Comparative Efficacy of Selected Chemicals With Biopesticides Against Yellow Stem Borer, *Scirpophaga Incertulas* (Walker) On Paddy (*Oryza sativa* L.)

ABSTRACT

The experiment was conducted at the research plot of the Department of Entomology at Central Research Farm (CRF), Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, during the *Kharif* season of 2022. The experiment was laid out in a Randomized Block Design (RBD) with three replications, seven treatments and untreated control were evaluated against, *Scirpophaga incertulas i.e.,* Chlorantraniliprole 0.4% G @ 10kg/ha, Spinosad 45% SC @ 200ml/ha, Acephate 75% SP @ 650gm/ha, Emamectin benzoate 5% SG @ 220gm/ha, *Bacillus thuringiensis* 2 x 10^8 CFU @ 1000gm/ha, Neem oil 5% @ 5lit/ha, Karanj oil 5% @ 5lit/ha and Control. Among the different chemicals and biopesticides, the lowest per cent dead hearts and white ears was recorded in Chlorantraniliprole 0.4% G (4.24%), followed by Spinosad 45% SC (4.54%) and Acephate 75% SP (4.94%). The next best treatments were found to be Emamectin benzoate 5% SG (5.50%), *Bacillus thuringiensis* 2 x 10^8 CFU (5.71%), Neem oil 5% (5.99%), Karanj oil 5% (7.0%) and the highest dead heart and white ears % infestation of *Scirpophaga incertulas* (Walker) was found in control treatment (14.00%). The highest yield and cost benefit ratio was recorded with Chlorantraniliprole 0.4% G (69.33 q/ha) and (1:4.7) followed by Spinosad 45% SC (62.16 q/ha) and (1:3.5), Acephate 75% SP (48.33 q/ha) and (1:3.9), Emamectin benzoate 5% SG (41 q/ha) and (1:3.47), *Bacillus thuringiensis* 2 x 10^8 CFU (37.66 q/ha) and (1:2.47), Neem oil 5% (29.33 q/ha) and (1:1.87), Karanj oil 5% (22.77 q/ha) and (1:1.8).

Keywords: Bio-Pesticides, Chemicals, Cost-Benefit ratio, Paddy, *Scirpophaga incertulas*.

INTRODUCTION

Rice (*Oryza sativa* L.), belongs to the family Poaceae or Gramineae, the staple food of 65% of the total population in India. In India, paddy is grown in 44.06 million ha constituting 34.4 % of the total cultivable area. About 70 % of our farmers are cultivating paddy and the production is about 105.31 million tonnes and productivity being 2178 t/ha **(Sharanappa *et al.*, 2017).** Rice is grown in almost all the states in the country however the major 5 states in rice growing areas are Uttar Pradesh (5.98 MH), West Bengal (5.51 MH), Odisha (4.18 MH), Chattisgarh (3.80 MH), Bihar (3.13 MH). West Bengal stand first in production (15.37 2 MT), followed by Uttar Pradesh (14.64MT). Tamil Nadu stands first in productivity (3100 kg/ha), followed by Telangana (3009 kg/ha), Andhra Pradesh (2852 kg/ha), West Bengal (2788 kg/ha) **(Agricultural Statistics At A Glance 2015)**.

The rice plant is attacked by more than 128 species of insects, 20 of them can cause serious economic loss and among them yellow stem borer, *Scirpophaga incertulas* (Walker) is one of the most destructive pest and is widely distributed monophagous pest in Indian subcontinent and has assumed the number one pest status and attacks the rice crop at all growth stages **(Pasulu *et al.*, 2002)**. It is a serious pest species of rice throughout the orients and abundant both on lowland rice and upland rice attacking young plant even in the nursery stage. In the vegetative stage of the rice plant, young larvae feed on the leaf sheath and ultimately bore into the stem and feed inside. This prevents the central leaf whorls from unfolding, causing them to turn brownish and die, bringing about the condition known as "Dead Hearts." In the infested plants, panicles may not emerge at all **(Atwal 1976).** During the reproductive stage of the rice plant, the stem borer's larvae cut the growing parts leading to the condition known as "White ears" and do not produce grain and become conspicuous.

Chemicals insecticides are always a front line weapons for the management of pests. Regular use of chemical pesticides create problem in the natural ecosystem like environmental pollution, pest resistance and health hazard etc. due to these reasons by studying the insecticidal properties and their results and plant products were used against stem borer *Scirpophaga incertulas* (Walker). Hence the present study was carried out to test the comparative efficacy of selected insecticides against yellow stem borer.

