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Bio-efficacy of different insecticides against brown planthopper, *Nilaparvata lugens* (Stal.) (Hemiptera: Delphacidae) on rice in Raipur, Chhattisgarh

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Abstract
The present experiment in field condition was carried out to evaluate the efficacy of different insecticides against, *Nilaparvata lugens* (Stal.) on rice was conducted at the Research cum Instructional Farm Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *Kharif* 2016-17. The result revealed that, the insecticides Buprofezin 25% SC @ 800 ml/ha were highly effective against brown plant hoppers population followed by Imidacloprid 17.1% w/w SL @ 300 ml/ha, Imidacloprid 17.1% w/w SL @ 250 ml/ha, Thiamethoxam 25% WG @ 100 g/ha, Confidor 200 SL (Imidacloprid 17.8% w/w SL) @ 125 ml/ha and Imidacloprid 17.1% w/w SL @ 200 ml/ha were found effective in reduction of BPH, respectively.

Keywords: rice, brown plant hopper, insecticides, bio-efficacy, evaluation

Introduction
Rice (*Oryza sativa* L.) is the world's single most important crop belonging to the family of grasses, Graminae or Poaceae is most common cereal, serving as a stable food for approximately half of the global population. Over two billion people in Asia alone derive 80% of their energy needs from rice, which contains 80% carbohydrates, 7–8% protein, 3% fat and 3% fiber [6]. India is the largest rice growing country across the world having 43 million hectare area under this crop with production of 115 million tonnes of milled rice and average productivity of 2.7 tonnes per hectare [1, 2]. The average per hectare productivity in the country is relatively low as compared to other Asian countries due to heavy losses caused by biotic factors such as insect-pests [9]. Insect-pests are the major constraints in enhancing the rice productivity, besides diseases and weeds [3]. In case of insects twenty insect species are economically significant although more than hundred insect species reported infesting this cereal [19]. Insect damage, especially due to brown plant hopper, *Nilaparvata lugens* (Stal.), white-backed plant hopper, *Sogatella furcifera* (Horvath.), yellow stem borer, *Scirpophaga incertulas* (Walker.), green leaf hopper, *Nephotettix nigropictus* (Distant.), leaf folder, *Cnaphalocrocis medinalis* (Guenee.) constitutes one of the major causes for the poor productivity of rice in India [20]. In general, yield loss due to insect pests of rice has been estimated at about 25% [8]. Approximately 21 percent of the global production losses of rice are attributed to the attack of insect pests [26]. The rice ecosystem is best owed with a lot of pests and natural enemy's complex. The average yield loss in rice have been accounted for 30% loss in stem borers, while plant hoppers 20%, gall midge 15%, leaf folder 10% and other pests 25%, respectively [14]. Sucking pests cause huge damage to rice by sucking plant sap, devitalizing plants and also act as vectors of several viral diseases [17]. Plant hoppers such as brown plant hopper, *Nilaparvata lugens* (Stal.) and white backed plant hopper, *Sogatella furcifera* (Horvath) also infest the rice crop severely during tillering to panicle initiation stage. The brown plant hopper (BPH) is one of the serious pests responsible for large-scale devastation of rice crop, causing yield losses amounting to as high as 60% [23, 15].
It is thus imperative to protect rice crop effectively against ravages of insect pests. Pesticides are important tool of pest management but need to be used judiciously for averting their adverse effects on environment. To make pesticides environment-friendly, molecules with novel mode of action are being synthesized and marketed.

Insecticides with novel mode of action, combination products and molecules with very low dosage requirement are available and can be used judiciously to avoid development of insecticide resistance in pests and minimize environmental contamination [5].

Materials and Methods

The experiment was laid out in randomized block design (RBD) with six treatments and one untreated control which were replicated thrice in Research Cum Instructional farm Department of Agronomy IGKV, Raipur (C.G.), under field conditions during Kharif 2016- 17 with a variety of "Mahamaya" (a most popular variety grown by the farmers of Chhattisgarh) in 5m X 4m plot size with 20 c.m..x 20 c.m. spaing. The target pests were brown plant hopper, Nilaparvata lugens Stal. For this sap feeder, the first application of test insecticide was carried out as and when, targeted insect were reached at ETL level. Sprayable solution was made with the 375-500 litre of water per hectare basis. Such insecticidal solution was sprayed with the either triple action or hollow cone nozzle spray.

