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Effect of Some Chemicals and Biopesticides against Yellow Stem Borer [*Scirpophaga incertulas* (Walker)] at Prayagraj

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted at the research field of Department of Entomology, Sam Higginbottom University of Agriculture Technology and Sciences Prayagraj, during *Kharif* season 2023. The experiment was laid out in a Randomized Block Design (RBD) with three replications, Eight treatments were evaluated against yellow stem borer *Scirpophaga incertulas viz.,* Spinosad 45SC @ 0.2ml/l, *Beauveria bassiana* (1x10^{8}CFU/g) @1.5 g/l, Fipronil 5SC @ 2ml/l, Acephate95SG @ 682ga.i/ha, *Metarhiziumanisopliae* (1.15% CFU) @2000g/ha, Lamda Cyhalothrin 5EC@ 0.5ml/l,

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Bacillus thuringiensis (2x10^9 POB) @1.5g/l, and Control. Among the different chemical and biopesticides, the pooled analysis of per cent dead hearts were recorded least in Spinosad45SC which was the most effective treatment with (12.98% and 13.93%) mean dead heart percent , followed by Lamda Cyhalothrin 5EC (13.27% and 14.63%), Acephate95SG (13.58% and 15.06%) and Fipronil 5SC (14.10% and 15.29%).The next best treatments were found to be *Beauveria bassiana* (1x10^{8}CFU/g) (14.38% and 15.67%), *Bacillus thuringiensis* (2x10^9 POB) (14.64 and 15.94%), *Metarhizium anisopliae* (1.15%CFU) (14.97 and 16.19%) and the highest dead heart percent infestation of *Scirpophaga incertulas* (Walker) was found in Control (15.77% and 18.54%). The highest yield and cost benefit ratio was recorded from Spinosad (51.5q/hac) and (1:4.51), followed by Lamda Cyhlothrin (45q/hac) and (1:4.35), Acephate (43q/ha c) and (1:4.18).

Keywords: Biopesticides; chemicals; cost benefit ratio; efficacy; paddy; Scirpophaga incertulas.

1. INTRODUCTION

Rice (*Oryza sativa*) is the most important cereal food crop in the world, belongs to family *Poaceae*. The word “Cereals” comes from “Ceres”, name of a Roman Goddess, means ‘Giver of Grains’. Rice is the major staple food for more than half of the World’s population [1-3]. “It is a grain of life for more than 90% of the world’s rice is grown and consumed in Asia, known as rice bowl of the world, where 60% of the earth’s people and two third of world’s poor lives. Rice crop is infested with more than 100 species of insects, but 20 species are of economic importance. Insect pests *viz*., stem borer, leaf folder, gall midge and plant hoppers are the major constraints in achieving desired level of rice yield [4-6]. Yellow stem borer is one of the widely distributed, dominant and monophagous pest of paddy in the Indian subcontinent and forms dead hearts in younger plant at the vegetative stages result in destruction of growing point and white ears head bearing panicles at the panicle bearing stage in older plant [7-11]. The average yield loss in rice have been accounted for 30% loss in stem borers” [1,12,13].

2. MATERIALS AND METHODS

Field experiment was conducted at Central Research Farm of Sam Higginbottom University of Agriculture Technology and Science, Prayagraj, UP during *Kharif* season 2023-24. The site selected was uniform, cultivable with typical sandy loam soil having good drainage. Trail was laid out in randomized block design consist of eight treatment including control. Each treatment was replicated thrice, and Basmati PB1121 seeds were sown and transplanted at a spacing of 20×15cm. The treatment used were Spinosad45SC@0.2ml/l, *Beauveria bassiana*(1x10^{8}CFU/g) @1.5g/l, Fipronil5SC @ 2ml/l, Acephate 95SG @682ga.i/ha, *Metarhizium anisopliae* (1.15%CFU) @ 2000g/h Lamda Cyhalothrin5EC@0.5ml, *Bacillus thuringiensis* (2x10^9 POB)@1.5g/l. Two spray were done on 8th September 2023 and second on 23rd September 2023. The observations on no. of dead heart were recorded on five randomly selected plants per treatment. First count was done one day before application of treatment and post treatments counts were made after 3,7 and 14 days. Two sprays were given with an interval of 15 days.

3. RESULTS

All insecticides were significantly superior over control in reducing the dead heart percent of stem borer recorded at 3rd, 7th and 14th day after first spray (Table 1). Among all the treatment Spinosad (12.98%) was found to be superior but it was lower than Lamda Cyhalothrin (13.27%) which was the check treatment followed by Acephate (13.58%), Fipronil (14.10%), *Beauveria bassiana* (14.38%). However, *Bacillus thuringiensis* (14.64%) *and Metarhizium anisopilae* (14.97%) found to be least effective in managing yellow stem borer.

