



# Efficacy of Biopesticides for the Management of Rice Yellow Stem Borer *Scirpophaga incertulas* (Walker) in Rice at Prayagraj, U.P, India

Roopwan<sup>a++\*</sup>, Usha Yadav<sup>a#</sup> and Buduru Madhu<sup>a</sup>

<sup>a</sup> Department of Entomology, Faculty of Agriculture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj-211007, Uttar Pradesh, India.

## Authors' contributions

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

## Article Information

DOI: 10.9734/IJPSS/2023/v35i183354

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/103116>

Original Research Article

Received: 18/05/2023  
Accepted: 20/07/2023  
Published: 25/07/2023

## ABSTRACT

The present experiment was conducted to highlight the Efficacy of biopesticides for the management of rice yellow stem borer [*scirpophaga incertulas* (Walker)] at prayagraj, U.P, India. The eight treatments comprised of different insecticides and biopesticides. *Metarhizium anisopliae* (T<sub>1</sub>), *Bacillus thuringiensis* 1.15% (T<sub>2</sub>), *Beauveria bassiana* 1.15% (T<sub>3</sub>), *Verticillium lecanii* 1.15% (T<sub>4</sub>), Neem oil 5% (T<sub>5</sub>), Eucalyptus oil 5% (T<sub>6</sub>), Imidacloprid 17.8%SL (T<sub>7</sub>), one untreated Control (T<sub>8</sub>) were evaluated against rice stem borer. The different insecticides and biopesticides treatments revealed that the minimum dead hearts, were recorded in synthetic insecticides, Imidacloprid 17.8%SL followed by *Beauveria bassiana* 1.15%, *Metarhizium anisopliae*. The minimum dead heart percentages Imidacloprid 17.8%SL were observed in as compared to the natural dead heart of per cent being noticed in untreated control. The percent of the dead heart infestation among the

<sup>++</sup> M. Sc Scholar;

<sup>#</sup> Assistant Professor;

\*Corresponding author: E-mail: roopwanmaurya888@gmail.com;

treatments are notices as *Metarhizium anisopliae* (T1) *Bacillus thuringiensis* 1.15%WP (T2), *Beauveria bassiana* 1.15%WP (T3), *Verticillium lecanii*1.15%WP (T4), Neem oil 5% (T5), Eucalyptus oil5% (T6), Imidacloprid 17.8%SL(T7), The yield and cost benefit ratio of the data revealed that the highest yield was recorded in the Imidacloprid 17.8%SL @46.66q/ha with highest Benefit-cost ratio of 1:3.47 followed by *Bacillus thuringiensis* 1.15% @ 38.33 q/ha with benefit cost ratio of 1:2:77 *Beauveria bassiana* 1.15% @ 43.33q/ha with benefit cost ratio of 1:3:27, *Verticillium lecanii* 1.15% @ 36.66q/ha with benefit cost ratio of 1:2:73, Neem oil 5% @ 33.33q/ha with benefit cost ratio of 1:2:46, Eucalyptus oil5% @ 31.66 q/ha with benefit cost ratio of 1:2:35, *Metarhizium anisopliae* @41.66q/ha with benefit cost ratio of 1:3:13. The chemicals shows better results in combating to the pest infestation compare to biopesticides and botanicals.

**Keywords:** Bio-pesticides; chemicals; cost benefit; efficacy; rice; stem borer (*Scirpophaga incertulas*).

## 1. INTRODUCTION

“Rice (*Oryza sativa* L.) occupies the prominent place in Indian agriculture. It is the most important staple food crop of the developing world for more than 3 billion people. The production and productivity of rice is low in Chhattisgarh and India as compared to world production. Chhattisgarh popularly known as “Rice Bowl of India” occupies an area around 3756.80 thousand hectares with the production of 5.22 million tones and productivity of 2050 kg per hectares” [1]. “Amongst various constraints for low productivity of rice the insect pests and diseases are very important” [1].

“The hot and humid environment in which rice is grown is very conducive for proliferation of insects and diseases. The rice plant is attacked by more than 128 species of insects, 20 of them can cause serious economic loss” [2]. “YSB causes 1% to 19% yield loss in early planted and 38% to 80% in late transplanted rice crops” [2].

