www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(7): 2570-2573

www.thepharmajournal.com
Received: 21-04-2023
Accepted: 02-06-2023

Repaka Harika
Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Sonali Deole
Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Corresponding Author:
Repaka Harika
Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Evaluation of selected insecticides against brown planthopper and their impact on natural enemies

Repaka Harika and Sonali Deole

Abstract
The present investigation on the effectiveness of different insecticides against the brown planthopper, *Nilaparvata lugens* (Stal.), on rice in field conditions demonstrated that pymetrozine 50% WG @ 150 g a.i./ha was found to be the most efficient chemical, recording the highest overall percent decline in BPH population, *i.e*., 76.88 percent and 79.86 percent after both the initial and second sprays, accordingly. Pymetrozine was succeeded by sulfoxaflor 24% SC @ 175 ml a.i./ha, which recorded 75.10 percent and 74.49 percent reduction. Pymetrozine 50% WG, with 2.21 BPH/hill after first spray and BPH/hill after second spray, had the lowest overall mean population of BPH, followed by sulfoxaflor 24% SC, with 2.38 BPH/hill after first spray and 2.28 BPH/hill after second spray. All the treatments reported safer to the population of spiders and coccinellids among them pymetrozine 50% WG recorded higher mean population of spiders 2.44 and coccinellids 1.08 per hill in comparison with untreated plot.

Keywords: Effectiveness, brown planthopper, pymetrozine and sulfoxaflor

Introduction

One of the most important cereal crops is Rice, *Oryza sativa* (Linnaeus), which is the main diet for more than 65% of the world's population (Mathur *et al.,* 1999) [6]. Since it supplies more than 20% of daily calories, rice is a staple food for more than 3.5 billion people (Tonini *et al*., 2011) [10]. Rice is a good source of energy as it contains 80% carbohydrates, 7–8% protein, 3% fat and 3% fibre (Choudhary *et al*., 2018) [2]. India is the world's second-largest producer and consumer of rice after China. India exhibited an upward tendency for rice, going from 53.6 million tonnes in the fiscal year 1980 to 120 million tonnes in the fiscal year 2020–21. Due to its considerable rice cultivation, Chhattisgarh is referred to as the "Rice Bowl of Central India" and produces 61 metric lakh tonnes of rice annually, ranking seventh in the whole country. An approximate yield loss of 52 per cent is observed every year due to biotic factors, out of which 21 per cent is mainly due to insect pest attack. More than 100 species of insect attack, out of which 20 cause economic damage (Pathak and Khan, 1994) [4]. Among them, it includes brown planthopper, white backed plant hopper, yellow stem borer, rice leaf folders, rice hispa etc.

Rice brown planthopper (BPH) *Nilaparvata lugens* (Stal.) is perhaps the most significant rice pest in Asia and a significant economic pest since it directly damages plants by sucking up plant sap and by ovipositing in plant tissue, which results in plant withering or hopper (Turner *et al*., 1999) [11]. For managing insect pests in an emergency situation that extends to or beyond ETL, insecticides show to be our only reliable solution. Moreover, the excessive use of broad-spectrum insecticides also weakens the biodiversity of natural enemies, causes the outbreak of secondary or minor pests, lifts natural control and contaminates the ecosystem (Singh, 2000) [9]. It also leads to the resurgence of brown planthopper. Therefore, it is essential to introduce newer chemicals that are safer, swiftly biodegrade, and have established insecticidal alternatives. These molecules must be utilised carefully. This will lead to practical and successful management of insect pests, along with compatible of insecticides with the environment and natural enemies.

Materials and Methods

The experimental trial used randomised block design (RBD) and included seven treatments *viz*., Imidacloprid 17.8% SL @ 25 g a.i./ha, Sulfoxaflor 24% SC @ 175 g a.i./ha, Thiomethoxam 25% WG @ 25 g a.i./ha, Pymetrozine 50% WG @ 150 g a.i./ha, Dinotefuran 20% SG @ 40 g a.i./ha, Flonicamid 50% WG @ 75 g a.i./ha and one as untreated control.

