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Efficacy of different insecticides and biopesticides against diamondback moth (*Plutella xylostella* L.) on cabbage

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Abstract
The present investigation was carried out at Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, during the *Rabi* season of 2021-22. The experiment was laid in Randomized Block Design, which consists of eight treatments *viz*, Emamectin benzoate 5% SG @ 0.4 gm/lit, Chlorantraniliprole 18.5 SC @ 0.3 ml/lit, Novaluron 10 EC @ 2 ml/lit, Spinosad 45 SC @ 0.5 ml/lit, *Beauveria bassiana* 1.15% WP @1gm/lit, Karanj oil 2% @ 20 ml/lit, Neem oil 2% @ 20 ml/lit and untreated control. The study revealed that all the treatments were found to be significantly superior to the control. The results showed that after two sprays, the plot treated with Chlorantraniliprole 18.5 SC recorded the lowest overall mean larval population (2.45) and was the most effective treatment, followed by Spinosad 45 SC (2.80), Emamectin benzoate 5% SG (2.95), Novaluron 10 EC (3.18), *Beauveria bassiana* 1.15% WP (3.43), Neem oil 2% (3.53), Karanj oil 2% (3.70) as compared to untreated control plot (6.00). The crop yield ranged between 245.51 q/ha to 65.20 q/ha in the treatments. The plot treated with Chlorantraniliprole 18.5 SC showed highest yield (245.51 q/ha) followed by Spinosad 45 SC (230.15 q/ha), Emamectin benzoate 5% SG (190.30 q/ha), Novaluron 10 EC (170.20 q/ha), *Beauveria bassiana* 1.15% WP (150.30 q/ha), Neem oil 2% (142.00 q/ha), Karanj oil 2% (122.45 q/ha) as compared to untreated control plot (65.20 q/ha). Among the treatments Chlorantraniliprole 18.5 SC was most economical treatment and recorded highest cost-benefit ratio (1:4.00), followed by Spinosad 45 SC (1:3.60), Emamectin benzoate 5% SG (1:3.25), Novaluron 10 EC (1:2.77), *Beauveria bassiana* 1.15% WP (1:2.58), Neem oil 2% (1:2.15) and Karanj oil 2% (1:1.97) as compared to untreated control (1:1.14).

Keywords: Cabbage, diamondback moth, efficacy, insecticides, *Plutella xylostella*

Introduction

Cabbage (*Brassica oleracea*) is one of India's most popular cole vegetables. It is the second most important Cole crop, originating in Europe and the Mediterranean region after cauliflower. It belongs to the family Cruciferae. It is commonly used fresh and as boiled vegetables, cooked in curries and process, salad, etc. It is known to possess medicinal properties, and its enlarged terminal buds are a rich source of Ca, P, Na, K, S, Vitamin A, Vitamin C, and dietary fiber (Devi and Tayde, 2017) [3]. The nutritional value per 100 gm of cabbage contains 25 g of calories, 18mg of sodium, 170 gm of potassium, 6 g of carbohydrate, 1.3 gm of protein, vitamin A 1%, vitamin C 60%, calcium 4%, iron 2%, vitamin B_6 5%, and mg 3% (USDA nutrient database 2019) [9]. It is an introduced vegetable crop in India, but it has adapted itself well and is grown all over the country. Sowing time in India is different in regions; in the Northern and eastern regions, for cool-season October - November, for hot weather July - Aug, Jan - Feb and Southern and western regions sow round the year (Anonymous, 2012) [1]. India stands second in the production of cabbage production after China. Maharashtra is one of India's cabbage-growing states, with an area of 18 thousand hectares, a production of 360 thousand metric tonnes, with the productivity of 20 metric tonnes per hectare (Nikam *et al*., 2015) [5]. In India, West Bengal accounts for the highest production of cabbage in the world, 2341.87 tonnes, which has a share of 24.38% followed by Orissa 1130.56 tonnes, Gujrat 796.73, Madhya Pradesh 796.38 tonnes, Assam 744.75 tonnes and Bihar 721.92 tonnes (NHB, 2021-2022) [8].

Diamondback moth causes colossal loss to cabbage every year. It damages the crop by feeding on the foliage. Attack by a large number of larvae hinders the plant's growth, leading to significant yield reduction. The infestation during the primordial stage of crop causes maximum yield loss within a concise period and needs immediate control of this pest.

The crop loss is estimated to vary from 52 to 100%, and about one billion US dollars is spent annually to manage this pest globally (Nikam *et al*., 2015) [5]. In recent years, various types of insecticides belonging to different chemical groups have been used to manage the pests, and excessive reliance on these chemicals has led to the problem of resistance, resurgence, environmental pollution, and health threat to the consumers thus, it has become essential to use the insecticides in optimal dosage to reduce and control the damage to the environment and human health as well as to reduce the pest incidence. Hence an investigation was undertaken to evaluate the performance of certain chemical insecticides with botanicals and biopesticides at their recommended dosages against diamondback moth in cabbage.

