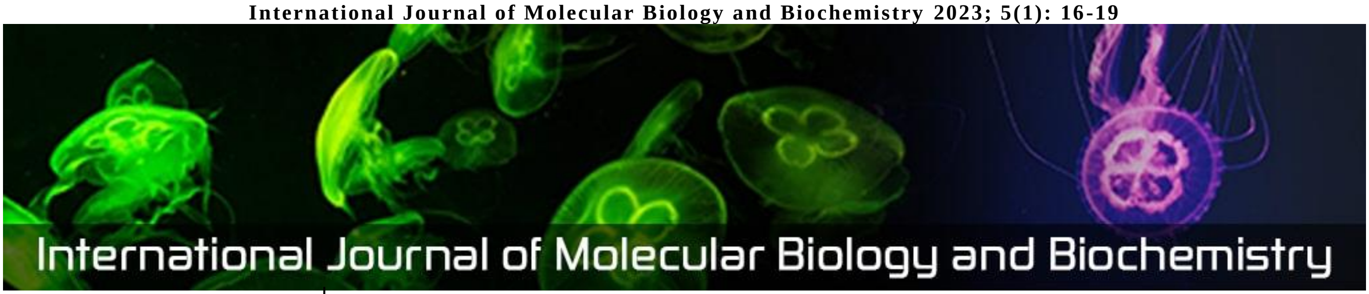

ISSN Print: 2664-6501
ISSN Online: 2664-651X
Impact Factor: RJIF 5.4
IJMBB 2023; 5(1): 16-19
www.biologyjournals.net
Received: 14-09-2022
Accepted: 15-11-2022

Saurabh Kumar
SRF, Department of Entomology, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

AK Singh
Associate Professor, Department of Plant protection, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

BK Singh
Professor, Department of Entomology, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Corresponding Author:
AK Singh
Associate Professor, Department of Plant protection, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Bio-efficacy of new insecticides against diamond back moth (*Plutella xylostella*) on cabbage

Saurabh Kumar, AK Singh and BK Singh

DOI: https://doi.org/10.33545/26646501.2023.v5.i1a.34

Abstract
The Diamondback moth (*Plutella xylostella*) shows resistance to every group of conventional insecticide and unable to reduce the population and their damage. New molecules are crucial tool for their management. The efficacy of insecticides were evaluated against *P. Xylostella* with treatments viz. spinosad 45% SC @ 185ml, emamectin benzoate 5% SG @ 250g, indoxacarb 14.5 SC @ 500ml, chlorantraniliprole 18.5 SC @ 150ml, Cyantraniliprole 10% OD @ 600g, neem oil 32% EC @ 1.5L and flubendiamide 20% WG @ 100g commercial formulation dosage ha^{-1}. The efficacies were calculated by Henderson and Tilton method. After five days of spray, maximum efficacy was obtained from chlorantraniliprole which was at par with, Cyantraniliprole, emamectin benzoate, flubendiamide and spinosad, these were significantly superior over indoxacarb and neem oil. After ten days of spray, maximum efficacy was again with Cyantraniliprole which was at par with chlorantraniliprole and these were significantly superior over rest of the treatments. Chlorantraniliprole and cyantraniliprole may be admissible in to IPM tool to combat *P. Xylostella* by dint of their efficiency.

Keywords: Bio-efficacy, *Plutella xylostella*, cabbage, chlorantraniliprole, cyantraniliprole

