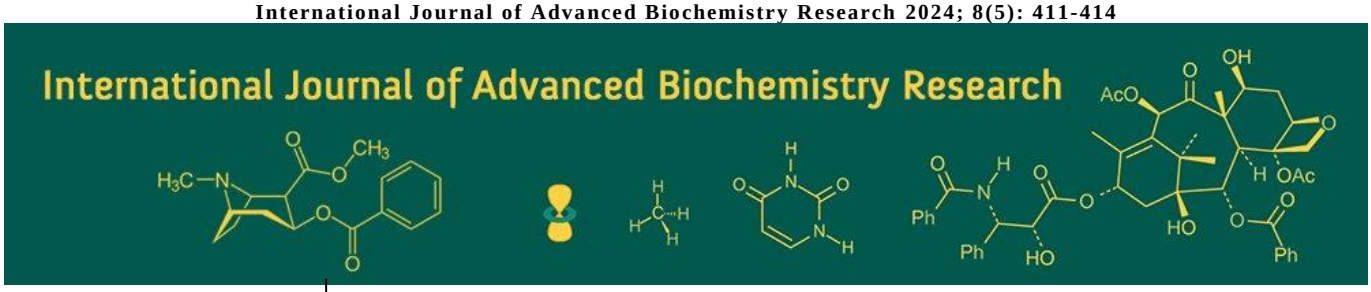

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Efficacy of selected insecticides and biopesticides against maize stem borer, *Chilo partellus* (Swinhoe)

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Abstract
The field experiment was conducted in *kharif* season of 2023-2024 at Central Research Farm (CRF), SHUATS, Prayagraj, Uttar Pradesh, India. The experiment was laid in Randomised Block Design with eight treatments each replicated thrice *viz*., Azadirachtin 0.3%, Neem oil 2% + Imidacloprid half dose 17.8% SL, *Beauveria bassiana* 1×108 CFU, Imidacloprid 17.8% SL, Neem oil 2%, Emamectin benzoate 5% SG, NSKE 5% and control plot. The data on larval population of *Chilo partellus* after first and second spray revealed that all the treatments were significantly superior over control. Among all treatments the lowest larval population of *Chilo partellus* after both sprays was recorded in Imidacloprid 17.8% SL (4.02 and 2.13) and Emamectin benzoate 5% SG (4.33 and 2.48) followed by Neem oil 2% + Imidacloprid ½ dose 17.8% SL (4.55 and 3.08), *Beauveria bassiana* 1×108 CFU (4.77 and 3. 39), Neem oil 2% (5.02 and 3.81), Azadirachtin 0.3% (5.39 and 4.37), NSKE 5% (5.86 and 4.75) was the least effective among all treatments respectively. While, the highest yield 41.4 q/ha was obtained from the treatment Imidacloprid 17.8% SL as well as C:B ratio 1:2.42 followed by Emamectin benzoate 5%SG (40.97 and 1:2.38), Neem oil 2% + Imidacloprid half dose 17.8% SL (37.5 and 1:2.13), *Beauveria bassiana* 1×108 CFU (29.56 and 1:1.75), Neem oil 2% (28.12 and 1:1.70), Azadirachtin 0.3% (26.18 and 1:1.53), N S K E 5% (21.17 and 1:1.27) and control (18.2 and 1:1.15).

Keywords: *Chilo partellus*, maize, insecticides, yield, C:B ratio

Introduction
Maize, *Zea mays* (L.) is cultivated globally and being one of the most important cereal crops worldwide. Maize, known as "Quuen of cereals" because of its immense yield potential, it is the highest yielding cereal crop of world (Shirisha *et al*., 2021) [12]. It has short growing season and is drought resistant that make it very easy to grow everywhere in different climatic conditions of the world (Amin 2011) [1]. In India, 9.43 million hectares are cultivated with maize, and the crop yields an average of 22.23 million tonnes of production and 2.5 tonnes of productivity per hectare. Pakistan has many advantages to cultivate maize because it is the country's third-most important cereal after rice and wheat. Currently, 1.026 million hectares of the crop are planted with 2.986 million tons of grains, producing an average national yield of 2893 kg/ha (Kumar *et al*., 2017) [6].

