Efficacy of Selected insecticides, *Beaveria bassina* ,Neem oil against Diamond back moth (*Plutella xylostella*)(L.) in Cabbage(*Brassica oleracea var capitata*).

A B S T R A C T

Efficacy of Selected insecticides, *Beaveria bassina* ,Neem oil against Diamond back moth (*Plutella xylostella*)(L.) in Cabbage(*Brassica oleracea var capitata*). The experiment was laid out in Randomised block design with eight treatments. Each replicated thrice using a variety Green soccer 546. The treatments were Spinosad 45 % SC , Indoxacarb 14.5 % SC, Emamectin Benzoate 5% SG, Chlorantaniliprole 18.5SC, Fipronil 5%SG , *Beaveria bassiana* , Neem oil 0.3% along with an untreated control against Diamond back moth (*Plutella xylostella*) in cabbage . The data on Mean larval Population of Diamond back moth over control on first and second spray overall mean revealed that treatments significantly superior over control. Among all treatments Chlorantraniliprole 18.5SC recorded lowest number of Larva of Diamond back moth (1.78) , which was significantly superior over control followed by Spinosad 45%SC (2.03),Indoxacarb14.5SC (2.25), Emamectin Benzoate 5%SG(2.39), Fipronil 5%SC(2.63), *Beaveria bassiana* (1 x 10^8 CFU /gm (2.72), Neem oil 0.3 % (3.1) recorded highest Number of larva .While the Highest yield 314.9q/ha was obtained from the treatment Chlorantraniliprole 18.5SC as well as B:C ratio (1:7.59) obtained high from the treatment was followed by Spinosad 45 % SC (1:6.77), Indoxacarb14.5SC(1:6.33) ,Emamectin Benzoate 5% SG (1: 5.25) , Fipronil 5% SG(1:5.78) , *Beaveria bassiana (*1 x 10 8 CFU /gm) (1:5.50) ,Neem oil 0.3% (1:4.72) as compared to control (1:4.32).

Keywords : *Beaveria bassiana*, Botanical ,Chlorantraniliprole , Cost-benefit ratio, *Plutella xylostella*

1.INTRODUCTION :

Cabbage is one of the most popular Cole vegetable crop in India. It is known to possess medicinal properties and its enlarge terminal buds is a rich source of Ca, P, Na, K ,S , Vitamin C and dietary fibre . It is said to be good for person suffering from diabetes. It may be used for prepare soup, stew, as stuffing for cake. **(Norton 1997)[10].** India is the second largest producer of cabbage after china. India is producing about 8755000 tonnes in an area of 388000/ha with a

productivity of 22,564(kg/ha). In Uttarpradesh cabbage is grown in an area of about 0.72million ha producing 5.7 million tonnes.

The brassica crop has multiple insect pest complex. A total of 37 insect pests have been reported to feed on cabbage in india. **(Lal, 1975)**[8]. The important insect pests species areDiamond back moth (*Plutella xylostella*)(L.), Cabbage caterpillar (*Pieris brassicae Linneaus*), Cabbage semilooper (*Thysanoplusia orchalcea Fabricus*) and (*Autographa nigrisigna Walker*),Tobacco caterpillar (*Spodoptera litura Fabricus*), Cabbage leaf webber (*Crocodolomia binotalis Zeller*),Cabbage borer (*Hellula undalis Fabricus*), Cabbage aphid (*Brevicoryne brassicae W.)*

Diamond back moth is the most destructive pest **(Kumar *et al.*,2007)**[7] and is limiting factor for successful cultivation of cruciferous crops **(Rai *et al.*, 1992)**[12] and reported 52% of loss in marketable yield due to the attack of *Plutella xylostella* (L.) and loss of US $ 16 Million per year. This has necessitated the use of alternative eco-friendly insecticides to sustain the management of diamondback moth and the development of resistance against these traditional insecticides can be easily breakdown by using the newer group of molecules.

Diamondback moth has developed resistant to almost all the group of chemical pesticides. In view of the undesirable effects due to unilateral dependence on conventional chemicals, recent advances in research are directed towards development of safer and effective insecticides i.e. avermectins, microbes, pyrazoles, spinosyns and biopesticides which are relatively safe to natural enemies and reduces pesticide load in environment and reported that these molecules spare good number of coccinellid beetles, spiders and Chrysoperla. **(Dhanalakshmi *et al.*, 2008)**[5]**.** Hence the present study was undertaken, ‘‘Efficacy of Selected insecticides, *Beauveria bassiana*, Neem oil against diamond back moth *Plutella xylostella*(L.) in cabbage (*Brassica oleracea var. capitata*) and to Calcualate Cost Benefit ratio.

2. MATERIALS AND METHODS :

2.1. Experimental site and Location :

The Research field is located on the right side of Rewa Road at 25° 22’ 15.888” North Latitude and 81°51’ 31.4712” East longitude and is about 98 m above mean sea level and situated 5km away on the right bank of Yamuna river.

