

Appraisal of the Efficacy of New Molecule Viola 10 SC (Flupyrimin) against Rice Plant Hoppers and their Natural Enemies under Punjab Conditions

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ABSTRACT

Viola 10 SC (Flupyrimin 10% SC), an insecticide of neonicotinoid class, was evaluated @ 500, 750 and 1000 ml / ha against rice planthoppers viz., brown planthopper (BPH) and the whitebacked planthopper (WBPH) infesting rice at farmer's field in district Amritsar during *Kharif* 2023 and 2024 seasons and was compared with the test insecticide Chess 50 WG (Pymetrozine) @ 300 g / ha. The experiment was laid out in randomized block design with three replications at each of the 3 farmer field's locations. Viola 10 SC showed increased efficacy in suppressing the BPH with increase in the concentration of the insecticide and days after spraying. Viola 10 SC @ 750 ml / ha was statistically at par with the control, Chess 50 WG @ 300 g / ha recording 1.07 BPH/hill after 3 days of insecticide application during the *kharif* season 2024. Similar results with the test insecticide were also observed against white backed planthoppers. After 10 days of insecticide application, the test insecticide @ 750 ml / ha recorded population of 0.73 hoppers/hill (pooled mean of 3 locations) and it was at par with Chess 50 WG (1.0 hoppers/hill) with 92.79 per cent suppression in BPH population after 10 days of insecticide application during the *kharif* season 2024. Highest basmati yield of 49.92 q / ha was obtained with Viola 10 SC @ 750 ml / ha which was statistically higher than the basmati yield of 49.42 q / ha in Chess 50 WG @ 300 g / ha and untreated control (43.75 q / ha). The test insecticide Viola 10 SC was also found safe to the natural enemies. Hence, the new insecticide, a blue chemistry compound, is effective against sap feeders infesting basmati rice and will help in better management of these insect pests. It will also enhance the choice of farmers in selecting insecticides from different groups.

Keywords: Basmati rice, Brown plant hopper, Insecticide, Management, Whitebacked plant hopper

INTRODUCTION

In Punjab, Rice (*Oryza sativa* L.) is grown on an area of 31.49 lakh ha. with the production of 208.83 lakh tonne during 2020–2021 (Anonymous, 2022). In India, insect pests contribute about 25–30 per cent to the average losses in rice production (Dhaliwal and Arora, 2010). So there are several yield limiting constraints that lead to the gap between the potential and actual rice yield across the nation. One of the main reasons for lower yields in the tropical Asian countries is the damage caused by the insect pests (Matteson, 2000). In India, approximately 100 insect species feed on rice but 20 of these are considered as major pests (Prakash *et al*, 2014). A few acts as vectors of virus diseases also (Pradhan, 1971) like grassy stunt, ragged stunt (Ling *et al*, 1978) and wilted stunt (Chen *et al*, 1978).

The brown planthopper (BPH), *Nilaparvata lugens* (Stal) (Homoptera: Delphacidae) and

Whitebacked planthopper (*Sogatella furcifera* Horvath.) (WBPH) are the most menacing insect pests of rice among the phloem sap feeders. At early infestation round yellow patches appear, which soon turn brownish due to drying up of the plants. Since this insect generally remain confined to plant stems and leaf sheaths. Hence, its presence goes undetected. In case of severe attack, it causes extensive plant mortality referred to as hopper burn symptoms (Watanabe and Kitagawa, 2000; Liu *et al*, 2008; Horgan, 2009; Vanitha *et al*, 2011). Under severe infestation, circular patches of hopper burn are evident in the field. Severely affected plants do not bear any grains. BPH is a typical phloem sap feeder that has reemerged as the threat to rice production in Asia (Chen and Cheng, 1978; Normile, 2008; Hardy and Heong, 2009; Prasannakumar *et al*, 2013). The plant would suffer 40-70% of the yield losses if attacked by 100-200 first instar nymphs at 25 days after rice seedling transplanting (Bae and Pathak, 1970). Both nymphs and adults of BPH suck sap from the lower portion of the plant. It causes yellowing of

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Table 1: Evaluation of efficacy of Viola 10 SC (flupyrimin) against rice planthoppers during *kharif* 2023

