

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(9): 381-383
www.biochemjournal.com
Received: 25-06-2024
Accepted: 28-07-2024

Mulla Mohammed Mohssen
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University
of Agriculture, Technology and
Sciences, Prayagraj, Uttar
Pradesh, India

Usha Yadav
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University
of Agriculture, Technology and
Sciences, Prayagraj, Uttar
Pradesh, India

Field efficacy of selected insecticides against fall armyworm, *Spodoptera frugiperda* (J.E. Smith) on maize (*Zea mays* L.) at Prayagraj

Mulla Mohammed Mohssen and Usha Yadav

DOI: <https://doi.org/10.33545/26174693.2024.v8.i9Se.2125>

Abstract

The field experiment was conducted in *Rabi* season of 2023-2024 at Central Research Farm (CRF), SHUATS, Uttar Pradesh, India. The experiment was laid in Randomized Block Design with eight treatments each replicated thrice viz., T₁ Fipronil 0.6% G, T₂ Spinosad 45% SC, T₃ Nisco sixer plus, T₄ Neem oil 1500 ppm, T₅ NSKE, T₆ Emamectin benzoate 5% SG, T₇ Chlorantraniliprole 18.5% EC and Untreated control. The data on larval population of *Spodoptera frugiperda* after first and second spray revealed that all the treatments were significantly superior over control. Among all treatments, Chlorantraniliprole 18.5% EC (2.22 and 1.36) recorded lowest larval population of *Spodoptera frugiperda* after both sprays followed by Spinosad 45% SC (2.42 and 1.63), Emamectin benzoate 5% SG (2.66 and 1.80), Fipronil 0.6% G (2.86 and 1.96), Nisco sixer plus (3.10 and 2.13), Neem oil (3.40 and 2.26), NSKE (3.53 and 2.46) was the least effective among all treatments respectively. While, the highest yield 42.72 q/ha Chlorantraniliprole 18.5% EC was obtained from the treatment as well as C:B ratio 1:2.7 followed by Spinosad 45% SC (40.80 and 1:1.5), Emamectin benzoate 5% SG (37.44 and 1:2.1), Fipronil 0.6% G (34.79 and 1:1.7), Nisco sixer plus (31.68 and 1:1.28), Neem oil (37.5 and 1:1.4), NSKE (26.49 and 1:1.2) and control (23.5 and 1:0.7).

Keywords: Biopesticides, *Spodoptera frugiperda*, chemicals, fall armyworm

Introduction

The most important crop in the world, maize (*Zea mays* L.) is widely grown as a cereal grain that was domesticated in Central America. With a greater range of adaptation, it is among the most adaptable developing crops. Due to its greatest genetic production potential, maize is referred to as the "queen of cereals" throughout the world (Kumar *et al.* 2011) ^[1].

India is the world's fifth largest producer of maize, accounting for 3 percent of worldwide production. Currently, 55% of total maize production is used for food, 14% for cattle, 18% for poultry feed, 12% for starch, and 1% for seed. (Kumar *et al.* 2017) ^[4, 7, 8]. It is also produced in Andhra Pradesh (20.9%), Maharashtra (9.1%), Karnataka (16.5%), Rajasthan (9.9%), Bihar (8.9%), Uttar Pradesh (6.1%), and Madhya Pradesh (5.7%) (Rameash *et al.* 2012) ^[10].

In India, there are 9.43 million hectares of maize planted, with an average productivity and production of 2.5 and 22.23 million tons per hectare, respectively. Given, that maize is the third most important grain after wheat and rice, and that it is now grown on 1.026 million hectares of land with 2.986 million tons of grain and an average national yield of 2893 kg/ha, Pakistan has ample advantages to cultivate this crop (Kumar *et al.* (2017) ^[4, 7, 8].

About 250 insect and mite pest species have been found to be affecting this crop, with just half a dozen being economically significant, threatening to limit crop yield. Among the many insect pests, the maize stem borer, *Chilo partellus*, is the most important pest, accounting for 90-95% of overall damage during the *Kharif* season. *Chilopartellus* (Lepidoptera: Crambidae) is the most damaging pest to maize (Kumar and Alam 2017) ^[8].