Observation on the population establishment of BPH was recorded 1 day before first imposition and 3rd, 5th and 7th Days after each insecticide application from randomly selected 5 plants. The data on the pest incidence were subjected to statistical analysis by single factor ANOVA after making necessary transformation whenever required.

Results

In pre treatment observation the mean population of BPH recorded one day prior to the spray was in range of 14.40 to 15.33 nymphs and adults pre hills in different plots. The pre treatment data revealed that the BPH population was homogenous over the experimental plots therefore statistically it was found non-significant (Table 1).

In post treatment observations, mean population and percent reduction over control was calculated after three, five and seventh days of each spray. After the three days of first spray, Buprofezin 25% SC @ 800 ml/ha was recorded the best effective treatment with the minimum BPH population per hill (4.40). Which was statically found at par with Imidacloprid 17.1% w/w SL @ 300 ml/ha (4.80) followed by Thiamethoxam 25% WG @ 100 g/ha (5.67), Imidacloprid 17.1% w/w SL @ 250 ml/ha (5.93), Confidor 200 SL (Imidacloprid 17.8 w/w SL) @ 125 ml/ha (6.13) and Imidacloprid 17.1% w/w SL @ 200 ml/ha (6.47). Whereas BPH population was maximum in untreated control plots recorded 13.00 BPH /hill (Table 1).

After five days of first spray, the performances of different insecticides were observed similar to earlier observation. However Buprofezin 25% SC @ 800 ml/ha (2.47) was found superior over rest of the insecticides. It was statistically at par with Imidacloprid 17.1% w/w SL @ 300 ml/ha (2.87) followed by Thiamethoxam 25% WG @ 100 g/ha (3.33), Imidacloprid 17.1% w/w SL @ 250 ml/ha (3.73), Confidor 200 SL (Imidacloprid 17.8 w/w SL) @ 125 ml/ha (3.93) and Imidacloprid 17.1% w/w SL @ 200 ml/ha (6.47). The maximum population of brown plant hopper was recorded in untreated control *i.e.* (13.07) hoppers/hill (Table 1).

After seventh day of first spray, Buprofezin 25% SC @ 800 ml/ha gave the best result and the lowest number of BPH (1.80) nymphs and adults per hill was recorded with this insecticide followed by Imidacloprid 17.1% w/w SL @ 300 ml/ha (2.73), Thiamethoxam 25% WG @ 100 g/ha (3.00), Imidacloprid 17.1% w/w SL @ 250 ml/ha (3.27), Confidor 200 SL (Imidacloprid 17.8 w/w SL) @ 125 ml/ha (3.53) and Imidacloprid 17.1% w/w SL @ 200 ml/ha (4.13). The maximum population of brown plant hopper was recorded in untreated control *i.e.* (13.47) hoppers/hill (Table 1).

Prior to second application of insecticides pre-treatment population again estimated. Which was found statically uniform, range between 13.13 to 16.27 BPH/hill. After the three days of second spray, the minimum BPH population was recorded with Buprofezin 25% SC @ 800 ml/ha (4.13) followed by Imidacloprid 17.1% w/w SL @ 300 ml/ha (4.93), Imidacloprid 17.1% w/w SL @ 250 ml/ha (5.53), Imidacloprid 17.1% w/w SL @ 200 ml/ha (5.60), Confidor 200 SL (Imidacloprid 17.8 w/w SL) @ 125 ml/ha (6.07) and Thiamethoxam 25% WG @ 100 g/ha (6.53) was least effective against BPH. The maximum population of brown plant hopper was found in untreated control *i.e.* (18.53) hoppers/hill (Table 1).