Treatment	Dose (g/ha)	Population of planthoppers (no./hill)					Spider population (no./hill)					Yield (q/ha)	
		BS	0 DAS	3 DAS	7 DAS	10 DAS	PROC	BS	0 DAS	3 DAS	7 DAS		10 DAS
Viola 10 SC	500	7.80 (2.97)	3.50 (2.12)	1.88 (1.70)	1.35 (1.53)	1.27 (1.51)	87.82	0.73	0.73	0.83	0.93	0.93	45.67
Viola 10 SC	750	8.07 (3.01)	2.78 (1.95)	1.47 (1.57)	1.37 (1.53)	1.23 (1.49)	88.14	0.77	0.77	0.87	1.03	1.07	49.42
Viola 10 SC	1000	7.8 (2.93)	1.25 (1.51)	1.15 (1.47)	1.05 (1.44)	1.00 (1.43)	90.38	0.80	0.80	0.87	0.87	0.97	49.75
Chess 50 WG	300	7.20 (2.86)	1.77 (1.66)	1.57 (1.60)	1.40 (1.55)	1.23 (1.50)	88.14	0.73	0.73	0.83	0.90	0.93	48.17
Untreated control	-	7.67 (2.94)	8.23 (3.04)	8.97 (3.16)	9.73 (3.27)	10.17 (3.34)	88.14	0.73	0.73	0.87	1.07	1.13	43.67
CD (p=0.05)		NS	0.065	0.064	0.068	0.045	NS	NS	NS	NS	NS	NS	0.538

PROC- Percent reduction over control

Values in parentheses are square root transformations

leaves, reduction in tillering and plant height, and increase in unfilled grains. Feeding also results in the reduction in chlorophyll and protein content of leaves and rate of photosynthesis. For their effective management, farmers rely heavily on insecticides and almost 50 per cent of the insecticides used in rice are targeted against them (Reddy *et al.*, 2012). Repeated applications of broad spectrum insecticides with similar mode of action may result in development of resistance (Saha and Mukhopadhyay, 2013) and less effective control. Though many conventional insecticides have been evaluated against this insect, yet most of the chemicals have failed to provide adequate control (Seni and Naik, 2017). Hence, the present study was carried out to find the efficacy of certain new molecules against brown plant hoppers in rice.

MATERIALS AND METHODS

Viola 10 SC (Flupyrimin, a blue chemistry insecticide), an insecticide of neonicotinoid class, was evaluated against rice planthoppers *viz.* brown planthopper (BPH) and the whitebacked planthopper (WBPH) infesting rice, when their population reached Economic Threshold Level of 5 hoppers/hill, at farmer's field in district Amritsar. The test insecticide

was compared with the check insecticide Chess 50 WG (Pymetrozine) @ 300 g / ha. The experiment was conducted during the main cropping season of *kharif*, 2023 and *kharif*, 2024. During *kharif*, 2023, Viola 10 SC (Flupyrimin) was evaluated @ 50, 75 and 100ml a.i./ ha (500, 750 and 1000 ml / ha, respectively) to standardize the dose required for good kill of the test insects while during *kharif*, 2024, only the standardize dose (750 ml / ha) was repeated and compared with the check insecticide, Chess @ 300 g / ha. The insecticides were applied with a manually operated knapsack sprayer, while directing the spray towards the base of plants. The basmati rice variety Pusa Basmati 1718 was taken due to its susceptibility to the attack of both these insect pests and grown using all the recommended package of practices. The experiments were laid out in randomized block design with three replications at each of the 3 farmer field's locations. The insecticides were applied by dissolving in 250 l of water, using hollow cone type nozzle. No chemical was used in case of control plots. The plot size was 500 m² for each treatment. The observations on number of BPH and WBPH were recorded before and, after 3, 7 and 10 days after insecticide spray (DAS) from 10 hills per replication and expressed as per hill basis. The percentage reduction over control of hoppers was also

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Table 2: Evaluation of efficacy of Viola 10 SC (flupyrimin) against rice planthoppers during *kharif* 2024

Treatment	Dose (g or ml / ha)	Population of planthoppers (nos./hill)					Spider population (nos./hill)					Yield (q/ha)
		BS	1 DAS	3 DAS	7 DAS	10 DAS	PROC	BS	3 DAS	7 DAS	10 DAS	
Viola 10 SC	750	8.33 (3.05)	1.17 (1.47)	1.07 (1.43)	0.90 (1.37)	0.73 (1.31)	92.79	0.77	0.83	0.97	0.97	49.92
Chess 50 WG	300	8.60 (3.09)	2.63 (1.90)	1.37 (1.53)	1.17 (1.47)	1.0 (1.41)	90.38	0.77	0.87	1.00	1.03	49.42
Untreated control	-	8.40 (3.06)	8.33 (3.05)	9.33 (3.21)	9.67(3.26)	10.40 (3.37)	-	0.73	0.87	1.10	1.13	43.75
CD (p=0.05)	-	NS	0.096	0.021	0.087	0.098	-	NS	NS	NS	NS	0.114

PROC- Percent reduction over control; Values in parentheses are square root transformations

calculated. Number of spiders before spray and, after 3, 7 and 10 days of insecticide application (DAS) from 30 randomly selected hills from each treatment were also recorded and expressed as per hill in the final table. The yield of paddy was recorded at harvest on whole plot basis and calculated to per hectare basis. The data thus obtained were subjected to statistical analysis and critical difference was calculated at 5% level of significance.

