Indian Journal of Entomology 86(1): 254-257 (2024) DoI. No.: 10.55446/IJE.2023.503

EFFICACY OF INSECTICIDES AGAINST RICE WHITE BACKED PLANTHOPPER

S S Thorat[1]*, R K Gangwar[1] and M B Parmar[1]

[1]Main Rice Research Station, Anand Agricultural University,
Nawagam, Kheda 387540, Gujarat, India
*Email: sanjuthorat2@gmail.com (corresponding author): ORCID ID 0000-002-8961-2008

ABSTRACT

Efficacy of some insecticides (pymetrozine 50WG, sulfoxaflor 24SC and imidacloprid 17.8SL) was evaluated against rice white backed plant hopper (WBPH) *Sogatella furcifera* Horvath. Sulfoxaflor 24SC @218.7 g a.i./ ha and pymetrozine 50WG @ 187.5 g a.i./ ha gave significantly results (7.57 and 7.82/ hill, respectively). However, highest grain and straw yield (40.87 and 64.33 q/ ha) was observed with pymetrozine 50WG @ 187.5 g a.i./ ha and sulfoxaflor 24SC @ 218.7 g a.i./ ha (40.41 and 64.22 q/ ha). Regarding incremental cost benefit ratio (ICBR), it was observed that maximum ICBR was obtained with pymetrozine 50 WG @ 187.5 g a.i./ ha (1: 3.55) followed by sulfoxaflor 24SC @ 218.7 g a.i./ ha (1: 2.99). Thus, pymetrozine 50 WG at 187.5 g a.i./ ha and sulfoxaflor 24SC at 218.7 g a.i./ha can be recommended against rice WBPH.

Key words: Rice, *Sogatella furcifera*, insecticides, pymetrozine 50WG, sulfoxaflor 24SC and imidacloprid 17.8SL, yield, cost benefit ratio

Rice is cultivated under 43.78 million ha with productivity of 2705 kg/ ha during 2019-20 (Anonymous, 2020a), and Gujarat has 0.90 million ha with productivity of 2192 kg/ ha (Anonymous, 2020b). About 100 insects were reported as pests, among them 21 insect pests are major pests (Jena et al., 2018; Pathak and Dhaliwal, 1981). Among these the white backed plant hopper (WBPH) *Sogatella furcifera* Horvath (Homoptera: Delphacidae) causes significant damage (Shamim et al., 2009), as it attacks from late vegetative stage to grains hardening stage, causing "hopper burn" symptoms (Dale, 1994). The yield losses vary from 10%- 90% (Elanchezhyan et al., 2020; Pandi et al., 2018; Sujithra and Chander, 2013; Kulshreshta, 1974). Availability of rice crop throughout the year coupled with susceptible varieties in some pockets along with heavy irrigation, higher doses of nitrogenous fertilizers, indiscriminate use of insecticides, lead to serious damage (Elanchezhyan et al., 2020; Shankar et al., 2018). Farmers normally deploy chemical control against this pest. Kumar et al. (2022), Adhikari (2016), Guruprasad et al. (2016) and Bhanu (2015) revealed that pymetrozine 50WG and sulfoxaflor 24SC are superior against the BPH and WBPH giving higher yield. The introduction of new insecticides that are safe, quickly degradable with better efficacy. So, there is a need to evaluate the new groups with different modes of action of insecticide requires evaluation of their efficacy, and this study evaluates few of these.

MATERIALS AND METHODS

The field experiment was carried out at the Main Rice Research Station (22º47´49´´N; 72º34´29´´E; 30 masl, Anand Agricultural University, Nawagam, Gujarat during kharif*,* 2018 and 2019. The experiment was laid out in randomized block design with variety GR 11 in plots of size 2.7x 2.4 having three replications of eight treatments viz., three dosages of pymetrozine 50WG @ (187.5, 150.0 and 112.5 g a.i./ha) and sulfoxaflor 24 SC @ (218.7, 175.0 and 131.25g a.i./ ha) with standard check imidacloprid 17.8SL @ 25.0 g a.i./ ha and untreated control. Twenty-five days old seedlings were transplanted in a spacing of 20x 15 cm with the treatments applied in the form of foliar spray with knapsack sprayer. First spray was applied based on the WBPH incidence and buildup at 50 days after transplanting (DAT); second after 15 days of the first spray. The incidence of WBPH was observed on 5 randomly selected hills/ plot before and after treatments (5, 10 and 14 days after spray). Grain and straw yield were recorded in kg/ plot and then converted into q/ ha. The data on incidence were square root transformed and statistically analyzed (Steel and Torrie, 1980), with means compared using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The results given in Table 1 revealed that WBPH