2.2. Climate Condition :

The climate at Prayagraj is typical subtropical which prevails in the eastern part of Uttar Pradesh. The extremes of both summer and winter are experienced here. The maximum temperature was recorded during summer up to 47°C and the minimum temperature was recorded during winter up to 1.5°C. All necessary facilities for cultivation of crop were made available at research farm.

2.3.Experimental Details :

The experiment was laid out in a randomized block design with eight treatments replicated three times using variety Greensoccer 546 in a plot size of (2m×2m) at a spacing of (60×45cm) with a recommended package of practices excluding plant protection. The Efficacy of Selected Insecticides , one biopesticide i.e. *Beauveria bassiana* (Almax) and one botanical i.e., Neem oil and five insecticides i.e., spinosad (Tracer), Indoxacarb (oxadizine) , Emamectin benzoate (Rebel), Chlorantraniprole (coragen), Fipronil (Regent) were purchased from local pesticide traders. For comparison untreated check was included. Application of treatments was started as soon as the pest level crossed the ETL i.e., 5-6 larvae per plant the second spray was given after 15 days respectively.

2.4. Assesment of pest population :

The insect population was count from randomly selected plant in every plot and population per 5 plants was noted. After that mean of three replications was calculated for each treatment and the same was done with the untreated plot. The population of *Plutella xylostella* was recorded before 1day spraying and on 3rd day, 7th day and 14th day after insecticidal application.

2.5. Marketable head yield :

Healthy cabbage heads were harvested when they reached appropriate marketable size and their weight from each treatment was expressed as marketable yield in quintal per hectare and subjected to analysis of variance.

2.6. Statastical Analysis :

The data collected on larval population of Diamondback moth (*Plutella xylostella*) were

subjected to statistical analysis for testing the level of significance. Similarly, the replication wise data of each treatment on yield of cabbage head were also subjected to analysis of variance.

2.7. Cost-Benefit ratio :

Cost effectiveness of each treatment was assessed based on net returns. Net return of each treatment was worked out by deducting total cost of the treatment from gross returns. Total cost of production included both cultivation as well as plant protection charges.

3. RESULTS :

3.1. Mean larval population of Diamond back moth after first spray :

The data (Table 1) on larval population of Diamondback moth on 3rd, 7th, 14th day after first spray which shows that all the treatments were significantly superior over control. Among the treatments used Chlorantraniliprole 18.5%SC recorded best effective on Diamondback moth (DBM)had showing less number of larva (2.33) which was par with Spinosad 45%SC (2.53) and Indoxacarb 14.5SC (2.77) was at par with Emamectin Benzoate 5% SG (2.93) and Fipronil 5% SC(3.19), *Beauveria bassiana* ($1X10^8$ CFU/gm) (3.28) was found par with each other on larval population over control. Neem oil 0.3% was found least effective among all treatments with larval population (3.73) but significantly superior over control (7.25).

3.2. Mean larval population of diamond back moth after second spray :

The data (Table1) on larval population of Diamond back moth on 3rd,7th,14th day after second spray which shows that all the treatments were significantly superior over control. Among the treatments Chlorantraniliprole 18.5%SC recorded best effective for Diamondback moth larval population had showing less number of larva (1.24) which was par with Spinosad 45% SC (1.53) and Indoxacarb 14.5% SC (1.73) was found par with Emamectin Benzoate 5% SG (1.86)on larval population and Fipronil 5% SC (2.08), *Beauveria bassiana* ($1X10^8$ CFU/gm) (2.17) was found par with each other on larval population over control, Neem oil 0.3% was found least effective among all treatments with larval population (2.57) but significantly superior over control (7.80).

3.3 Cost- benefit ratio :

All the insecticides were found very effective and significantly superior over control. The data on Marketable yield revealed that Chlorantraniliprole 18.5%SC recorded best effective for Diamond back moth (DBM) with a yield (283.6q/ha) followed by Spinosad 45%SC (273.71q/ha) Indoxacarb 14.5%SC (233.48 q/ha), Emamectin benzoate 5% SG (221.72 q/ha),Fipronil 5% SC (211.27 q/ha),*Beauveria bassiana* (1X108CFU/gm) (201.57 q/ha), Neem oil 0.3% (194.90 q/ha) as compared to control (165.15q/ha). When Cost-benefit ratio was worked out, interesting result was achieved.

Among best and most economical treatment Chlorantraniliprole 18.5%SC recorded highest Diamondback moth (DBM) CBR (1:7.59) followed by Spinosad 45%SC (1:6.77),Indoxacarb 14.5SC (1:6.33),Emamectin Benzoate 5% SG (1:5.25),Fipronil 5% SC(1:5.78),*Beauveria bassiana* ($1X10^8$ CFU/gm) (1:5.50) Neem oil 0.3% (1:4.72) as compared to control (1:4.32).