Materials and Methods

The trial was conducted at the Central Research Farm of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India, during *Rabi* season 2021-2022. The experiment was conducted in Randomized Block Design (RBD) with eight treatments, including the untreated control with three replications. The “Pride of India” variety of cabbage was used and followed all the recommended agronomical practices to raise a healthy crop. The plot size was 2m x 2m, and the spacing between rows and plants were maintained at 60 cm x 60 cm. The experiment eight different treatments, *viz*. Emamectin benzoate 5% SG @ 0.4 gm/lit, Chlorantraniliprole 18.5 SC @ 0.3 ml/lit, Novaluron 10 EC @ 2 ml/lit, Spinosad 45 SC @ 0.5 ml/lit, *Beauveria bassiana* 1.15% WP @ 1 gm/lit, Karanj oil 2% @ 20 ml/lit, Neem oil 2% @ 20 ml/lit and untreated control were included. The insecticidal spray solution of desired concentration as per treatments was freshly prepared every time at the site of the experiment just before the start of spraying operations. A hand compression knapsack sprayer was used for imposing the treatments. The first spray was applied as soon as the pest level crossed the economic threshold level (ETL), i.e., 4-5 larvae per plant; the second spray was given after 15 days, respectively.

The population of diamondback moth counts was recorded by randomly selecting five plants. The larvae were counted after the 3rd, 7^{th,} and 14th days after spraying, and the larval count was recorded in the morning hours. The yield data in each treatment was recorded separately and subjected to statistical analysis to test the significance of mean yield variation in different treatments. The increase in yield over control in various treatments was calculated, and cost-benefit ratio was calculated.

Table 1: Effect of treatments on larval population of diamondback moth at different days of intervals

Treatments		Larval population of *Plutella xylostella*									Overall mean	Yield (q/ha)	Cost Benefit ratio
		1st spray					2nd spray						
		1 DBS	3 DAS	7 DAS	14 DAS	Mean	3 DAS	7 DAS	14 DAS	Mean			
T_1	Emamectin Benzoate 5% SG @ 0.4 gm/lit	04.06	03.60^{de}	03.06^{de}	03.20^{de}	03.28^{de}	03.06^{de}	02.60^{de}	02.20^{c}	02.62^{cde}	02.95^{bc}	190.30	1:3.25
T_2	Chlorantraniliprole 18.5 SC @ 0.3 ml/lit	03.86	03.20^{f}	02.66^{f}	02.80^{f}	02.88^{e}	02.60^{f}	02.00^{f}	01.46^{d}	02.02^{e}	02.45^{c}	245.51	1:4.00
T_3	Novaluron 10 EC @ 2 ml/lit	04.20	03.93^{cd}	03.20^{d}	03.53^{cd}	03.55^{cd}	03.40^{cd}	02.80^{cd}	02.26^{c}	02.82^{bcd}	03.18^{bc}	170.20	1:2.77
T_4	Spinosad 45 SC @ 0.5 ml/lit	03.93	03.53^{ef}	02.86^{ef}	03.13^{ef}	03.17^{de}	03.00^{e}	02.33^{e}	02.00^{c}	02.44^{de}	02.80^{bc}	230.15	1:3.60
T_5	*Beauveria bassiana* 1.15% WP @ 1 gm/lit	04.40	04.06^{bc}	03.46^{c}	03.66^{bc}	03.72^{bc}	03.53^{bc}	03.06^{bc}	02.86^{b}	03.15^{bc}	03.43^{bc}	150.35	1:2.58
T_6	Karanj Oil 2% @ 20 ml/lit	04.53	04.33^{b}	03.73^{b}	03.93^{b}	03.99^{b}	03.80^{b}	03.33^{b}	03.13^{b}	03.42^{b}	03.70^{b}	122.45	1:1.97
T_7	Neem Oil 2% @ 20 ml/lit	04.46	04.13^{bc}	03.60^{bc}	03.73^{bc}	03.82^{bc}	03.53^{bc}	03.20^{b}	03.00^{b}	03.24^{b}	03.53^{bc}	142.00	1:2.15
T_0	Control	04.53	04.93^{a}	05.33^{a}	05.86^{a}	05.37^{a}	06.13^{a}	06.66^{a}	07.13^{a}	06.64^{a}	06.00^{a}	65.20	1:1.14
	F- test	NS	S	S	S	S	S	S	S	S	S		
	S.Ed (+/-)	0.264	0.161	0.118	0.158	0.202	0.170	0.126	0.137	0.284	0.400		
	C.D at 5%	-	0.349	0.255	0.343	0.435	0.367	0.272	0.300	0.612	1.161		

*DBS- Day Before Spraying, *DAS- Days after Spraying, *NS- Non significant, *S- Significant