“Various control strategies have been adopted to check insect pest of rice, use of synthetic insecticides is a common method of pest control. But The indiscriminate uses of insecticides have resulted in a number of undesirable side effects such as the development of resistant strain of insects, environmental pollution and health hazards to farmers” [3].

“Pesticides have also entered into the food chain and have bioaccumulated in the higher tropic level. More recently, several human acute and chronic illnesses have been associated with pesticides exposure” [16-18]. Therefore, it has now become necessary to search for the alternative means of pest control, which can minimize the use of synthetic pesticides. Botanical pesticides are the important alternatives to minimize or replace the use of

synthetic pesticides. Botanicals with different modes of action may minimize insecticide resistance and pest “resurgence problems while being safe and ecologically acceptable” [3].

“Biopesticides are a good alternative to the synthetic pesticide. Neem is one of the most reliable botanical sources of biopesticides. Neem plant has been known for three decades for its potential against insect pests” [13-15].

“Leaves and seed extract of Neem plant have been observed for their deleterious effects on insects. The principle component that has insecticidal activity in Neem extracts is a limonoid, Azadirachtin. Azadirachtin is non-toxic to mammals, rat, oral acute LD<sub>50</sub> is more than 5000 mg/kg. A 90 day oral feeding of rats with 10,000ppm of Azadirachtin did not show chronic toxicity” [4]. The purpose of this study was to find out the Efficacy of biopesticides for the management of rice yellow stem borer at prayagraj, U.P, India.

## 2. MATERIALS AND METHODS

The Field experiment was conducted at the Central Research Farm of Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, U.P. during *kharif* season 2022. Trail was laid out in Randomised Block Design consisting of eight treatments including control. Each treatment was replicated thrice and C84 was sown and transplant date spacing of 30x35cm. Standard agronomic practices were followed to ensure a good crop stand. the treatments Imidacloprid 17.8%SL, *Beauveria bassiana*1.15%, *Bacillus thuringiensis*1.15%, Neem oil 5%, *Metarhizium anisopliae* 1.15% Eucalyptus oil 5% “The observations on account of Dead hearts and White heads were recorded on five randomly selected plants per treatment. First count was

done one day before insecticide application and post treatment counts were made after 3,7,14 days. Two sprays was given with an interval of 15 days. In order to assess the per cent of Dead hearts and White heads on five randomly selected and tagged plants per net plot. Dead hearts and White ears due to rice yellow stem borer pest was recorded from each net plot and the population was worked out per plant” [5].

### 2.1 Observations

The observations on the number of rice yellow stem borer pest were recorded from the ten randomly selected and tagged plants from each plot. The observations were recorded a day before followed by 3<sup>rd</sup>, 7<sup>th</sup>, 14<sup>th</sup> days after spraying. Dead hearts and White ears due to rice yellow stem borer pest were recorded from each net plot and the population was worked out per plant.

The per cent dead hearts and whit ears calculated by using given formula.

$$\text{Percentage of dead hearts} = \frac{\text{Total no dead hearts}}{\text{Total no of tillers}} \times 100$$