4. DISCUSSION AND CONCLUSION

From the present study, the results showed that Spinosad 45SC (T1), is the most effective treatment against yellow stem borer and produces maximum yield, and recorded the highest Cost-Benefit ratio compared to other treatments. From the critical analysis of the present findings it can be concluded that yellow stem borer increase with maximum temperature and decreased with decline in minimum temperature. Insecticides like Lamda Cyhalothrin 5EC (T6) and Acephate 95SG (T4) was found significantly superior than other treatments.

Table 1. Efficacy of different treatments against yellow stem borer [*Scirpophaga incertulas*] during *kharif* season 2023-24

S.N.	Treatments	Dead heart (%)								Yield q/ha	C:B ratio
		Day Before spray	1st Spray				2nd Spray				
			3 DAS	7 DAS	14 DAS	Mean	3 DAS	7 DAS	14 DAS	Mean	
T_1	Spinosad 45SC@0.2ml/l	11.51	12.27^{C}	13.11^{e}	13.58^{d}	12.98^{f}	13.75^{d}	13.96^{e}	14.09^{e}	13.93^{f}	51.5	1:4.51
T_2	*Beauveria bassiana* ($1x10^8$ CFU/g) @1.5g/l	11.50	13.58^{abc}	14.55^{abc}	15.02^{abc}	14.38^{cd}	15.29^{bc}	15.55^{bc}	16.18^{bcd}	15.67^{bc}	35.5	1:3.39
T_3	Fipronil 5SC @2ml/l	11.66	13.12^{bc}	14.31^{bcd}	14.88^{bc}	14.10^{d}	15.03^{bc}	15.29^{bcd}	15.56^{bcd}	15.29^{cd}	37	1:3.43
T_4	Acephate 95SG@682g a.i/ha	11.57	12.45^{c}	13.75^{cde}	14.55^{bcd}	13.58^{e}	14.88^{bcd}	15.03^{cd}	15.29^{cde}	15.06^{de}	43	1:4.18
T_5	*Metarhizium anisopilae* (1.15%CFU) @2000g/ha	11.28	14.09^{ab}	15.29^{ab}	15.55^{ab}	14.97^{b}	15.76^{b}	16.18^{b}	16.65^{b}	16.19^{b}	29.5	1:2.83
T_6	Lamda Cyhalothrin 5EC@0.5ml/l	11.43	12.38^{c}	13.34^{de}	14.09^{cd}	13.27^{ef}	14.31^{cd}	14.55^{de}	15.03^{de}	14.63^{e}	45	1:4.35
T_7	*Bacillus thuringiensis* Var(*kurstaki)*($2x10^9$*POB*) @ 1.5g/l	11.33	13.60^{abc}	15.03^{ab}	15.29^{abc}	14.64^{bc}	15.56^{b}	15.76^{bc}	16.50^{bc}	15.94^{b}	31.5	1:2.94
T_8	Control	11.44	14.95^{a}	15.56^{a}	16.82^{a}	15.77^{a}	17.37^{a}	18.54^{a}	19.72^{a}	18.54^{a}	25	1:2.46
	F-Test	NS	S	S	S	S	S	S	S	S		
	S.Ed.(±)	NS	0.74	0.50	0.55	0.18	0.89	0.58	0.60	0.29		
	CD (0.05)(0.05)	NS	1.59	1.11	1.27	0.35	1.18	0.97	1.34	0.56		

Followed next effective treatment found was Fipronil(T_3), *Beauveria bassiana* (1x10^8 CFU/g) (T2). However, *Bacillus thuringiensis* (2x10^9 POB) (T7) *and Metarhizium anisopilae* (T5) found to be least effective in managing yellow stem borer [*Scirpophaga incertulas* (Walker)] as an effective tool under chemical control. Hence, it is suggested that effective insecticides may be alternated along with biopesticides with the existing Integrated pest management programs to avoid the problems associated with insecticidal resistance, pest resurgence etc.

The data on 3,7,14 days after 2nd spray reveled that among all the treatment Spinosad (13.93%) was found to be superior but it was lower than Lamda Cyhalothrin (14.63%) which was the check treatment followed Acephate (15.06%), Fipronil (15.29%), and *Beauveria bassiana* (15.67%). However, *Bacillus thuringiensis* (15.94%) *and Metarhizium anisopilae* (16.19%) was found to be least effective in managing yellow stem borer.

The mean data of all observation regarding the efficacy of different treatments against yellow stem borer revealed the Spinosad (13.45%) was superior followed by Lamda Cyhalothrin (13.95%), Acephte (14.32%), Fipronil (14.69%), *Beauveria bassiana* (15.02%) *Bacillus thuringiensis* (15.29%) and *Metarhizium anisopliae* (15.58%) as compared to control (17.15%). In the result DH of yellow stem borer per hill were obtained in plot treated with Spinosad (13.45%), similar results were reported by Chatterjee and Mondal [14] who recorded 13.54 % dead heart. The result of Lamda Cyhalothrin 13.95% dead heart per hill are similar to the finding of Katel et al. [15] who reported 8.46% DH/hill from the treatment Lamda Cyhalothrin.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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