The invasion of this insect has resulted in yield losses ranging from 24% to 75% in some places. Maize stem borer causes crop losses ranging from 24% to 84%. Stemborer yield losses in maize vary greatly across locations, ranging from 25-40% depending on pest population density and crop phenological stage at infestation (Khan *et al.* 2015) ^[6].

Corresponding Author:
Mulla Mohammed Mohssen
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University
of Agriculture, Technology and
Sciences, Prayagraj, Uttar
Pradesh, India

Materials and Methods

The experiment was carried out at the Central Research Farm of Sam Higginbottom University of Agriculture, Technology, and Sciences in Prayagraj. The research field is located on the right side of Rewa Road at 25°27' North Latitude and 80°51' East Longitude, approximately 98 m above mean sea level. Prayagraj has a typical subtropical climate, as does the eastern region of Uttar Pradesh. Summer and winter weather extremes can be found here. Summer maximum temperatures reached 49 °C, while winter minimums were 2.5 °C. The research trail was laid out in Rabi 2023-2024 using a Randomised Block Design (RBD), with eight distinct treatments replicated three times. The plot measured 2 x 1 square meters. Maize seeds of variety 'Suvarna' were sown in plots with a row to row and plant to plant distance of 45 x 30 cm.

The treatments employed in the experiment were Fipronil 0.6% G, Spinosad 45% SC, Nisco sixer plus, Neem oil 1500 ppm, NSKE, Emamectin benzoate 5% SG, Chlorantraniliprole 18.5% EC and control. During the experiment, two sprays were performed at 15- day intervals to evaluate pesticide efficacy when the *Spodoptera frugiperda* larval population reached the ETL threshold.

The insect population was counted from randomly selected plants in each plot, and the population per five plants was calculated. The mean of three replications was obtained for each treatment and compared to the untreated plot. The population of *Spodoptera frugiperda* was counted before and after one day of spraying, as well as on the third, seventh-, and fourteenth-days following insecticide application. Healthy cobs were harvested, and their weight from each treatment was converted into marketable output in quintals per hectare. Finally, the cost benefit ratio was estimated using the current market prices of yield, pesticides, and spraying costs (Charitha and Kumar (2023) [3].

$$\text{C:B Ratio} = \frac{\text{Gross returns}}{\text{Total cost of cultivation}}$$

Charitha and Kumar (2023) [3]

Results and Discussion

The results (Table -1) after the first and second sprays demonstrated that all treatments were significantly superior to the control. The data on the mean larvae population of maize stem borer *Spodoptera frugiperda* 3rd, 7th, and 14th

day after the first spray revealed that all of the chemical treatments were considerably superior to the control. Among all the treatments lowest larval population of *Spodoptera frugiperda* was recorded in Chlorantraniliprole 18.5 SC (2.42) followed by Spinosad (2.22), Emamectin benzoate 5% SG (2.66), Fipronil 0.6% G (2.86), Nisco sixer plus (3.10), Azadirachtin (3.40), NSKE (3.53) and control (7.56). The data on the mean larval population of maize stem borer *Spodoptera frugiperda* 3rd, 7th, and 14th days after the second spray showed that all treatments outperformed the control. Among all treatments, the lowest larval population of *Spodoptera frugiperda* was reported in Chlorantraniliprole 18.5 SC (1.36) followed by Spinosad 45% SC (1.63), Emamectin benzoate 5% SG (1.80), Fipronil 0.6% G (1.96), Nisco sixer plus (2.13), Azadirachtin (2.26), NSKE (2.46) and control (8.00)

The highest yield and cost benefit ratio was recorded in Chlorantraniliprole 18.5 SC (42.72 q/ha) and (1:2.7) followed by Spinosad 45% SC (40 q/ha and 1:1.5), Emamectin benzoate 5% SG (37.44 q/ha and 1:2.1), Fipronil 0.6% G (34.79 q/ha and 1:1.7), Nisco sixer plus (31.68q/ha and 1:1.28), Azadirachtin (37.5 q/ha and 1:1.4), NSKE (26.49 and 1:1.2) and control (23.5 q/ha and 1:0.7).