Introduction
During post green revolution globally crop losses by dint of insect pest were 13.6% and in first decade of this century it declined 10.8% and similar trend also recorded in India (Dhaliwal *et al.*., 2015) [3]. The insect-pests cause 23.73 % weight loss in cabbage (Jat *et al.*., 2017) [7]. The *P. Xylostella* is a most detrimental pest of cabbage. This insect rely on glucosinolates cue for host location, oviposition and herbivore. Certain glucosinolates, cardenolides, plant volatiles, waxes, plant nutritional quality, leaf morphology and leaf color, or a combination of these factors, may trigger reproductive and feeding activities of *P. Xylostella* (Sarfraz *et al.*., 2006) [14]. This insect difficult to control due to rapid develops resistance against multiple insecticides. Insecticides remain key tool for *P. Xylostella* (Talekar and Shelton 1993) [16]. It shows resistance to almost every group of conventional insecticide (Ridland and Endersby, 2011) [13]. The conventional insecticides are unable to reduce the population of *P. Xylostella* and their damage due to resistance (Perumal *et al.*., 2009) [12]. Most of the conventional insecticides slow degradable and their bioaccumulations affect human health. New molecules *viz.* Cyantraniliprole, chlorantraniliprole and flubendiamide belong to diamide group and trending as safer insecticides with novel modes of actions. These molecules are more efficacious and fast degradable. These molecules are ideal for IPM. Hence, present investigations envisage to evaluate the bio-efficacy of new insecticides against *P. Xylostella*.

Materials and methods
The experiment was conducted under field condition at the Experimental farm of Banda University of Agricultural & Technology, Banda, during *Rabi* 2020 on susceptible variety of cabbage Green Voyager. The crop was grown as per recommended package and practices in Randomized Block Design with 8 treatments including control and replicated thrice. The dosage of commercial formulation of insecticidal treatments *viz*. spinosad 45% SC @ 185 ml ha^{-1}, flubendiamide 20% WG @ 100 g ha^{-1}, neem oil 32% EC @ 1.5 l ha^{-1}, Cyantraniliprole 10% OD @ 600 g ha^{-1}, emamectin benzoate 5% SG @ 250 g ha^{-1}, indoxacarb 14.5 SC @

500 ml ha-1, chlorantraniliprole18.5 SC @ 150ml ha-1, dosage ha-1, control with two sprays with hand operated knapsack sprayer (300 l ha-1) were applied.

The first spray was applied at ETL 5 larvae plant^{-1} (Patra *et al*.., 2015) [11] and second spray was applied at 15 days interval after the first application. The larval populations were recorded from randomly selected five plants from each plot. The head portion of the plant was observed and recorded larval population. The observations of larval population were recorded at just before the spray and 5th & 10th days after spray. The percentage reduction of larval population of the treatments over control was expressed as percent field efficacies of various treatments were calculated by Henderson and Tilton as given below. The yield of marketable cabbage head was recorded from each plot. The cumulative yield thus obtained from each plot was extrapolated in to yield in quintal ha^{-1}. The percent efficacy data were arc sine transformed and yield data were square root transformed and data of each character were subjected to statistical analysis by applying analysis of variance technique (Gomez and Gomez, 1983) [5].

$$\text{Percent efficacy} = \left[1 - \frac{\text{Cb} \times \text{Ta}}{\text{Ca} \times \text{Tb}}\right] \times 100$$

Where, Ca = Number of larvae per plant on untreated check after treatment.

Cb = Number of larvae per plant on untreated check before treatment.

Ta = Number of larvae per plant on treated plot after treatment.

Tb = Number of larvae per plant on treated plot before treatment.

Results and discussion

The larval incidence of *P. Xylostella* and efficacy of insecticides given in table 1, reveals that the before treatment larval populations were statistically at par to each other. At 5th day after 1st spray of insecticides, larval populations were varied from 0.67 to 5.27 plant^{-1}. The chlorantraniliprole and Cyantraniliprole were at par to each other and both these treatments were significantly superior over rest of the treatments. All the chemical treatments were significantly superior over the neem oil and all the treatments were significantly superior over untreated plots. At 10th day after 1st spray, larval population was varied in the range 0.67 to 6.00 plant^{-1}. Again Cyantraniliprole and chlorantraniliprole were at par to each other and both these treatments were significantly superior over rest of the treatments. Similar results were observed after 2nd spray of insecticidal application. Chlorantraniliprole and Cyantraniliprole belong to anthranilic diamide class; these insecticides cease feeding immediately after contact, opens muscular calcium channels in the ryanodine receptor ensued rapidly cause paralysis and death (Karin *et al*.., 2010) [8]. The feeding cessation by dint of chlorantraniliprole is significantly greater than that of most recently developed other insecticides (Hannig *et al*.., 2009) [6]. Due to above facts, chlorantraniliprole and cyantraniliprole showed better results. This finding corroborates by Yadav (2014) [17]. Flubendiamide was most effective followed by spinosad and indoxacarb (Kurakula and Pandurang, 2015) [9].