MATERIALS AND METHODS

The experiment was carried out under field conditions at Central Research Farm (CRF), Sam Higginbottom University of Agriculture, Technology And Sciences (SHUATS), Prayagraj, during *Kharif* 2022 on paddy using variety CH-8. The experimental site is situated at 25°27" North Latitude 80°05 East Longitudes and at an Altitude of 98 meter above sea level. Transplanting was done 1 month after sowing at a spacing of 15×10cm with a recommended package of practices excluding plant protection. Experiment was laid on Randomized Block Design (RBD) having eight treatments *i.e.*, Acephate 75% SP @ 650gm/ha (T_1), Karanj oil 5% @ 5lit/ha (T_2), *Bacillus thuringiensis* 2×10^8 CFU @ 1000gm/ha (T_3), Emamectin benzoate 5% SG @ 220gm/ha (T_4), Chlorantraniliprole 0.4% G @ 10kg/ha (T_5), Neem oil 5% @ 5lit/ha (T_6), Spinosad 45% SC @ 200ml/ha (T_7) along with a control. Each treatment was replicated thrice in a net experimental area of 2m×1m in each. Spraying was initiated when the ETL was 5-10%. Total of two spray applications were given during the crop period with an interval of 15 days. The observations on the per cent Dead hearts and White ears were made on randomly selected and tagged 5 plants on day before spray and 3^{rd},7^{th},14^{th} days after spray.

The percent dead hearts and white ears were calculated by using the following formula:

$$\text{Percent of dead hearts} = \frac{\text{Total number of dead hearts}}{\text{Total number of tillers}} \times 100$$

(Omprakash *et al.*, 2017)

$$\text{Percent of white ears} = \frac{\text{Total number of white ears}}{\text{Total number of tillers}} \times 100$$

(Omprakash *et al.*, 2017)

All the data obtained were subjected to statistical analysis with the standard procedure **(Gomez and Gomez 1976)**. The data on yield was recorded from each plot individually. The grain yield was converted into quintals per hectare. Cost Benefit Ratio was also assessed by dividing Gross returns by the total cost of cultivation.

RESULTS AND DISCUSSION

The data on the per cent dead hearts after the first spray showed that all the insecticides were significantly superior over control in reducing the infestation of yellow stem borer. Pooled analysis of data on 3^{rd}, 7^{th} and 14^{th} days after the first spray

revealed that, the lowest per cent dead hearts was recorded in Chlorantraniliprole 0.4% G (5.16%), followed by Spinosad 45% SC (5.28%), Acephate 75% SP (5.88%), Emamectin benzoate 5% SG (6.39%), *Bacillus thuringiensis* 2×10^8 CFU (6.47%), Neem oil 5% (6.73%). Among all the treatments, Karanj oil 5% (7.79%) was found to be the least effective but superior over the control (12.60%).

Pooled analysis of data on 3rd, 7th and 14th days after the second spray revealed that, Chlorantraniliprole 0.4% G (3.32%) was effective in reducing the per cent white ears, followed by Spinosad 45% SC (3.81%), Acephate 75% SP (4.0%), Emamectin benzoate 5% SG (4.62%), *Bacillus thuringiensis* 2×10^8 CFU (4.95%), Neem oil 5% (5.25%) and Karanj oil 5% (6.21%) was found to be the least effective but superior over the control (15.41%).

The overall mean of first and second spray revealed that, among all the treatments, Chlorantraniliprole 0.4% G (4.24%) was the most effective, followed by Spinosad 45% SC (4.54%), Acephate 75% SP (4.94%), Emamectin benzoate 5% SG (5.50%), *Bacillus thuringiensis* 2×10^8 CFU (5.71%), Neem oil 5% (5.99%), Karanj oil 5% (7.00%) and control (14.00%).

The data also showed that the highest grain yield of 69.33 q/ha was registered in Chlorantraniliprole 0.4% G, followed by Spinosad 45% SC (48.83 q/ha)**,** Acephate 75% SP (48.33 q/ha), Emamectin benzoate 5% SG (41 q/ha), *Bacillus thuringiensis* 2×10^8 CFU (37.66 q/ha), Neem oil 5% (29.33 q/ha), Karanj oil 5% (22.77 q/ha). As low as 13.33 q/ha was recorded in untreated plot control.

The analysis of Cost benefit ratio of all treatments were also carried out which revealed that the highest monetary return was obtained with in Chlorantraniliprole 0.4% G (1:7.73), followed by Spinosad 45% SC (1:6.12), Acephate 75% SP (1:5.7), Emamectin benzoate 5% SG (1:4.87), *Bacillus thuringiensis* 2×10^8 CFU (1:4.48), Neem oil 5% (1:3.12) and Karanj oil 5% (1:2.62). The least monetary return was obtained with control (1:1.1).