It is one of the most adaptable crops, produced in a wide range of agro-ecological conditions in tropical, subtropical, and temperate countries around the world. It is utilized to make starch, oil, liquor, dextrose, colors, and other products as well as sustenance for humans and animals. About 28% of the maize grown in India is utilized for human use, 11% for animal feed, 48% for poultry feed, 12% for the wet milling sector, and 1% for seed (Shirisha *et al*., 2021) [12].

Insect pests are the major factors responsible for low productivity of maize in India. Out of them, *Chilo partellus* (Swinhoe) is a serious pest of maize throughout India during *kharif* season causing garin yield loss of 24.3 to 36.3% (Prakash *et al*., 2017) [9]. The most common pest, *Chilo partellus*, causes 90–95% of the damage to maize crops and infests them from seedling stage to maturity. In some regions, reports of this pest's onslaught have indicated yield reductions ranging from 24 to 75%. The maize stem borer can cause between 24 and 84 percent of crop losses.

The yield losses caused by stem borers to maize vary widely in different regions and range from 25-40% according to the pest population density and phenological stage of the crop at infestation (Khan *et al*., 2015) [5]. Stem borer can cause severe damage at different stages in the development of cereal crops from seedling to maturity. When infestation is severe, there is a physiological disruption of plant growth (Babu and Kumar 2022) [2].

The attack by stem borer can cause lodging, breaking, and dead heart in the maize plant, all of which lower the plant's production. Effective pesticides and the time of their application (early whorl stage) are important for managing stem borers infesting maize effectively because this pest is an internal feeder and controlling it at a different stage offers a limited window of opportunity for chemical control (Ravinder *et al*., 2015) [10].

The management of pesticide resistance is strengthened by the application of multiple insecticides with varying modes of action. Therefore, it is required to demonstrate how to manage pests using various insecticide treatments. Therefore, the current study was conducted in order to determine which is the most successful at managing the maize stemborer based on a comparison of chemical pesticides.

Materials and Methods

The experiment was conducted at the Central Research Field of Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, UP. The research field is situated at the right side of Rewa road at 25o22' 15.888" North Latitude and 81o51' 31.4712" East Longitude and is about 98m above mean sea level. The climate at Prayagraj is typical subtropical which prevailis in the eastern part of UP. The experiment was laid out during *kharif* 2023-2024 in Randomized block design (RBD) with eight different treatments replicated thrice. The plot had a dimension of 2 ×1 m2. The maize seeds of variety 'Hybrid Suvarna' were sown in plots keeping row to row and plant to plant distance of 45 × 30 cm. All of the insecticides used in the study were sprayed as foliar application. The treatments used in experiment were *viz*., T_1 Azadirachtin 0.3% (1ml/L), T_2 Neem oil 2% + Imidacloprid ½ dose 17.8% SL (10ml/L + 2ml/L), T_3 *Beauveria bassiana* 1*108CFU (1.15gm/L), T_4 Imidacloprid 17.8% SL (2ml/L), T_5 Neem oil 2% (10ml/L), T_6 Emamectin benzoate 5%SG (0.2gm/L), T_7 NSKE 5% (20ml/L) and T_8 control. Two sprays were carried out at intervals of 15 days during the experiment to assess the effectiveness of pesticides when the *Chilo partellus* larval population reached the ETL threshold. The insect population was counted from randomly 5 selected plants 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 *Chilo partellus* was recorded before 1 day spraying and on 3rd day, 7th day and 14th day after insecticidal application. Healthy cobs were harvested and their weight from each treatment was expressed as marketable yield in quintal per hectare. Ultimately, the cost benefit ratio was calculated on the basis of prevailing market price of yield, insecticides and spraying cost (Devi and Tayde, 2017) [4].

$$\text{B:C Ratio} = \frac{\text{Total number of codons}}{\text{Total number of bases}}$$

Results and Discussion

The results (Table-1) after 1st and 2nd spray revealed that all the treatments were significantly superior over the control. The data on the mean larval populaton of stem borer *Chilo partellus* in maize 3rd, 7th and 14th day after first spray revealed that all the chemical treatments were significantly superior over control. Among all the treatments lowest larval population was recorded in Imidacloprid 17.8% SL (4.02), Emamectin benzoate 5% SG (4.33), Neem oil 2% + Imidacloprid ½ dose 17.8% SL (4.55), *Beauveria bassiana* 1×108 CFU (4.77), Neem oil 2% (5.02), Azadirachtin 0.3% (5.39), NSKE 5% (5.86) and control (6.62).