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

### 3. RESULTS AND DISCUSSION

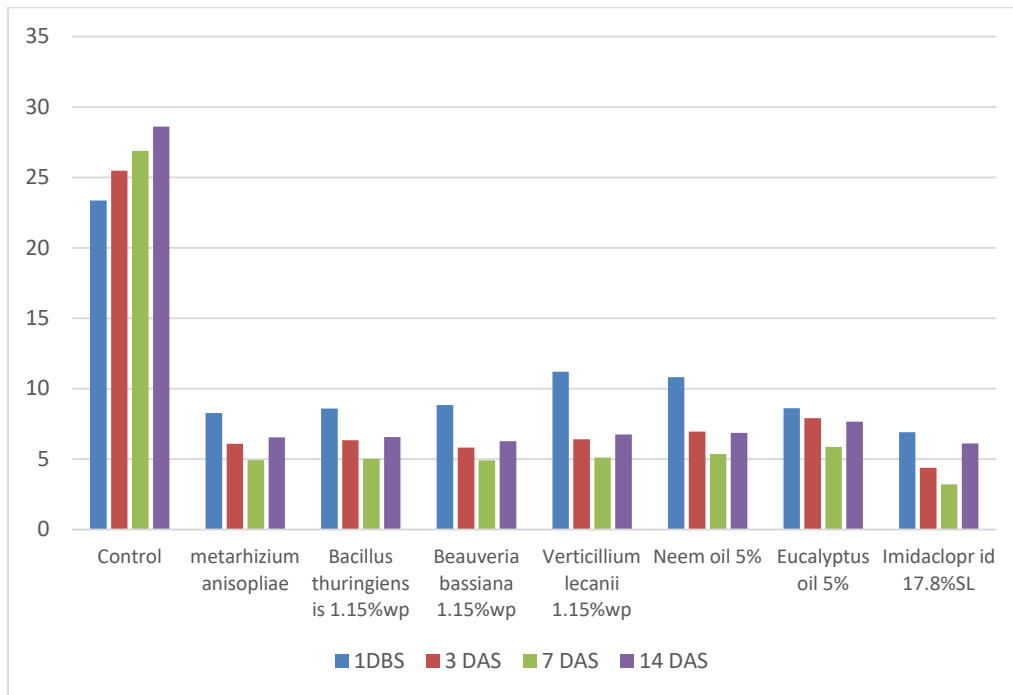
All the insecticides were significantly superior over control in reducing the infestation percent of stem borer which were the mean of 3, 7, and 14 DAS after insecticidal application. Imidacloprid 17.8SL was found significantly superior (4.92), these findings are supported by the Chatterjee et al. [6], Followed by *Beauveria bassiana* 1.15WP (6.37) these findings are supported by Singh et al. [7] *Metarhizium anisopliae* (6.59) was found next best treatment similar results are recorded by by Chormule et al. [8], *Bacillus thuringiensis* 1.15WP (6.80) was found next similar result recorded by Madhu et al. [9] *Verticillium lecanii* (7.00), similar findings are also reported in Rice by Samanta et al. [10], Neem oil 5% (7.80) was next best treatment these similar findings are with those of Choudhary et al. [11], Eucalyptus oil 5% (8.43) found to be least effective but comparatively superior over the untreated control recorded (23.51) these results were in supportive with Longkumar et al. [12].

**Table 1. “Effect of biopesticides for the management of rice yellow stem borer [*scirpophaga incertulas* (walker)] at prayagraj” infestation after first spray**