Table 1. Efficacy of newer insecticides against white backed plant hoppers (WBPH) in rice (*Kharif*, 2018 and 2019)

Sr. No.	Treatments	Dose (g a.i./ ha)	No. of WBPH/ hill								
			Kharif, 2018				*Kharif*, 2019				Cumulative mean
			Before spray	1st spray	2nd spray	Mean	Before spray	1st spray	2nd spray	Mean	
1	Pymetrozine 50 WG, 0.037%	187.5	4.59 (20.53)	3.75^{a} (13.57)	2.75^{a} (7.04)	3.25^{a} (10.05)	3.93 (14.93)	2.59^{a} (6.22)	2.45^{a} (5.52)	2.52^{a} (5.87)	2.89a (7.82)
2	Pymetrozine 50 WG, 0.030%	150.0	4.50 (19.79)	3.86^{a} (14.43)	2.89^{ab} (7.85)	3.38^{ab} (10.90)	3.93 (14.92)	3.41^{b} (11.14)	3.23^{b} (9.94)	3.32^{b} (10.53)	3.35b (10.72)
3	Pymetrozine 50 WG, 0.022%	112.5	4.48 (19.60)	3.97^{ab} (15.28)	3.16^{c} (9.45)	3.56^{c} (12.20)	3.93 (14.93)	3.85^{c} (14.33)	4.06^{c} (15.95)	3.95^{c} (15.13)	3.76c (13.60)
4	Sulfoxaflor 24 SC, 0.043%	218.7	4.54 (20.10)	3.73^{a} (13.42)	2.72^{a} (6.89)	3.22^{a} (9.90)	3.89 (14.60)	2.53^{a} (5.90)	2.39^{a} (5.21)	2.46^{a} (5.55)	2.84a (7.57)
5	Sulfoxaflor 24 SC, 0.036%	175.0	4.49 (19.67)	3.82^{a} (14.07)	2.86^{ab} (7.68)	3.34^{ab} (10.64)	3.84 (14.25)	3.35^{b} (10.74)	3.28^{b} (10.26)	3.32b (10.50)	3.33b (10.59)
6	Sulfoxaflor 24 SC, 0.026%	131.3	4.68 (21.40)	3.94^{ab} (14.99)	3.01^{bc} (8.56)	3.47^{bc} (11.56)	3.86 (14.39)	3.80^{c} (13.93)	4.00^{c} (15.51)	3.90^{c} (14.71)	3.69c (13.08)
7	Imidacloprid 17.8 SL, 0.005%	25.0	4.56 (20.33)	4.13^{b} (16.57)	3.43^{d} (11.28)	3.78^{d} (13.80)	3.70 (13.18)	4.40^{d} (18.85)	4.40^{d} (18.90)	4.40d (18.88)	4.09d (16.23)
8	Untreated	-	4.52 (19.92)	4.85^{c} (23.04)	4.62^{e} (20.83)	4.74^{e} (21.92)	3.66 (12.89)	5.64^{e} (31.28)	6.23^{e} (38.36)	5.94^{e} (34.73)	5.34e (28.01)
SE (m)±			0.07	0.076	0.079	0.055	0.12	0.073	0.07	0.051	0.019
CD (p=0.05)			NS	0.216	0.226	0.154	NS	0.209	0.201	0.143	0.052
CV (%)			2.68	5.69	7.5	6.48	5.34	5.97	5.63	5.81	6.15

Figures in parentheses retransform values and those outsides $\sqrt{x + 0.5}$ (square root) transformed value; Treatment means with the letter(s) in common not deffering significantly by DMRT (p=0.05).

incidence at pretreatment did not vary significantly among the treatments. Plots treated with the sulfoxaflor 24SC @ 218.7 g a.i./ ha and pymetrozine 50WG @ 187.5 g a.i./ ha led to significantly less incidence (9.90 and 10.05/ hill, respectively), and these were at par with each other. During 2nd year, sulfoxaflor 24SC @ 218.7 g a.i./ ha and pymetrozine 50WG @ 187.5 g a.i./ again were found superior, with cumulative mean data confirming that higher dose of sulfoxaflor 24SC @ 218.7 g a.i./ ha and pymetrozine 50 WG @ 187.5 g a.i./ ha are significantly superior (7.57 and 7.82/ hill, respectively). Imidacloprid 17.8SL @ 25.0 g a.i./ ha and untreated control plots recorded more incidence (16.23 and 28.01/ hill, respectively). These observations corroborate with those of earlier workers viz., Kumar et al. (2022), Konchada (2017) and Seni and Naik (2017) on pymetrozine 50WG. Ghosh et al. (2013) and Chander et al. (2012) revealed that sulfoxaflor 14SC was highly effective. Naik et al. (2016) reported that pymetrozine 50 WG @ 0.6 g/ l and imidacloprid + ethiprole @ 0.25 g/ l are effective. Shankar et al. (2018) observed that sulfoxaflor 24SC @ 375 ml/ ha is superior, while Guruprasad et al. (2016) revealed that sulfoxaflor 24SC @ 438.0 ml/ ha was the best.