The data on the mean larval population of stem borer *Chilo partellus*, infesting maize 3rd, 7th and 14th days after second spray revealed that all the chemical treatments were significantly superior over the control. Among all the treatments lowest larval population was in Imidacloprid 17.8% SL (2.13) followed by Emamectin benzoate 5% SG (2.48), Neem oil 2% + Imidacloprid ½ dose 17.8% SL (3.08), *Beauveria bassiana* 1×108 CFU (3.39), Neem oil 2% (3.81), Azadirachtin 0.3% (4.37), NSKE 5% (4.75) and control (7.26).

The yields among the treatments were significant. The highest yield was recorded in Imidacloprid 17.8% SL (41.4 q/ha) followed by Emamectin benzoate 5% SG (40.97 q/ha), Neem oil 2% + Imidacloprid ½ dose 17.8% SL (37.5 q/ha), *Beauveria bassiana* 1×108 CFU (29.56 q/ha), Neem oil 2% (28.12 q/ha), Azadirachtin 0.3% (26.18 q/ha), NSKE 5% (21.17q/ha) and untreated control plot (18.2 q/ha).

Among the treatments studied, the best and economical treatment was Imidacloprid 17.8% SL (1:2.42) followed by Emamectin benzoate 5% SG (1:2.38), Neem oil 2% + Imidacloprid ½ dose 17.8% SL (1:2.13), *Beauveria bassiana* 1×108 CFU (1:1.75), Neem oil 2% (1:1.70), Azadirachtin 0.3% (1:1.53), NSKE 5% (1:1.27) and untreated control plot (1:1.15). However, all the treatments controlled maize stem borer effectively compared to untreated plot.

The data on the mean larval population in the first and second spray in Imidacloprid 17.8% SL were (4.02 and 2.13), which was most effective treatment in reducing the pest population of *Chilo partellus*, these results are supported with the findings of Prakash *et al*., (2017) [9] and Kurly and Kumar (2021) [7]. Emamectin benzoate 5% SG was also found to be very effective (4.33 and 2.48) and the same results observed by Babu and Kumar (2022) [2] and Chouraddi and Mallapur (2017) [3]. Neem oil 2% + Imidacloprid ½ dose 17.8% SL were (4.55 and 3.08). Similar findings were observed by Kurly and Kumar (2021) [7].

The cost benefit ratio ranged between 1:2.42 and 1:1.15. Maximum cost benefit ratio (1:2.42) and yield 41.4q/ha was obtained in Imidacloprid 17.8% SL treated plants, which is supported by Neupane *et al*., (2016) [8], followed by cost benefit ratio (1:2.38) and yield (40.97q/ha) were recorded in Emamectin benzoate 5% SG treated plants, and the results were similar to the findings of Babu and Kumar (2022) [2], Neem oil 2% + Imidacloprid ½ dose 17.8% SL also had a profitable yield of (37.5q/ha) and cost benefit ratio (1:2.13) according to Kurly and Kumar (2021) [7].

Table 1: Effect of Insecticides and biopesticides against larval population of *Chilo partellus* on Maize after 1st and 2nd spray