Results and Discussion

The data on the larval population of *Plutella xylostella* 3rd, 7^{th,} and 14th days after the first spray revealed that all the treatments were significantly superior to control. Among all the treatments Chlorantraniliprole 18.5 SC (0.3 ml/lit) recorded lowest mean population of diamondback moth population (2.88) followed by Spinosad 45 SC (0.5 ml/lit) (3.17), Emamectin benzoate 5% SG (0.4 gm/lit) (3.28), Novaluron 10 EC (2 ml/lit) (3.55), *Beauveria bassiana* (1 gm/lit) (3.72), Neem oil 2% (20 ml/lit) (3.82) and Karanj Oil 2% (20 ml/lit) (3.99) was least effective among all the treatments. The data on larval population after the second spraying revealed that Chlorantraniliprole 18.5 SC recorded the lowest population of diamondback moth (2.02), followed by Spinosad 45 SC (2.44), Emamectin benzoate 5% SG (2.62), Novaluron 10 EC (2.82), *Beauveria bassiana* (3.15), Neem oil 2% (3.24), Karanj Oil 2% (3.42) was least effective among all the treatments. The yields among the treatment were significantly higher over control. The highest yield was recorded in Chlorantraniliprole 18.5 SC (245.51 q/ha) followed by Spinosad 45 SC (230.15 q/ha), Emamectin benzoate 5% SG (190.30 q/ha). The average yield was recorded in the treatment Novaluron 10 EC (170.20 q/ha) and *Beauveria bassiana* (150.35 q/ha). The lower yield was given by Neem oil 2% (142 q/ha) and Karanj oil 2% (122.45 q/ha) as compared to untreated control (65.20 q/ha). Among the treatment studied, the best and most economical treatment was Chlorantraniliprole 18.5 SC having highest (1:4.00), followed by Spinosad 45 SC (1:3.60), Emamectin benzoate 5% SG (1:3.25), Novaluron 10 EC (1:2.77), *Beauveria bassiana* (1:2.58), Neem oil 2% (1:2.15) and Karanj oil 2% (1:1.97), as compared to control (1:1.14).

The data on the overall mean larval population of diamondback moth after the first and second spray revealed that all the treatments were effective as compared to untreated control. Chlorantraniliprole 18.5 SC was the most effective among all the treatments and recorded minimum larval population of diamondback moth (2.45), similar to the findings of Sawant and Patil (2018) [7]. The next effective treatment was Spinosad 45 SC (2.80) which was followed by

Emamectin benzoate 5% SG (2.95); these results were similar to the findings of Mane *et al*. (2020) [6]. It was followed by Novaluron 10 EC (3.18), *Beauveria bassiana* (3.43), Neem oil 2% (3.53) and Karanj oil 2% (3.70) which showed low results but comparatively superior over the untreated control; similar findings reported by Chandraker *et al*. (2022) [2].

The yield and cost-benefit ratio data revealed that Chlorantraniliprole 18.5 SC recorded the highest yield 245.51 q/ha, with a cost-benefit ratio (1:4.00); these findings are similar with the results of Sawant and Patil (2018) [7]. The Spinosad 45 SC recorded the yield of 230.15 q/ha with cost benefit ratio (1:3.60), which was similar to the findings of Kumar and Kumar (2020) [4]. Emamectin benzoate 5% SG recorded the yield of 190.30 q/ha (1:3.25), similar finding was reported by Sawant and Patil (2018) [7]. The treatment Novaluron 10 EC recorded yield 170.20 q/ha with cost benefit ratio (1:2.77) followed by *Beauveria bassiana* 150.35 q/ha, Neem oil 2% 142 q/ha, Karanj oil 2% 122.45 q/ha with the cost-benefit ratio of (1:2.58), (1:2.15), (1:1.97) respectively, which was similar to the findings of Chandraker *et al*. (2022) [2]. Untreated control recorded a yield of 65.20 q/ha and a cost-benefit ratio of 1:1.14.

References

1. Anonymous. 2012. http://www.indiaagronet.com
2. Chandraker MK, Rana DK, Saran B. Efficacy of botanicals and microbial agents for the management of diamondback moth (*Plutella xylostella*) in cabbage. The Pharma Innovation Journal. 2022;11(6):2348-2351.
3. Devi HD, Tayde AR. Comparative Efficacy of Bio-Agents and Botanicals on the Management of Diamondback Moth *(Plutella xylostella* Linn.) on Cabbage under Allahabad Agroclimatic Conditions. International Journal of Current Microbiology and Applied Sciences. 2017;6(7):711-716.
4. Kumar AN, Kumar A. Comparative efficacy of certain chemicals with biopesticides against diamondback moth, *Plutella xylostella* (L.) in cabbage, *Brassica oleracea* (L.). Journal of Entomology and Zoology Studies. 2020;8(6):1350-1353.
5. Nikam TA, Chandele AG, Nikita SA. Relative Toxicity of some newer insecticides to Diamondback Moth, *Plutella xylostella* Linnaeus. The Ecoscan. 2015;8:105-108.
6. Mane PD, Singh BB, Singh PK. Bio-efficacy of insecticides against pest complex of cabbage. Journal of Entomology and Zoology Studies. 2020;8(6):2000-2002.
7. Sawant CG, Patil CS. Bio-efficacy of Newer Insecticides against Diamondback Moth (*Plutella xylostella* Linn.) in Cabbage at Farmers Field. International Journal of Current Microbiology and Applied Sciences. 2018;7(7):2319-7706.
8. Source: National Horticultural Board (NHB), 2021-2022.
9. USDA nutrient database, 2019.