The results presented in Table 2 revealed that higher grain and straw yield recorded in different treatments was found significantly superior over untreated control. The highest grain and straw yield (40.87 and 64.33 q/ ha, respectively) was recorded from the plots treated with pymetrozine 50 WG @ 187.5 g a.i./ha followed by sulfoxaflor 24 SC @ 218.7 g a.i./ha (40.41 and 64.22 q/ha, respectively). Whereas, lowest grain and straw yield were recorded in plots treated with imidacloprid 17.8 SL @ 25.0 g a.i./ha (31.37 and 46.27 q/ha, respectively) and untreated control plot (28.59 and 43.88 q/ha, respectively). The data presented in Table 2 also showed that highest incremental cost benefit ratio (ICBR) (1: 3.55) was obtained from the plots treated with pymetrozine 50 WG @ 187.5 g a.i./ha followed by sulfoxaflor 24 SC @ 218.7 g a.i./ha (1: 2.99). The present findings are in close conformity with the finding of earlier workers viz., Guruprasad et al. (2016), Konchada (2017) and Shankar et al. (2018) who reported that application of pymetrozine 50 WG and sulfoxaflor 24 SC recorded highest grain yield. The present experiment summarized that the plots treated with pymetrozine 50 WG at 187.5 g a.i./ ha and sulfoxaflor 24 SC at 218.7 g a.i./ha significantly reduced the buildup of white backed plant hoppers population with higher yield and economics in rice crop.

Table 2. Economics of newer insecticides evaluated against white backed plant hoppers (WBPH) in rice

Insecticides	Dose (g a.i./ ha)	Quantity of insecticides required for two sprays (L/kg/ ha)	Cost of insecticides for two sprays (₹)	Total cost of treatments including labour charge (₹/ ha)	Yield (q/ ha)		Net gain over control (q/ ha)		Realization over control (₹/ ha)		Total realization over control (₹/ ha)	ICBR
					Grain	Straw	Grain	Straw	Grain	Straw		
Pymetrozine 50 WG, 0.037%	187.5	0.75	6563	7836	40.87	64.33	12.28	20.45	21488	6339	27827	1: 3.55
Pymetrozine 50 WG, 0.030%	150.0	0.60	5250	6524	35.91	52.08	7.31	8.20	12801	2543	15344	1: 2.35
Pymetrozine 50 WG, 0.022%	112.5	0.45	3938	5211	31.83	50.03	3.24	6.15	5667	1906	7572	1: 1.45
Sulfoxaflor 24 SC, 0.043%	218.7	1.82	7746	9019	40.41	64.22	11.82	20.34	20678	6307	26985	1: 2.99
Sulfoxaflor 24 SC, 0.036%	175.0	1.46	6198	7472	35.67	50.64	7.08	6.76	12387	2097	14484	1: 1.94
Sulfoxaflor 24 SC, 0.026%	131.3	1.09	4648	5922	32.90	47.25	4.31	3.37	7535	1044	8579	1: 1.45
Imidacloprid 17.8 SL, 0.005%	25.0	0.28	1208	2481	31.73	46.27	3.14	2.39	5487	742	6228	1: 2.51
Untreated	-	-	-	-	28.59	43.88	-	-	-	-	-	-

500 litre spray solution required for one spray per ha and two sprays were given during the cropping season; Labour charge @ ₹ 318.40/ day × two labour= ₹ 636.8/ ha/ Spray; Price of rice grain= ₹ 1750/ q and rice straw= ₹ 310/ q; Insecticide cost as per market rate Pymetrozine 50 WG, ₹ 1050/ 120 g, Sulfoxaflor 24 SC, ₹ 850/ 200 ml and Imidacloprid 17.8 SL, ₹ 2150/ 500 ml.

ACKNOWLEDGEMENTS

The authors acknowledge the Director of Research, Anand Agricultural University, Anand for providing the technical guidance for the work at Main Rice Research Station, AAU, Nawagam.