The data on the mean larval population in the first and second spray in Chlorantraniliprole 18.5 SC were (2.22) and (1.36). These results were supported by Srujana *et al.* (2021) [13] and Kamakshi *et al.* (2023) [5]. Spinosad 45% SC was also found to be very effective (2.42) and (1.63). These findings are supported by Ravikumar *et al.* (2022) [14] and Thumar *et al.* (2020) [16]. Emamectin benzoate 5% SG (2.66) and (1.80). The findings are supported by Reddy and Kumar (2019) [11], and Kumar *et al.* (2017) [4, 7, 8]. Fipronil 0.6% G (2.86) and (1.96), these results are supported by Prakesh *et al.* (2017) [9] and Reddy and Kumar (2021) [12].

The cost benefit ranged between 1:2.7 and 1:1.4. Maximum cost benefit ratio (1:2.7) and yield (42.72 q/ha) was obtained in Chlorantraniliprole 18.5 SC treated plants, which is supported by Kamakshi *et al.* (2023) [5] and Srujana *et al.* (2021) [13], followed by cost benefit ratio (1:1.5) and yield (40.80 q/ha) were reported in Spinosad 45% SC treated plants, and the results were supported by Ahir *et al.* (2021) [2] and Thumar *et al.* (2020) [16]. Emamectin benzoate 5% SG and Fipronil 0.6% G were also had a profitable yield of (37.44 q/ha) and (34.79 q/ha) and cost benefit ratio (1:2.1) and (1:1.7) these findings are supported by Reddy and Kumar (2019) [11], Singh and Yadav (2023) [15], Reddy and Kumar (2021) [12].

Table 1: Efficacy of selected insecticides on the larval population of *Chilo partellus* on maize after the 1st and 2nd spray

S. No.	Treatments	Number of larval Population per 5 plants											Pooled mean	Yield (q/ha)	C: B Ratio
		Dosage	First spray					Second spray							
			1 DBS	3 DAS	7 DAS	14 DAS	Mean	1 DBA	3 DAS	7 DAS	14 DAS	Mean			
T1	Fipronil 0.6% G	1.5 ml/L	5.0	3.26	2.40	3.00	2.86	3.00	2.73	1.53	1.73	1.96	2.41	22.5	1:1.7
T2	Spinosad 45% SC	0.5 ml/L	5.4	3.00	1.93	2.66	2.42	2.66	2.26	1.26	1.53	1.63	2.02	26.7	1:1.5
T3	Nisco sixer plus	0.2 gm/L	4.87	3.53	2.66	3.26	3.10	3.26	2.96	1.66	1.93	2.13	2.61	21.2	1:2.5
T4	Neem oil 1500 ppm	0.2 ml/L	4.40	3.80	2.80	3.60	3.40	3.60	3.06	1.60	2.06	2.26	2.83	17.0	1:1.4
T5	NSKE 5%	2 ml/L	4.0	3.93	2.93	3.66	3.53	3.66	3.26	1.86	2.40	2.46	2.99	11.7	1:1.2
T6	Emamectin benzoate 5% SG	1.5 ml/L	5.00	3.13	2.20	2.73	2.66	2.73	2.46	1.40	1.60	1.80	2.23	25.8	1:2.1
T7	Chlorantraniliprole 18.5% EC	1.5 ml/L	5.73	2.73	1.86	2.20	2.22	2.20	2.13	0.93	1.06	1.36	1.79	28.3	1:2.7
T8	Control	-	6.20	6.93	7.13	8.46	7.56	8.46	7.93	8.33	8.86	8.37	7.96	9.3	1:0.7
	F-test		NS	S	S	S	S	S	S	S	S	S			
	S. ED (±)		1.469	0.93	0.93	0.81	0.51	0.81	0.81	0.40	0.65	0.53			
	C.D. (P = 0.5)		0.685	5.31	5.31	6.75	3.54	6.75	6.75	5.31	6.753	3.54			