S. N	Treatment	Number of larval population per 5 plants										Pooled mean	Yield	B:C Ratio
			First spray					Second spray						
		Dosage	1DBS	3DAS	7DAS	14DAS	MEAN	1DBS	3DAS	7DAS	14DAS	MEAN			
T_1	Azadirachtin 0.3%	1ml/L	06.20	05.66^{b}	05.13_{b}	05.40^{c}	05.39^{bc}	05.40^{c}	04.73^{b}	04.00^{c}	04.40^{b}	04.37^{bc}	04.88^{bc}	26.18	1:1.53
T_2	Neem oil 2% + Imidacloprid ½ dose 17.8% SL	10ml/L + 2ml/L	06.33	04.80^{de}	04.13^{de}	04.73^{e}	04.55^{d}	04.73^{e}	03.66^{d}	02.66^{e}	02.93^{d}	03.08^{de}	03.81^{de}	37.5	1:2.13
T_3	*Beauveria bassiana* (1 x108CFU/ml)	1.15gm/ L	05.73	05.20^{cd}	04.33^{cd}	04.80^{d}	04.77^{d}	04.88^{d}	03.86^{c} d	02.93^{e}	03.40^{c}	03.39^{d}	04.08^{bcde}	29.56	1:1.75
T_4	Imidacloprid 17.8% SL	2ml/L	05.86	04.33^{f}	03.53^{f}	04.20^{f}	04.02^{e}	04.20^{f}	02.80^{e}	01.60^{g}	02.00^{e}	02.13^{f}	03.07^{e}	41.4	1:2.42
T_5	Neem oil 2%	10ml/L	06.20	05.33^{bc}	04.60^{c}	05.13^{c}	05.02^{cd}	05.13^{c}	04.26^{c}	03.53^{d}	03.66^{c}	03.81^{cd}	$04.41b^{cd}$	28.12	1:1.70
T_6	Emamectin benzoate 5% SG	0.2gm/L	06.40	0.60^{ef}	03.73^{ef}	04.66^{e}	04.33^{de}	04.66^{e}	03.13^{e}	02.00^{f}	02.33^{e}	02.48^{ef}	03.40^{de}	40.97	1:2.38
T_7	NSKE 5%	20ml/L	06.46	06.33^{a}	05.46^{b}	05.80^{b}	05.86^{b}	05.80^{b}	05.06^{b}	04.40^{b}	04.80^{b}	04.75^{b}	05.30^{b}	21.17	1:1.27
T_8	Control	….	06.86	a	a	a	a	a	a	a	a	a	a	18.2	1:1.15
	F-test		NS	S	S	S	S	S	S	S	S	S	S	-	-
	S. Ed (±)		0.35	0.82	0.96	0.81	0.85	0.81	1.36	1.77	1.71	1.61	1.23	-	-
	C.D. (P = 0.5)		-	0.429	0.404	0.291	0.268	0.291	0.442	0.349	0.415	0.405	1.328	-	-

DBS** - Day Before Spray**, DAS**- Day After Spray***

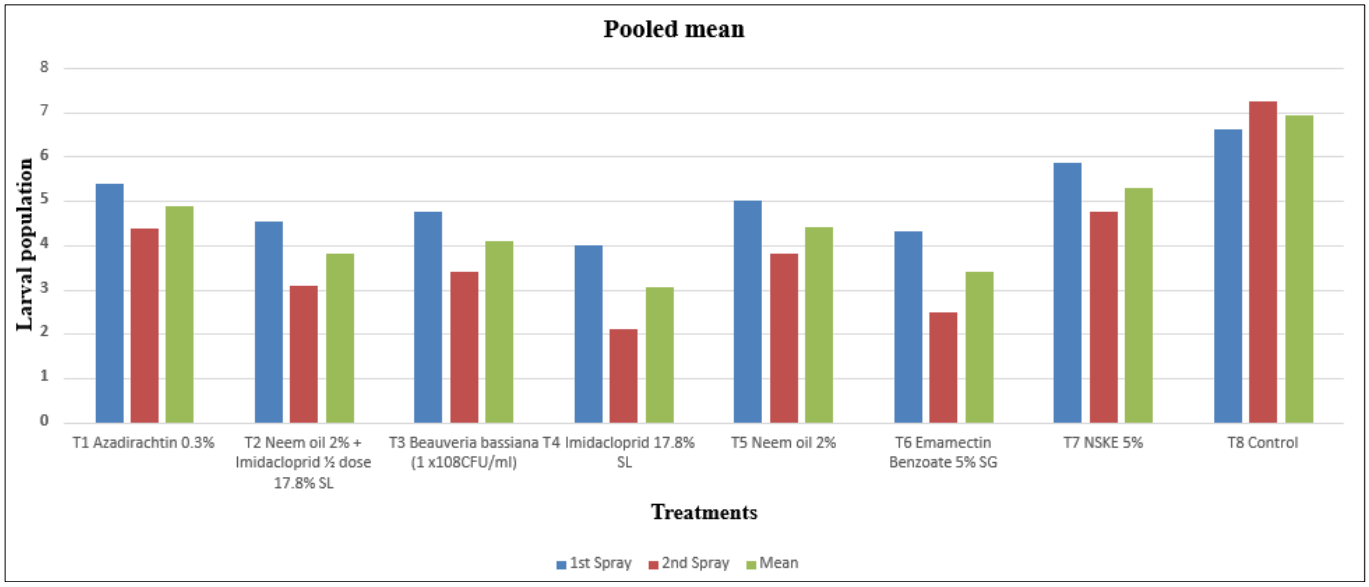

Fig 1: Effect of Insecticides and biopesticides against on overall mean larval population of Chilo partellus on maize