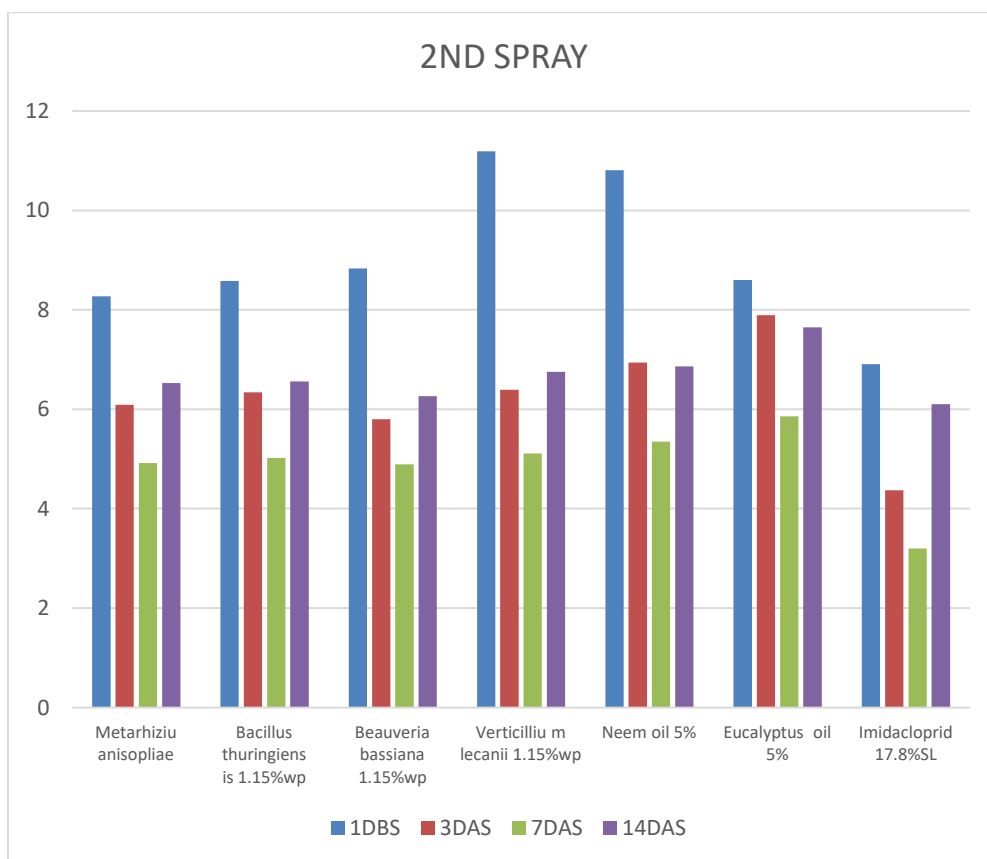
Treatments	Mean % of Dead hearts/5 plants				
	1DBS	3DAS	7DAS	14DAS	Mean
T0 Control	16.17	16.95	19.15	23.35	19.81
T1 <i>Metarhizium anisopliae</i>	10.17	7.71	5.73	8.60	7.347
T2 <i>Bacillus thuringiensis</i> 1.15%wp	10.58	7.96	6.10	8.83	7.630
T3 <i>Beauveriabassiana</i> 1.15%wp	9.90	7.58	5.14	8.58	7.100
T4 <i>Verticillium lecanii</i> 1.15%wp	11.86	8.18	6.36	9.24	7.927
T5 Neem oil 5%	12.96	9.32	7.51	10.83	9.220
T6 Eucalyptus oil 5%	13.98	10.01	7.85	11.19	9.683
T7 Imidacloprid 17.8%SL	9.72	5.61	3.38	6.91	5.300
F-TEST	NS	S	S	S	S
C.V	--	3.58	1.97	3.04	1.01
CD (5%)	--	3.31	2.46	3.05	1.76

**Table 2. “Effect of biopesticides for the management of rice yellow stem borer [*scirpophaga incertulas* (walker)] at prayagraj” infestation after second spray**

Treatments	Mean % dead hearts and white heads				
	1dbs	3das	7das	14das	Mean
T0 Control	23.35	25.48	26.88	29.27	27.210
T1 <i>Metarhiziu anisopliae</i>	8.60	6.09	4.92	6.53	5.847
T2 <i>Bacillus thuringiens</i> 1s 1.15%wp	8.83	6.34	5.02	6.56	5.973
T3 <i>Beauveriabassiana</i> 1.15%wp	8.58	5.80	4.89	6.26	5.650
T4 <i>Verticillium lecanii</i> 1.15%wp	9.24	6.39	5.11	6.75	6.083
T5 Neem oil 5%	10.83	6.94	5.35	6.86	6.383
T6 Eucalyptus oil 5%	11.19	7.89	6.04	7.65	7.193
T7 Imidacloprid 17.8%sl	6.91	4.37	3.20	6.10	4.557
F-test	Ns	S	S	S	S
Cv	--	1.71	1.22	1.67	0.51
Cd (5%)	--	2.31	1.94	2.26	1.25



**Fig. 1. Effect of biopesticides for the management of rice yellow stem borer (application of 1<sup>st</sup> spray)**



**Fig. 2. Effect of biopesticides for the management of rice yellow stem borer (application of 2<sup>nd</sup> spray)**

#### 4. CONCLUSION

Applications of the treatments for the management of rice yellow Stem Borer were initiated when the infestation crossed ETL (5 %) in the field. Subsequently applications were undertaken at an interval of 20 days. In all two applications were made during the experimental period. The observations on stem were recorded after 3, 7 and 14 days of application. The results are summarized as follows.

Among all the treatments, most effective Number of dead heart percentage infestation of yellow stem borer, was recorded in imidacloprid 17.8%SL (4.92), followed by *Beauveria basiana* 1.15%wp (6.37), *Metarhizium anisopliae* (6.59), *Bacillus thuringiensis* 1.15%wp (6.80), *Verticillium lecanii* 1.15%wp (7.00), Neem oil 5% (7.80), Eucalyptus oil 5%(8.43), were significantly superior over untreated control (23.51).

