.N. (2013). Efficacy of microbials and botanicals against *Helicoverpa armigera* (Hubner) in sunflower, *Current Biotica*, **7**(3):241-245.