Conclusion

From the critical analysis of the present findings, it can be concluded that, among all the treatments Imidacloprid 17.8% SL is more effective in controlling larval population of *Chilo partellus* followed by Emamectin benzoate 5%SG, Neem oil 2% + Imidacloprid ½ dose 17.8% SL, *Beauveria bassiana* 1×108 CFU, Neem oil 2%, Azadirachtin 0.3%, and NSKE 5%. Among the treatments studied, Imidacloprid 17.8%SL gave the highest cost benefit ratio (1:2.42) and marketing yield (41.4q/ha) followed by Emamectin benzoate 5%SG (1:2.38 and 40.97q/ha), Neem oil 2% + Imidacloprid ½ dose 17.8% SL(1:2.13 and 37.5q/ha), *Beauveria bassiana* 1×108 CFU (1:1.75 and 29.56q/ha), Neem oil 2% (1:1.70 and 28.12q/ha), Azadirachtin 0.3% (1:1.53 and 26.18q/ha) and NSKE 5% (1:1.27 and 21.17q/ha) respectively as such more trails are required in future to validate the findings.

References

1. Amin MEMH. Effect of different nitrogen sources on growth, yield and quality of fodder maize (*Zea mays* L.). J Saudi Soc. Agric Sci. 2011;10(1):17-23.
2. Babu JS, Kumar A. Efficacy of certain chemicals and biopesticides against maize stem borer, *Chilo partellus* (Swinhoe). Pharma Innovation J. 2022;11(7):4156-4159.
3. Chouraddi M, Mallapur CP. Impacts of newer molecules of insecticides on management of maize stem borers. J Entomol. Zool. Stud. 2017;5(4):1424-1428.
4. 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. Int. J Curr Microbiol Appl. Sci. 2017;6(7):711-716.
5. Khan IA, Khan MN, Rasheed Akbar MS, Farid A, Ali I, Alam M, *et al*. Assessment of different control methods for the control of maize stem borer, Chilo partellus (Swinhoe) in maize crop at Nowshera-Pakistan. J Entomol Zool Stud. 2015;3:327-330.
6. Kumar A, Kumar A. Field efficacy of seven insecticides against *Chilo partellus* (Swinhoe) on maize (*Zea mays* L.) in Allahabad. J Pharmacogn Phytochem. 2017;6(4):1591-1593.

7. Kurly S, Kumar B. Eco-friendly management of maize stem borer with botanical and chemical insecticides. Pharma Innovation J. 2021;SP-10(2):135-137.
8. Neupane S, Bhandari G, Sharma SD, Yadav S, Subedi S. Management of stem borer (*Chilo partellus* Swinhoe) in maize using conventional pesticides in Chitwan, Nepal. J Maize Res Dev. 2016;2(1):13-19.
9. Prakash V, Singh DV, Singh R, Singh G, Kumar S. Efficacy of some novel insecticide against maize stem borer, *Chilo partellus* (Swinhoe) in maize. J Pharmacogn Phytochem. 2017;6(6S):481-484.
10. Ravinder Kumar RK, Jawala Jindal JJ. Economic evaluation of biorational and conventional insecticides for the control of maize stem borer *Chilo partellus* (Swinhoe) in Zea mays. J Appl Nat Sci. 2015;7(2):644-648.
11. Saraswati Neupane SN, Ghanashyam Bhandari GB, Sharma SD, Surendra Yadav SY, Subash Subedi SS. Management of stem borer (*Chilo partellus* Swinhoe) in maize using conventional pesticides in Chitwan, Nepal. J Maize Res Dev. 2016;2(1):13-19.
12. Shirisha P, Kumar A. Evaluation of different insecticides on maize stem borer, *Chilo partellus* (Swinhoe). J Entomol Zool Stud. 2021;9(4):422-425.