RESULTS AND DISCUSSION

Viola 10 SC @ 1000 ml / ha proved significantly better than its lower dosages of 500 and 750 g / ha and the untreated control against both the insect species at all the farmer's field locations in the *kharif* season 2023 (Tables 1). Viola 10 SC @ 500, 750 and 1000 ml / ha recorded 1.88, 1.47 and 1.15 BPH/hill (pooled mean of 3 locations), respectively after 3 DAS. Also, Viola 10 SC showed increased efficacy in suppressing the BPH with increase in the concentration of the insecticide and days after spraying i.e. highest suppression of 90.38 per cent of BPH population was observed at highest dose of 1000 ml /ha after 10-days of spraying the insecticide. Also, Viola 10 SC @ 750 ml / ha was statistically at par with the check, Chess 50 WG recording 1.23 BPH/hill with 88.14 per cent suppression in BPH population after 10 DAA. Hence Viola @ 750 ml / ha is considered as the best dose for the management of BPH and WBPH. The untreated control recorded 10.17 BPH/hill and proved statistically inferior to all the insecticidal treatments (Table 1). Viola 10 SC @ 1000 ml / ha recorded basmati

yield statistically higher than the check insecticide, Chess 50 WG @ 300 g / ha at all the test locations. Highest basmati yield of 49.75 q/ha was obtained with Viola 10 SC @ 1000 ml / ha which was statistically higher than the basmati yield of 48.17 q/ha in Chess 50 WG @ 1000 ml / ha (Table 1). Viola 10 SC @ 750 ml / ha (49.42 q / ha) recorded basmati yield statistically at par with the Viola 10 SC @ 1000 ml / ha (49.75) at all the test locations. Overall, Viola 10 SC @ 750 ml / ha recorded 2.59 per cent increase in yield over the check insecticide Chess 50 WG and 13.16 per cent increase over the untreated control (Table 1). As Viola 10 SC @ 750 ml / ha provided the yield statistically same as Viola @ 1000 ml / ha, hence Viola 10 SC @ 750 ml / ha is considered as the best dose in the management of both BPH and WBPH.

As Viola 10 SC @ 750 ml / ha proved to be statistically at par with the higher dose 1000 ml / ha, this dose was again tested against the test insects during the *kharif* season 2024 using the same check insecticide, Chess 50 WG. Viola 10 SC @ 750 ml / ha proved significantly better than check, Chess 50 WG @ 300 ml / ha and the untreated control against both the insect species at all the farmer's field locations in the *kharif* season 2024 (Tables 2). Viola 10 SC @ 750ml / ha recorded 0.73 BPH/hill (pooled mean of 3 locations), with 92.79 per cent suppression in BPH population after 10 DAA. Also, Viola 10 SC @ 750 ml / ha was statistically at par with the check, Chess 50 WG recording 1.0 BPH/hill with 90.38 per cent suppression in BPH population after 10 DAS. The untreated control recorded 10.40 BPH/hill and proved statistically

inferior to all the insecticidal treatments (Table 2). Wu L. *et al* (2024) determined LC₅₀ of dinotefuron (2.51 mg/L) and flupyrimin (2.80 mg/L) in third instar *Sogatella furcifera*. The grain yield per hectare was also significantly more with these treatments. Viola 10 SC @ 750 ml / ha recorded basmati yield statistically higher than the check insecticide, Chess 50 WG @ 300 g / ha at all the test locations. Basmati yield of 49.92 q / ha was obtained with Viola 10 SC @ 750 ml / ha which was statistically higher than the basmati yield of 49.42 q/ha in Chess 50 WG @ 300 g / ha (Table 2). Overall, Viola 10 SC @ 750 ml / ha recorded 1.01 per cent increase in yield over the check insecticide Chess 50 WG and 14.10 per cent increase over the untreated control (Table 2). Results also showed that drone-based applications at 75 and 100 g a.i./ha were statistically at par ($p \leq 0.05$) in suppressing brown planthopper populations while achieving grain yields of 55.83 and 56.28 q / ha, respectively (Kavya *et al*, 2025). Spiders are amongst the important predators of rice planthoppers and leafhoppers. The indiscriminate use of insecticides causes disruption of their life cycle. Hence selection of insecticide is very important to conserve them. The spider population recorded in various treatments ranged from 0.73 to 0.93, 0.77 to 1.07 and 0.80 to 0.97 spiders/hill when Viola 10 SC was used @ 500, 750 and 1000 ml / ha after 0, 3, 5 and 10 DAS, respectively, however the differences among them were non-significant (Table 1).

CONCLUSION

The new molecule, Viola 10 SC (Blue chemistry chemical) was therefore, effective against rice planthoppers (BPH and WBPH) infesting basmati @ 750 ml / ha and will help in better management of these insect pests. It will also enhance choice of farmers in selecting the chemicals from different groups.

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