Conclusion

From the critical analysis of the present findings, it can be concluded that, among all the treatments Chlorantraniliprole 18.5 SC is more effective in controlling larval population of *Spodoptera frugiperda* followed by Spinosad 45% SC, Emamectin benzoate 5% SG, Fipronil 0.6% G, Nisco sixer plus, Azadirachtin 0.03% and NSKE. Among the treatments studied, Chlorantraniliprole 18.5 SC (42.72 q/ha) and (1:2.7) followed by Spinosad 45% SC (40 q/ha and 1:1.5), Emamectin benzoate 5% SG (37.44 q/ha and 1:2.1), Fipronil 0.6% G (34.79 q/ha and 1:1.7), Nisco sixer plus (31.68q/ha and 1:1.28), Azadirachtin (37.5 q/ha and 1:1.4), NSKE (26.49 and 1:1.2) and control (23.5 q/ha and 1:0.7) respectively as such more trails are required in future to validate the findings.

References

- Kumar B, Karjagi CG, Jat SL, Parihar CM, KR Y, Singh V, *et al.* Maize biology: an introduction; c2011.
- Ahir KC, Mahla MK, Sharma K, Babu SR, Kumar A. Bio-efficacy of insecticides against fall armyworm. Indian J Agric Sci. 2021;91(12):1796-800.
- Charitha K, Kumar A. Cost Effective Analysis of Fall Armyworm (Lepidoptera: Noctuidae) on Maize at Allahabad. Int J Environ Clim Change. 2023;13(8):1028-1034.
- Kumar GS, Madhumathi T, Kumar DS, Kumar VM, Ahamad ML. Bioefficacy of different biorational insecticides for the management of spotted stem borer, *Chilo partellus* (Swinhoe) in maize (*Zea mays* L.). J Res ANGRAU. 2017;45(2):19-30.
- Kamakshi N, Srujana Y, Krishna TM, Sameera SK, Parveen SI. Mitigation of exotic fall armyworm *Spodoptera frugiperda* (JE Smith) on dryland Sorghum in Southern parts of India. Int J Trop Insect Sci. 2023;43(4):1169-1177.
- Khan IA, Khan MN, Rasheed Akbar MS, Farid A, Ali I, Alam M, Shah B. 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(4):327-330.
- 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.
- Kumar R, Alam T. Bio-efficacy of some newer insecticides against maize stem borer, *Chilo partellus* (Swinhoe). J Entomol Zool Stud. 2017;5(6):1347-1351.
- 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(6):481-484.
- Rameash K, Kumar A, Kalita H. Biorational management of stem borer, *Chilo partellus* in maize. Indian J Plant Prot. 2012;40(3):208-213.
- Reddy BS, Kumar A. Field efficacy of certain insecticides against maize stem borer *Chilo partellus* (Swinhoe). J Entomol Zool Stud. 2019;7(4):910-912.
- Reddy GV, Kumar A. Efficacy of various insecticides against maize stem borer *Chilo partellus* (Swinhoe) and their cost-benefit analysis at Prayagraj. J Entomol Zool Stud. 2021;9(6):130-134.
- Srujana Y, Kamakshi N, Krishna TM. Insecticidal activity of diverse chemicals for managing the destructive alien pest fall armyworm *Spodoptera frugiperda* (JE Smith) on maize crop in India. Int J Trop Insect Sci. 2021;41(1):103-108.
- Ravikumar A, Anand KV, Basavaraj K. Field bio-efficacy of chlorpyrifos 50%+ cypermethrin 5% EC against fall armyworm, stem borer and on natural enemy maize during 2020-21 kharif season. J Exp Zool India. 2022;25(1):259-265.
- Singh A, Yadav U. Evaluate the efficacy of different biopesticides with imidacloprid against maize spotted stem borer (*Chilo partellus* Swinhoe) on maize under field conditions. Int J Plant Soil Sci. 2023;35(18):1001-1006.
- Thumar RK, Zala MB, Varma HS, Dhobi CB, Patel BN, Patel MB, Borad PK. Evaluation of insecticides against fall armyworm, *Spodoptera frugiperda* (J. E. Smith) infesting maize. Int J Chem Stud. 2020;8(4):100-104.