FINANCIAL SUPPORT

The financial assistance by the Director of Research, Anand Agricultural University, Anand is acknowledged

AUTHOR CONTRIBUTION STATEMENT

All authors equally contributed.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

Adhikari B. 2016. Field evaluation of some new molecules against planthoppers and leafhoppers in rice. M Sc Thesis. Orissa University of Agriculture, Bhuvneshwar. pp. 27-30.

Anonymous. 2020a. Agricultural statistics at a glance 2020. Government of India ministry of agriculture and farmers welfare department of agriculture cooperation and farmers welfare directorate of economics and statistics, New Delhi, 46 pp.

Anonymous. 2020b. Directorate of agriculture Gujarat state, Krushibhavan, Gandhinagar, https://dag.gujarat.gov.in/estimate-guj.htm.

Bhanu K V. 2015. Bio-efficacy of pymetrozine 50 WG against brown plant hopper, *Nilaparvata lugens* and white backed plant hopper, *Sogatella furcifera* in Rice. Journal of Rice Research 8(2): 64-70.

Chander S, Sujithra M, Palta R K. 2012. Efficacy of a novel insecticide and combination product against rice insect-pests. Pesticide Research Journal 24(2): 235-237.

Dale D. 1994. Insect pest of rice plant their biology and ecology. Biology and management of rice insects, Heinrichs E A (ed.). Wiley, New York. pp. 363-485.

Elanchezhyan K, Sathyan T, Manikandan K R. 2020. Brown plant hopper (BPH) and their management in rice. Research Today 2(4): 90-92.

Ghosh A, Das A, Samanta A, Chatterji M L, Roy A. 2013. Sulfoximine: A novel insecticide for management of rice brown plant hopper in India. African Journal of Agricultural Research 8(38): 4798-4803.

Guruprasad G S, Naganagoud A A, Kapasi M, Kenganal M, Negalur R K. 2016. Sulfoxaflor 24 SC: A novel insecticide for the management of paddy plant hoppers. The Ecoscan 10(1 & 2): 239-242.

Jena M, Pandi G P, Adak T, Rath P C, Gowda B G, Patil N B, Prasanthi G, Mohapatra S D. 2018. Paradigm shift of insect pests in rice ecosystem and their management strategy. Oryza 55: 82-89.

Konchada D, Chennamasetty R V, Choragudi S R. 2017. Evaluation of newer insecticides against brown plant hopper, *Nilaparvata lugens* (Stal.) infesting Rice. Chemical Science Review and Letters 6(23): 1423-1427.

Kulshreshta J P. 1974. Brown plant hopper epidemics in Kerala (India). Rice Entomological Newsletter 1: 3-4.

Kumar A, Rao M N, Rao R C. 2022. Evaluation of insecticide rotations against rice brown plant hopper *Nilaparvata lugens* (stal). Indian Journal of Entomology eRef No. e21141 doi 10.55446/IJE.2022.163.

Naik B S, Swain D, Pal R, Seni A, Nayak B R. 2016. Progress of rice research in the west central table land zone of Odisha in India. International Journal of Advanced Research 4(5): 795-802.

Pandi G P, Chander S, Pal M, Soumia P S. 2018. Impact of elevated CO_2 on *Oryza sativa* phenology and brown plant hopper, *Nilaparvata lugens* (Hemiptera: Delphacidae) population. Current Science 114(8): 1767-1777.

Pathak M D, Dhaliwal G S. 1981. Trends and strategies for rice insect problems in Tropical Asia. IRRI Research Papers Series 64: 5-6.

Seni A, Naik B S. 2017. Evaluation of some insecticides against brown plant hopper, *Nilaparvata lugens* (Stal) in Rice, *Oryza sativa* L. International Journal of Bio-resource and Stress Management 8(2): 268-271.

Shamim M, Shekh A M, Patel V J, Dodia J F, Korat D M, Mehta A M. 2009. Effect of weather parameters on population dynamics of green leaf hopper and white backed plant hopper in paddy grown in middle Gujarat region. Journal of Agrometeorology 11(2): 172-174.

Shankar M, Bhadru D, Kumar R M, Naik R V, Sivaprasad G. 2018. Bio-efficacy of sulfoxaflor against planthoppers in rice. International Journal of Agriculture Sciences 10(6): 5497-5499.

Steel R G D, Torrie J H. 1980. Principles and procedures of statistics McGraw Hill Book Company, New York, 137 pp.

Sujithra M, Chander S. 2013. Simulation of rice brown plant hopper, *Nilaparvata lugens* (Stal.) population and crop-pest interactions to assess climate change impact. Climatic Change 121: 331-347.

(Manuscript Received: August, 2022; Revised: December, 2022;
Accepted: December, 2022; Online Published: January, 2023)
Online First in www.entosocindia.org and indianentomology.org Ref. No. e22503