They were three times replicated in the field circumstances during *Kharif* 2022 at the Research Cum Instructional Farm, IGKV, Raipur (C.G.). The variety MTU-1010 was cultivated in 5m × 5m plot size with 20 cm × 15 cm spacing.

Insecticides were sprayed against BPH twice at 15 days interval when pest observed at ETL level by using hollow cone nozzle. Observations on number of mobile stages (nymphs and adults) per hill was taken one day prior (pre-treatment) and 3, 7, 15 days after spraying on 10 randomly selected hills from each plot and averaged to express in per hill basis. The population of natural enemies *viz.,* spiders and coccinellids was recorded to assess the safety of insecticides at 10 randomly selected hills from each plot and averaged to express in per hill basis. The data on the pest incidence was subjected to statistical analysis after making necessary transformation whenever required. Different treatments were evaluated for S.E(m) ± as well as critical difference (CD) at 5% level, which were determined using the RBD standard calculation approach, had been verified for significance. Using the below formula (Abbott's 1925), the mean original data of the reduction percentage of insect population over control was determined.

$$\text{Percent reduction} = \frac{C-T}{C} \times 100$$

Where,

T = Reduction of insect population in treated plot

C = Reduction of insect population in control plot

Results and Discussion

The observations obtained after the initial spray showed that the percent reduction of BPH population ranged from 69.24 to 76.88 percent in selected treatments. The overall maximum BPH population reduction over control was recorded in T_4 - pymetrozine 50% WG @ 150 g a.i./ha (76.88%) succeeded by T_2 - sulfoxaflor 24% SC @ 175 ml a.i./ha (75.10%), T_5 - dinotefuran 20% SG @ 40 g a.i./ha (72.38%), T_6 - flonicamid 50% WG @ 75 g a.i./ha (71.33%), T_1 - imidacloprid 17.8% SL @ 25 ml a.i./ha (69.66%) and it was lowest in T_3 – Thiomethoxam 25% WG @ 25 g a.i./ha (69.2%) (Table 1).

After second spray, percent reduction of BPH population was ranged from 66.44 to 79.86 percent in selected treatments. The overall maximum BPH population reduction over control was recorded in T_4 - pymetrozine 50% WG @ 150 g a.i./ha (79.86%) followed by T_2 - sulfoxaflor 24% SC @ 175 ml a.i./ha (74.49%), T_5 - dinotefuran 20% SG @ 40 g a.i./ha (72.70%), T_6 - flonicamid 50% WG @ 75 g a.i./ha (70.13%), T_1 - imidacloprid 17.8% SL @ 25 ml a.i./ha (68.56%) and it was lowest in T_3 – thiomethoxam 25% WG @ 25 g a.i./ha (66.44%) (Table 2).

The overall mean population of BPH was noticed lowest in pymetrozine 50% WG having 2.21 BPH/hill after first spray and 1.80 BPH/hill after second spray followed by sulfoxaflor 24% SC having 2.38 BPH/hill after first spray and 2.28 BPH/hill after second spray (Table 3).

All the treatments were reported safer to the population of spiders and coccinellids as the recorded population in treated plots is similar with the untreated plot. Among them, pymetrozine 50% WG @ 150 g a.i./ha noted higher mean population of spiders 2.44 and coccinellids 1.08 per hill succeeded by sulfoxaflor 24% SC @ 175 ml a.i./ha with spiders (2.27) and coccinellids (0.94).

The findings above were similar with the results of Deekshitha and Ramarao (2018) [3], who reported that pymetrozine 50% WG was found to be most effective insecticide against BPH with 62.98% reduction over control succeeded by dinotefuran 20% SG and sulfoxaflor 24% SC and also reported that these insecticides had no effect on the natural enemies. And also similar to other findings of Gui *et al*., (2009) [4], Kirankumar (2016) [5] and Shanker *et al*. (2019) [8] who reported pymetrozine 50 WG was effecient in suppressing the BPH population.