At 5th day of treatment, the field bio-efficacy varied from 22.33 to 87.01 percent. The field bio-efficacy of chlorantraniliprole, Cyantraniliprole, flubendiamide and emamectin benzoate were statistically at par to each other and these treatments were significantly superior over rest of the treatments. At 10th day of treatment, the field bio-efficacy varied from 14.34 to 89.89 percent. The field bio-efficacy of chlorantraniliprole and Cyantraniliprole, were statistically at par to each other and both these treatments were significantly superior over rest of the treatments and all the chemical treatments were significantly superior over the neem oil treatment. Similar results were observed after 2nd spray of insecticidal application. Chlorantraniliprole, Cyantraniliprole and flubendiamide cease feeding almost immediately after contact with the product (Karin *et al*.., 2010) [8]. Due to above facts, chlorantraniliprole, Cyantraniliprole and flubendiamide showed better results in comparison of spinosad, indoxacarb and neem oil insecticides. Similarly, Dotasara *et al*.. (2017) [4] reported that chlorantraniliprole was the most effective pesticides. Kurakula and Pandurang (2015) [9] reported flubendiamide was most effective followed by spinosad and indoxacarb.

The results of marketable yield depict in Fig. 1, reveals that all the treatments effective in reducing marketable yield loss. The highest marketable yield 398.17 q ha^{-1} was recorded from chlorantraniliprole and minimum marketable yield 106.83 q ha^{-1} was recorded from untreated. The marketable yield of chlorantraniliprole and Cyantraniliprole were at par to each other and both these treatments were significantly superior over rest of the treatments. The marketable yields of all the treatments were significantly superior over the neem oil treatment and all the treatments were significantly superior over control. Larva is damaging stage and this infestation reduce marketable yield. The minimum larval population was recorded in chlorantraniliprole and Cyantraniliprole both treatments were superior over rest of the treatments and all the treatments were significantly superior over control, similar trend was observed marketable yield. Our findings corroborate by Sawant and Patil (2018) [15] reported highest yield of cabbage recorded from the chlorantraniliprole followed by spinosad and flubendiamide.

Table 1: Bio-efficacy of insecticidal treatments *Plutella xylostella* against on cabbage *Rabi* 2020

Treatments	**Dosage ha^{-1}**	**DBM larvae population head^{-1} (1st spray)**			**Population reduction % after 1st spray**		**DBM larvae population head^{-1} (2nd spray)**			**Population reduction % after 2nd spray**	
		Before spray	**After 5th day of spray**	**After 10th day of spray**	**After 5th day of spray**	**After 10th day of spray**	**Before spray**	**After 5th day of spray**	**After 10th day of spray**	**After 5th day of spray**	**After 10th day of spray**
Spinosad 45% SC	185 ml	4.40	2.20	3.13	54.66 (7.39)	44.06 (6.65)	5.13	2.13	3.40	52.30 (7.25)	37.00 (6.11)
Flubendiamide 20% WG	100 g	5.20	1.40	2.20	76.62 (8.78)	66.87 (8.20)	4.67	1.27	1.93	69.07 (8.34)	60.34 (7.79)

Neem Oil 32% EC	1.5 lit	4.67	4.13	5.13	22.33 (4.69)	14.34 (3.59)	5.13	3.87	4.53	13.63 (3.60)	15.82 (3.90)
Cyantraniliprole 10% OD	600 g	5.07	0.87	0.67	85.19 (9.26)	89.89 (9.51)	3.00	0.53	0.47	78.76 (8.88)	84.09 (9.18)
Emamectin benzoate 5% SG	250 g	5.20	1.47	2.07	75.10 (8.69)	68.89 (8.32)	5.07	1.40	2.13	68.81 (8.32)	59.55 (7.72)
Indoxacarb 14.5 SC	500 ml	5.00	2.47	3.60	56.51 (7.54)	44.38 (6.70)	5.20	2.20	3.93	51.35 (7.11)	28.00 (5.32)
Chlorantraniliprole 18.5 SC	150 ml	4.60	0.67	0.73	87.01 (9.35)	87.52 (9.38)	3.73	0.47	0.60	85.67 (9.28)	84.49 (9.22)
Untreated control	-	4.60	5.27	6.00	0.00 (0.71)	0.00 (0.71)	7.00	6.13	7.33	0.00 (0.71)	0.00 (0.71)
SE (m) ±	-	0.26	0.09	0.31	0.26	0.39	0.18	0.22	0.28	0.41	0.41
CD 5 %	-	0.80	0.26	0.96	0.79	1.18	0.54	0.67	0.83	1.23	1.26