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Krishi Diary. Indira Gandhi Krishi Vishwavidyalaya, Raipur, C.G. 2016;5-6.
2. Kalode MB. Insect pest of rice and their management in rice in Indian Perspective Today and Tomorrow Printers and Publishers (India). 2005;3:819-854.
3. Mehlhorn HK, Al-Rasheid AS, Abdel-Ghaffar F. The neem tree story: Extracts that really work. Parasitol Research Journal. 2011;1:77-108.
4. Madhu B, Warghat AN, Tayde AR. Comparative effect of bio pesticides and neem commercial products on rice yellow stem borer, *Scirpophaga incertulas* (Walker). Journal of Entomology and Zoology Studies. 2020;8(1):758-60.
5. Chatterjee S, Singh B. Relative efficacy of some biorational and microbial insecticides against yellow stem borer and whorl maggot of boro paddy. Journal of Biopesticides. 2021;14(2):90-96.
6. Singh P, Singh R, Dhaka S, Kumar SD. Bioefficacy of insecticides and biopesticides against yellow stem borer, *Scirpophaga incertulas* (walk.) and their effect on spiders in rice crop. South Asian Journal of Food Technology. 2015;1(2): 179-183.
7. Chormule AJ. Bioefficacy of new insecticide molecules against rice yellow stem borer, *Scirpophaga incertulas* (walker). 2014;0974-0376.
8. Chaudhari R, Chandrakar G, Bhardwaj JR, Khan HH, Sahu R. Assessment of the efficacy of neem-based insecticides for the management of yellow stem borer, (*Scirpophaga incertulas*) Walk. in paddy field. Journal of Pharmacognosy and Phytochemistry. 2017;6(5):1446-1499.
9. Longkumar IY, Singh KI, Singh A. Efficacy of eco-friendly insecticides against yellow stem borer under kharif rice-crop-ecosystem of Manipur valley. The Pharma Innovation Journal. 2017; 6(11):19- 21.
10. Dhivya G, Kumar K. Bio-efficacy of botanical against the stem borer *Scirpophaga incertulas* (Walker) in rice. The Pharma Innovation Journal. 2021; 10(8):311-314.
11. Ghongade DS, Sangha KS. Efficacy of biopesticide against of *Scirpophaga incertulas*. Egyptian Journal of Biological Pest Control. 2021;31-19.
12. Kachhawa D. Microorganism as a biopesticides. Journal of Entomology and Zoology Studies. 2017;5(3):468-473.
13. Sarwar M. Study on the non-aromatic rice (*Oryza sativa* L.) varieties resistance to rice stem borers (*Lepidoptera: Pyralidae*) and yield factors. International Journal of Agronomy and Plant Production. 2012;3(5):159-163.
14. Rajpoot SK, Dixit S, Prasad S, Giri V, Singh SP, Parkash RA. Evaluation of insecticides and biopesticides against *Scirpophaga incertulas* (Walker), leaf folder (*Cnaphalocrosis medinalis*) and green leafhopper in basmati rice .The Pharma Innovation Journal. 2021;0(12): 368-371 .
15. Kumbhar CR, Singh SPN. Efficacy of newer insecticides against rice borer complex under North Bihar condition. Journal of Entomology and Zoology Studies. 2020;8(4):797-801.
16. Sasmal A, Pratap, Sarangi AK. Bio-efficacy evaluation of some insecticides (solo and pre mixed) against major insect pests of rice. Journal of Crop and Weed. 2018; 14(1):238-244.
17. Atwal AS. Agricultural pests of India and South East Asia. Kalyani Publishers, Ludhiana, India. 1976;153-160.

18. Karthikeyan K, Purushothaman SM. (Pyralidae, Lepidoptera) in rabi rice, Indian Journal of Plant Protection. 2000;28(2): 212-214.  
Efficacy of carbosulfan against rice yellow stem borer, *Scirpophaga incertulas* Walker

© 2023 Roopwan et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:*  
<https://www.sdiarticle5.com/review-history/103116>