4. Discussion :

The data (Table1) on larval population of Diamondback moth on 3rd, 7th, 14th day after first spray which shows that all the treatments were significantly superior over control. Among the treatments used Chlorantraniliprole 18.5%SC recorded best effective on Diamondback moth (DBM) had showing less number of larva (2.33) **Venkateswarlu *et al.*, (2011)[14]** followed by Spinosad 45%SC (2.53) **Mandal *et al.*, (2009)[9]** and Indoxacarb 14.5SC (2.77) **Jaishree banjaree (2017)[3],** Emamectin Benzoate 5% SG (2.93) **AD *et al* (2014)[2]**, Fipronil 5% SC(3.19) **Deivendram *et al* (2007)[4]**, *Beauveria bassiana* (1X10^8 CFU/gm) (3.28) **Shelton *et al.*, (1998)[13]**. **Nikhil *et al.*, (2020)[1]** Neem oil 0.3% was found least effective among all treatments with larval population (3.73) but significantly superior over control (7.25).

The data (Table1) on larval population of Diamond back moth on 3rd,7th,14th day after second spray which shows that all the treatments were significantly superior over control. Among the treatments Chlorantraniliprole 18.5%SC recorded best effective for Diamondback moth larval population had showing less number of larva (1.24) **Nikam(2013)[11]** followed by Spinosad 45% SC (1.53)**Mandal *et al.*, (2009)[9]** and Indoxacarb 14.5% SC (1.73)**Jaishree banjaree (2017)[3]**, Emamectin Benzoate 5% SG (1.86) **AD *et al* (2018)[2]**, Fipronil 5% SC (2.08), **Deivendran *et al.*, (2007)[4]**, *Beauveria bassiana* (1X10^8 CFU/gm) (2.17) **Shelton *et al.*, (1998)[13]** . **Devi *et al.*, (2017)[6]** Neem oil 0.3% was found least effective among all treatments with larval population (2.57) but significantly superior over control (7.80).

Chlorantraniliprole was superior and effective for diamond back moth larval population had showing lowest larval population was reported by **Venkestwarulu (2011)[14] and Nikhil *et al.*, (2020)[1]** reported that Spinosad is effective for Diamondback moth larval population had showing lowest number of larval population.

The highest yield and cost benefit ratio was recorded in Chlorantraniliprole (283.6q/ha) (1:7.59)s respectively and this result supported by **Nikam *et al.*, (2013)[11]** followed by Spinosad (273.71q/ha) (1:6.77) this result supported by **Mandal *et al.*, (2009)[9].**

4. CONCLUSION :

From the analysis of present study it was concluded that among all treatment Chlorantraniliprole 18.5%SC (0.1ml/L) recorded best and proved best effective for Diamondback moth (DBM) followed by Spinosad 45SC (0.5ml/L) ,Indoxacarb 14.5SC ,(0.25ml/L),Emamectin Benzoate 5% SG (0.45gm/L) ,Fipronil 5% SC (25-50gma.i./ha) in managing (*Plutella xylostella*) in cabbage (*Brassica oleracea*) on larval population of Diamond back moth. Therefore, the biopesticide i.e. *Beauveria bassiana* (Almax) and botanical i.e., neem oil may be useful in devising proper integrated pest management strategy against on Diamond Back Moth *(Plutella xylostella*).

Table.1. Efficacy of different insecticides, *Beauveria bassiana* and Neem oil against diamond back moth (*Plutella xylostella*)

		Larval Population / Plant								
		1st spray			2nd spray			Cummulative Mean	Yield	B:C Ratio
	TREATMENTS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS			
T_1	Spinosad 45SC	2.8	2.2	2.6	2.00	1.26	1.33	**2.03**	**273.71**	**1:6.77**
T_2	Indoxacarb 14.5SC	3.06	2.46	2.86	2.26	1.46	1.53	**2.25**	**233.48**	**1:6.33**
T_3	Emamectin Benzoate 5% SG	3.2	2.6	3	2.40	1.53	1.66	**2.39**	**221.72**	**1:5.25**
T_4	Chlorantraniliprole 18.5%SC	2.6	2	2.4	1.80	1.00	0.93	**1.78**	**283.61**	**1:7.59**
T_5	Fipronil 5% SC	3.46	2.86	3.26	2.66	1.80	1.80	**2.63**	**211.27**	**1:5.78**
T_6	Beauveria bassiana($1X10^8$ CFU/gm)	3.6	2.93	3.33	2.80	1.86	1.86	**2.72**	**201.57**	**1:5.50**
T_8	Neem oil 0.3%	4	3.4	3.8	3.20	2.33	2.20	**3.15**	**194.9**	**1:4.72**
T_0	Control	6.86	7.33	7.53	7.6	7.8	8.00	**7.52**	**165.15**	**1:4.32**
	SEm+_	**0.12**	**0.14**	**0.11**	**1.35**	**0.94**	**0.18**	-		
	CD at 5%	**0.28**	**0.25**	**0.31**	**0.24**	**0.23**	**0.24**	-		

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COMPETING INTERESTS :

Authors have declared that no competing interest exist .

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