Table 1: Effectiveness of selected treatments against BPH in rice after first spray

S. No.	Treatment	Mean population (Nymphs and adults)/ hill						
		Dose (g. or ml/ha)	Pre-treatment	3 DAS	7 DAS	15 DAS	Overall mean population	Percent reduction over control
T_1	Imidacloprid 17.8% SL	125	8.50 (3.08)	3.67 (2.26)	2.66 (1.91)	2.36 (1.83)	2.90	69.66
T_2	Sulfoxaflor 24% SC	729	8.33 (3.05)	3.10 (2.02)	2.20 (1.78)	1.83 (1.68)	2.38	75.1
T_3	Thiomethoxam 25% WG	100	8.56 (3.09)	3.87 (2.20)	2.73 (1.93)	2.23 (1.79)	2.94	69.24
T_4	Pymetrozine 50% WG	300	8.43 (3.07)	(3.00) (2.00)	2.07 (1.74)	1.57 (1.60)	2.21	76.88
T_5	Dinotefuran 20% SG	200	8.30 (3.05)	3.47 (2.11)	2.53 (1.87)	1.93 (1.71)	2.64	72.38
T_6	Flonicamid 50% WG	150	8.43 (3.07)	3.63 (2.15)	2.40 (1.84)	2.20 (1.78)	2.74	71.33
T_7	Untreated control		8.20 (3.03)	8.93 (3.15)	9.60 (3.25)	10.13 (3.37)	9.56	
	SE(m)±		0.14	0.15	0.19	0.13		
	CD (5%)		NS	0.46	0.59	0.40		

Variables in parentheses are (X+ 0.5) square root transformed values DAS: Days After Spraying NS: Non-Significant

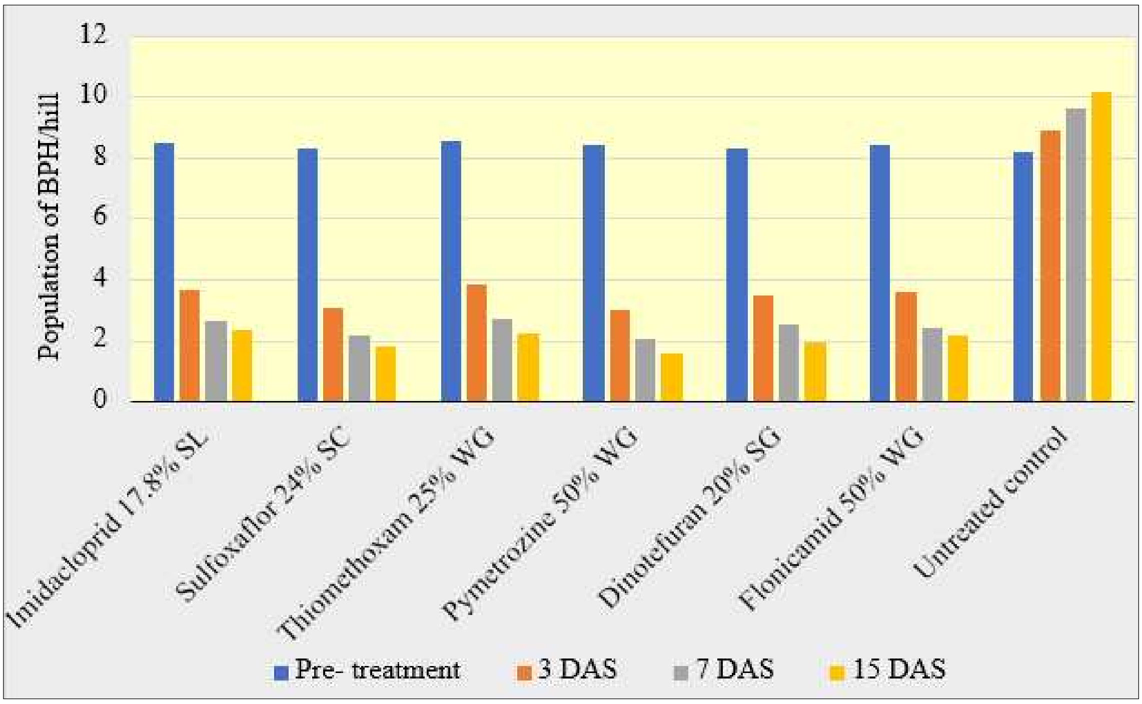
Table 2: Effectiveness of selected treatments against BPH in rice after second spray