The mean data of all observations regarding the efficacy of different treatments against yellow stem borer revealed that, Chlorantraniliprole 0.4% G (4.24%), the most effective among all, were similar with the findings of **Omprakash *et al*., (2017), Rani *et al*., (2017).** Followed by Spinosad 45% SC

(4.54%), which lined with the findings of **Chatterjee and Mondal (2014), Madhu *et al*., (2019)**, Acephate 75% SP (4.94%), similar results were supported by **Sharanappa *et al*., (2017)**, **Kumari *et al*., (2019)**.

The highest yield and cost benefit ratio were recorded in Chlorantraniliprole 0.4% G (69.33 qt/ha) and (1:7.73), similar findings were supported by **Pallavi and Sharanabasappa (2018)**, followed by Spinosad 45% SC (62.16 qt/ha) and (1:6.12), this result was supported by the findings of **Madhu *et al*., (2019)** Followed by Acephate 75% SP (48.33 qt/ha) and (1:5.7), this result was supported by the findings of **Sharanappa *et al*., (2017)**.

CONCLUSION

From the present investigation, it is concluded that, among all the treatments Chlorantraniliprole 0.4 % G @ 10kg/ha proved to be the most effective in reducing the infestation of yellow stem borer resulting in the highest grain yield of 69.33 q/ha with cost benefit ratio of 1:7.73.

Table 1. Effect of different chemicals and biopesticides on the incidence of yellow stem borer, *Scirpophaga incertulas* (Walker) on paddy (1st and 2nd spray) during *Kharif* season 2022.

S. No	Treatments	Mean percent infestation (%)							Overall mean %	Yield (q/ha)	C: B ratio
		First spray (dead heart)				Second spray (white ear)					
		1DBS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS			
T_1	Acephate 75 % SP @ 650gm/ha	08.41 (02.89)	06.86^{bc} (02.60)	04.90^{bc} (02.21)	05.90^{cde} (02.42)	04.69^{de} (02.14)	03.15^{def} (01.77)	04.18^{de} (02.04)	04.94^{bc} (02.21)	48.33^{c}	1:5.7
T_2	Karanj oil 5% @ 5lit/ha	09.67 (03.11)	08.98^{b} (02.97)	06.77^{b} (02.56)	07.64^{b} (02.75)	07·13^{b} (02.66)	05.43^{b} (02.33)	06.09^{b} (02.46)	07.00^{b} (02.64)	22.77^{f}	1:2.6
T_3	*Bacillus thuringiensis* 2 x 10^8 CFU @ 1000gm/ha	08.84 (02.95)	07.19^{bc} (02.66)	05.87^{bc} (02.39)	06.35^{cd} (02.51)	05·69^{cd} (02.38)	04.04^{cd} (02.00)	05.12^{c} (02.26)	05.71^{bc} (02.38)	37.66^{d}	1:4.4
T_4	Emamectin benzoate 5% SG @ 220gm/ha	08.72 (03.13)	07.15^{bc} (02.64)	05.86^{bc} (02.42)	06.16^{cde} (02.48)	05·12^{cde} (02.26)	03.94^{cde} (01.98)	04.82^{cd} (02.19)	05.50^{bc} (02.33)	41.00^{d}	1:4.8
T_5	Chlorantraniliprole 0.4 % G @ 10kg/ha	09.89 (03.13)	06.13^{c} (02.46)	04.29^{c} (02.03)	05.08^{e} (02.25)	04.10^{e} (02.01)	02.70^{f} (01.63)	03.16^{f} (01.77)	04.24^{c} (02.04)	69.33^{a}	1:7.7
T_6	Neem oil 5% @ 5lit/ha	09.96 (02.96)	07.38^{bc} (02.70)	05.88^{bc} (02.41)	06.93^{bc} (02.63)	06.00^{bc} (02.44)	04.41^{c} (02.09)	05.36^{bc} (02.31)	05.99^{bc} (02.44)	29.33^{e}	1:3.1
T_7	Spinosad 45 % SC @ 200ml/ha	09.57 (03.08)	06.17^{bc} (02.47)	04.44^{c} (02.09)	05.24^{de} (02.28)	04.55^{de} (02.13)	03.03^{ef} (01.74)	03.85^{ef} (01.96)	04.54^{bc} (02.12)	62.16^{b}	1:6.1
T_0	Control	08.10 (02.84)	11.85^{a} (03.44)	12.54^{a} (03.54)	13.42^{a} (03.66)	13.94^{a} (03.73)	15.23^{a} (03.90)	17.07^{a} (04.13)	14.00^{a} (03.73)	13.33^{g}	1:1.1
	F-test	NS	S	S	S	S	S	S	S	-	-
	S. Em (±)	0.92	0.93	0.74	0.37	0.41	0.30	0.26	0.79	0.13	-
	C.D. (0.05%)	-	0.53	0.46	0.22	0.27	0.22	0.16	0.44	0.14	-

*****DBS=Day Before Spray, **DAS=Day After Spray, ***NS=Non-Significant, ****S-Significant

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