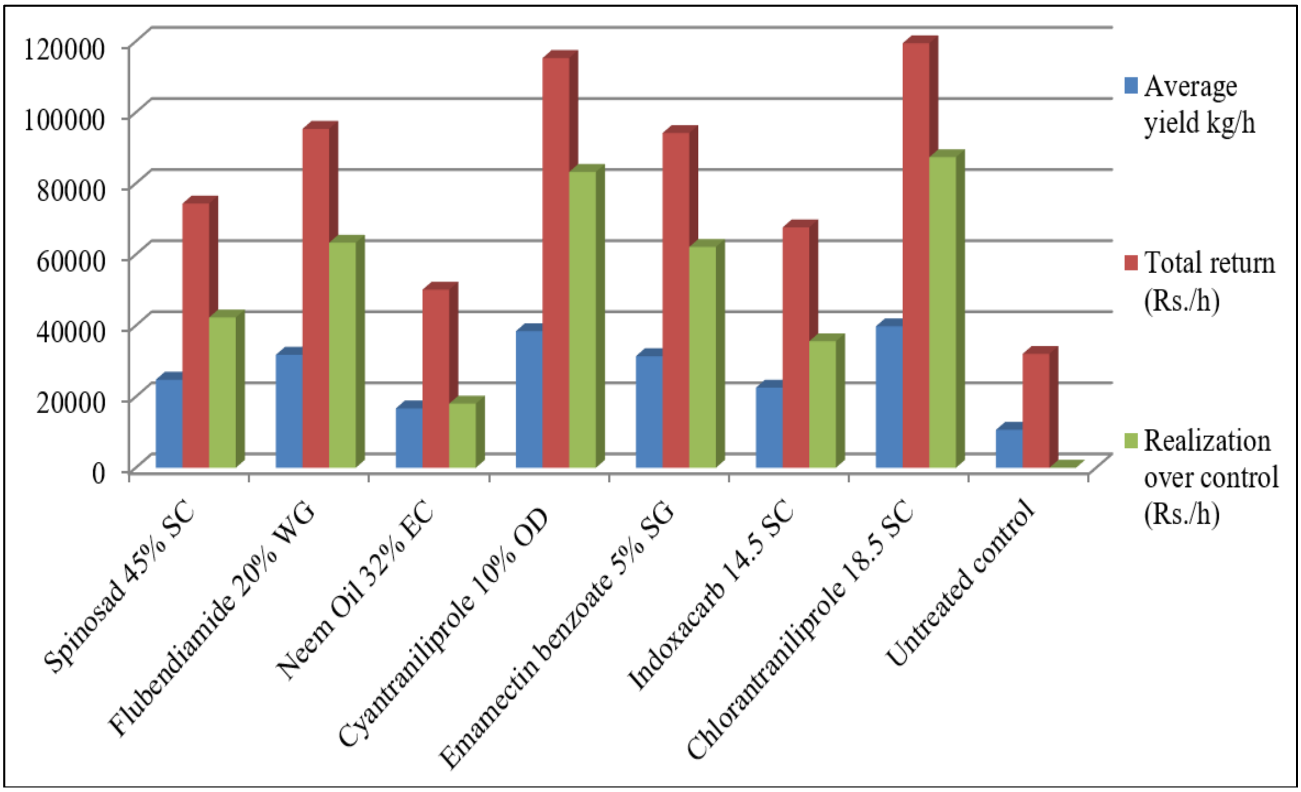

Fig 1: Yield, total return and realization over control of cabbage

Conclusion

Chlorantraniliprole, Cyantraniliprole, flubendiamide and emamectin benzoate are best alternatives of conventional insecticides and out of these chlorantraniliprole, Cyantraniliprole shows great promises in order to protect the loss of yield. These molecules may be admissible in to IPM tool to combat *P. Xylostella* by dint of their high efficiency.