S. No.	Treatment	Dose (g. or ml/ha)	Mean population (Nymphs and adults)/ hill					
			Pre- treatment	3 DAS	7 DAS	15 DAS	Overall mean population	Percent reduction over control
T_1	Imidacloprid 17.8% SL	125	7.43 (2.90)	3.47 (2.11)	2.67 (1.91)	2.30 (1.81)	2.81	68.56
T_2	Sulfoxaflor 24% SC	729	7.20 (2.86)	2.77 (1.94)	2.30 (1.81)	1.76 (1.66)	2.28	74.49
T_3	Thiomethoxam 25% WG	100	7.40 (2.89)	3.53 (2.12)	2.97 (1.99)	2.50 (1.86)	3.00	66.44
T_4	Pymetrozine 50% WG	300	7.20 (2.86)	2.27 (1.80)	1.77 (1.66)	1.36 (1.53)	1.80	79.86
T_5	Dinotefuran 20% SG	200	7.23 (2.87)	3.00 (2.00)	2.43 (1.85)	1.90 (1.70)	2.44	72.7
T_6	Flonicamid 50% WG	150	7.30 (2.88)	3.367 (2.08)	2.63 (1.90)	2.00 (1.73)	2.67	70.13
T_7	Untreated control		7.70 (2.94)	8.20 (3.03)	8.97 (3.15)	9.66 (3.26)	8.94	
	SE(m)±		0.14	0.108	0.073	0.128		
	CD (5%)		N/S	0.337	0.228	0.4		

Variables in parentheses are (X+ 0.5) square root transformed values DAS: Days After Spraying NS: Non-Significant

Table 3: Effect of insecticides on natural enemies in rice during *Kharif*, 2022

S. No.	Treatment	Dose (g. or ml/ha)	Mean population (no./hill) Spiders Coccinellids					
			1st spray	2nd spray	Mean	1st spray	2nd spray	Mean
T_1	Imidacloprid 17.8% SL	125	2.16	2.38	2.27	0.89	0.98	0.94
T_2	Sulfoxaflor 24% SC	729	2.37	2.48	2.37	1.01	1.09	1.05
T_3	Thiomethoxam 25% WG	100	2.06	2.28	2.17	0.87	0.95	0.91
T_4	Pymetrozine 50% WG	300	2.34	2.54	2.44	1.03	1.12	1.08
T_5	Dinotefuran 20% SG	200	2.14	2.33	2.24	0.94	1.01	0.98
T_6	Flonicamid 50% WG	150	2.06	2.44	2.25	0.98	1.04	1.01
T_7	Untreated control		2.52	2.78	2.65	1.13	1.24	1.19