Acknowledgment

This research was meticulously accomplished for partial fulfillment of M.Sc. (Ag.) in Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India. Authors are grateful to Mr. Rajesh who provided valuable help in the field.

Reference

1. Aiswarya VA, Bhosle BB and Bhede BV. Evaluation of some recent insecticidal against DBM *Plutella Xylostella* L. on cabbage under field condition. Journal of entomological research. 2018;42(3):383-386.
2. Bentley KS, Fletcher JL, Woodward MD. Chlorantraniliprole: an insecticide of the anthranilic diamide class. Hayes' Handbook of Pesticide Toxicology. 2010, 2231-2242
3. Dhaliwal GS, Jindal V, Mohindru B. Crop losses due to insect pests: global and Indian scenario. Indian Journal of entomology. 2015;77(2):165-168.
4. Dotasara SK, Agrawal N, Singh N, Swami D. Efficacy of some new insecticides against diamondback moth (*Plutella Xylostella* L.) on cauliflower. International Journal of Current Microbiology and Applied Sciences. 2017;6(5):1958-1963.
5. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research (2nd edition). A Wiley interscience publication, New York, 1983.
6. Hannig GT, Ziegler M, Marcon PG. Feeding cessation effects of chlorantraniliprole, a new anthranilic diamide insecticide, in comparison with several insecticides in distinct chemical classes and mode-of-action groups. Pest management science. 2009;65(9):969- 974.
7. Jat GC, Lekha R, Jat SK, Yadav PC. Assessment of quantitative losses due to Insect pests of Cabbage. International Journal of Agriculture Sciences. 2017;9(14):4087-4090.

8. Karin S, Bentley JL, Michael F, Woodward D. Chlorantraniliprole: An Insecticide of the Anthranilic Diamide Class. Hayes' Handbook of Pesticide Toxicology (3rd edition); c2010, p. 2231- 2242.
9. Kurakula S, Pandurang BM. Toxicity of new molecules of insecticides against diamondback moth, *P. xylostella* infesting cabbage. International Journal of Information Research and Review. 2015;2(12):1530-1532.
10. Mane PD, Singh BB, Singh MKP. Bio–efficacy of insecticides against pest complex of cabbage. Journal of Entomology and Zoology Studies. 2020;8(6):2000-2002.
11. Patra B, Das BC, Alam SF, Dhote V, Patra S, Chatterjee ML, *et al.*. Evaluation of new insecticides against diamond back moth, *Plutella xylostella* (L.) on red cabbage. International Journal of Bio-resource and Stress Management. 2015;6(2):280-284.
12. Perumal Y, Marimuthu M, Salim AP, Ponnusamy B. Host plant mediated population variations of cotton whitefly, Bemisiatabaci Gennadius (Aleyrodidae: Homoptera) characterized with random DNA markers. American Journal of Biochemistry and Biotechnology. 2009;5(1):40-46.
13. Ridland P, Endersby N. Some Australian populations of diamondback moth, *Plutella Xylostella* (L.) show reduced. In The Sixth International Workshop on Management of the Diamondback Moth and Other Crucifer Insect Pests. AVRDC-World Vegetable Center. 2011;755:207.
14. Sarfraz M, Dosdall LM, Keddie BA. Diamondback moth–host plant interactions: implications for pest management. Crop protection. 2006;25(7):625-639.
15. 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):2986-2998.
16. Talekar NS, Shelton AM. Biology, ecology and management of the diamondback moth. Annual Review of Entomology. 1993;38:275- 301.
17. Yadav PR. Efficacy of newer insecticides against, *Plutella Xylostella* (L.) on cabbage. Journal of Experimental Zoology India. 2014;17(2):487-489.