Graph 1: Reduction percent of BPH population after initial spray

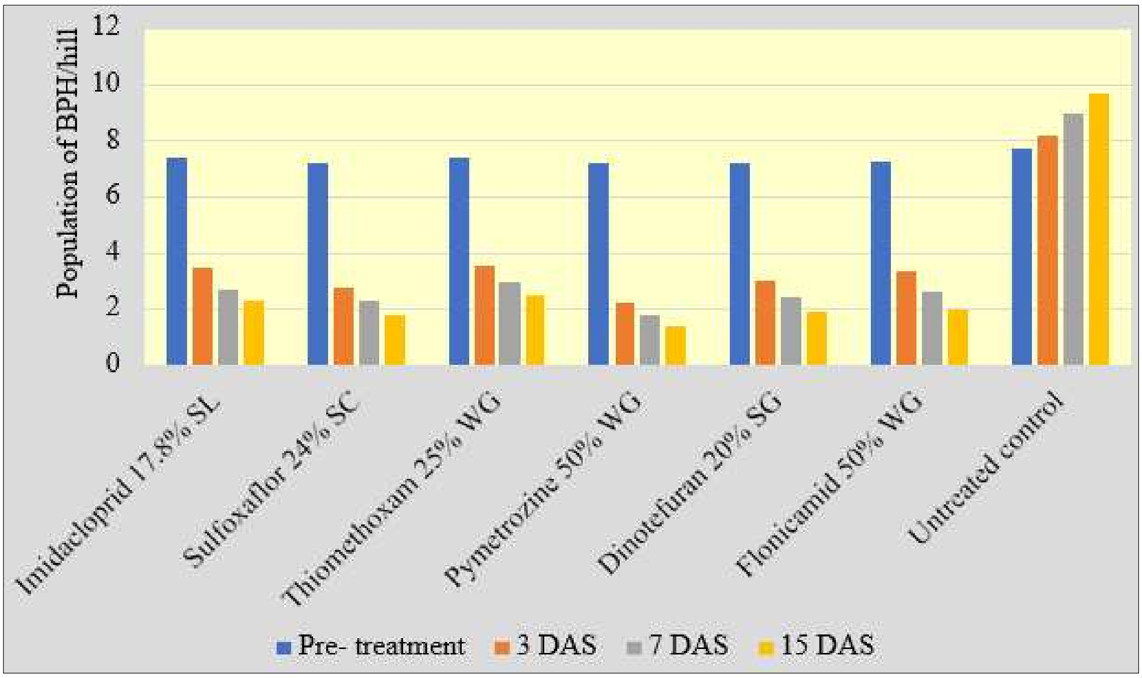


Fig 2: Reduction percent of BPH population after second spray

Conclusion
Therefore, all treatments for the management of BPH were effective, according to the findings of the current study, though pymetrozine 50% WG at 150 g a.i./ha was shown to be the most effective, followed by sulfoxaflor 24% SC at 175 ml a.i./ha.

Acknowledgements
The HOD, Dept. of Entomology at the IGKV in Raipur (C.G.), who provided the required resources and ongoing encouragement, is greatly appreciated by the authors.

References
1. Abbott WS. A method of computing the effectiveness of an insecticide. Journal of Economic Entomology. 1925;18:265-267.
2. Choudhary PR, Tamraker N, Singh L, Tandon A, Sharma D. Rice nutritional and medicinal properties. A review article. Journal of Pharmacognosy and Phytochemistry. 2018;7(2):150-156.
3. Deekshita K, Ramarao CV. Pymetrozine: A Pyridine Azomethine insecticide for management of rice brown plant hopper in India. Chemical Science Review and Letters. 2018;7(25):335-339.
4. Gui Z, Yang AG, Zhong-Yan WU, Aio-GUO WU. Field efficacy trials of 25% pymetrozine SC against brown rice planthopper in field. World Pesticides. 2009;5:37-38.
5. Kirankumar R. Efficacy of pymetrozine 50 WG against brown planthopper, *Nilaparvata lugens* (Stal.) on paddy *Oryza sativa* L. International Journal of Plant Protection. 2016;9(1):68-78.
6. Mathur KC, Reddy PR, Rajamali S, Moorthy BTS. Integrated Pest Management of Rice to Improve Productivity and Sustainability. Oryzae. 1999;36(3):195-207.
7. Pathak MD, Khan ZR. Insect pests of rice. International Rice Research Institute; c1994. p. 1-17.
8. Shankar M, Shivaprasad G, Sumalini K, Balazzii Naaik RVT, Cheeranjeevi K. Bio-efficacy and phytotoxicity of novel insecticides agianst brown plant hopper (Stal.), *Nilaparvata lugens* (Hemiptera: delphacidae) on rice. Journal of Entomology and Zoology Studies. 2019;7(5):860-865.
9. Singh SP. Bio-intensive approach helpful. The Hindu Survey of Indian Agriculture; c2000. p. 159-163.
10. Tonini A, Cabrera E. Opportunities for global rice research in a changing world, Technical Bulletin No. 2011;15:25.
11. Turner R, Song YH, Uhm KB. Numerical model simulations of brown plant hopper *Nilaparvata lugens* and white-backed plant hopper *Sogatella furcifera* (Hemiptera: Delphacidae) migration. Bulletin of Entomological Research. 1999;89:557-568.