After the five days of second spray the highest mortality was recorded with Buprofezin 25% SC @ 800 ml/ha (2.40) had proved its supremacy over rest of the treatments followed by Imidacloprid 17.1% w/w SL @ 300 ml/ha (3.47), Imidacloprid 17.1% w/w SL @ 250 ml/ha (3.60), Thiamethoxam 25% WG @ 100 g/ha (4.13), Confidor 200 SL (Imidacloprid 17.8% w/w SL) @ 125 ml/ha (4.47) and Imidacloprid 17.1% w/w SL @ 200 ml/ha (5.87) was least effective against BPH. In untreated control plot the insect population was (17.93) nymph and adult/hill (Table 1).

Seven days after the application of different insecticides Buprofezin 25% SC @ 800 ml/ha was found superior over rest of the insecticides (1.33) followed by Imidacloprid 17.1% w/w SL @ 300 ml/ha (2.53), Imidacloprid 17.1% w/w SL @ 250 ml/ha (2.93), Thiamethoxam 25% WG @ 100 g/ha (3.00), Confidor 200 SL (Imidacloprid 17.8% w/w SL) @ 125 ml/ha (3.20) and Imidacloprid 17.1% w/w SL @ 200 ml/ha (4.47). In untreated control plot the insect population was (16.93) nymphs and adults/hill (Table1).

On the basis of two schedule application of insecticide the pooled data revealed that Buprofezin 25% SC @ 800 ml/ha (2.76) was the best treatment followed by Imidacloprid 17.1% w/w SL @ 300 ml/ha (3.56), Imidacloprid 17.1% w/w SL @ 250 ml/ha (4.17), Thiamethoxam 25% WG @ 100 g/ha (4.28), Confidor 200 SL (Imidacloprid 17.8% w/w SL) @ 125 ml/ha (4.56) and Imidacloprid 17.1% w/w SL @ 200 ml/ha (5.16) were recorded as the least effective insecticide against the brown plant hopper population (Table 1).

Table 1: Population of brown plant hoppers in pre-treatment and post treatment observations during *Kharif -2016.*

Nymph and adult population of brown plant hopper/hill											
		1st spray					2nd spray				
S.N.	Treatment	Dose/ha (g. or ml)	Pre-treatment	Post treatment			Pre-treatment	Post treatment			Overall mean
				3 DAS	5 DAS	7 DAS		3 DAS	5 DAS	7 DAS	
T_1	Imidacloprid 17.1% w/w SL	200 ml/ha	15.27 (8.78)	6.47 (5.76)	4.40 (4.79)	4.13 (4.31)	13.13 (8.16)	5.60 (5.37)	5.87 (4.82)	4.47 (4.12)	5.16
T_2	Imidacloprid 17.1% w/w SL	250 ml/ha	14.67 (8.61)	5.93 (5.53)	3.73 (4.42)	3.27 (4.16)	14.80 (8.66)	5.53 (5.34)	3.60 (4.34)	2.93 (3.95)	4.17
T_3	Imidacloprid 17.1% w/w SL	300 ml/ha	14.93 (8.69)	4.80 (4.98)	2.87 (3.91)	2.73 (3.82)	14.53 (8.57)	4.93 (5.06)	3.47 (4.27)	2.53 (3.69)	3.56
T_4	Imidacloprid 17.8% w/w SL	125 ml/ha	15.33 (8.80)	6.13 (5.61)	3.93 (4.54)	3.53 (4.65)	14.87 (8.66)	6.07 (5.59)	4.47 (5.48)	3.20 (4.71)	4.56
T_5	Buprofezin 25% SC	800 ml/ha	15.13 (8.75)	4.40 (4.79)	2.47 (3.64)	1.80 (3.16)	14.27 (8.50)	4.13 (4.65)	2.40 (3.60)	1.33 (2.76)	2.76
T_6	Thiamethoxam 25% WG	100 g/ha	15.20 (8.75)	5.67 (5.41)	3.33 (4.19)	3.00 (3.99)	14.60 (8.59)	6.53 (5.79)	4.13 (4.64)	3.00 (3.99)	4.28
T_7	Untreated control	-	14.40 (8.530)	13.00 (8.12)	13.07 (8.13)	13.47 (8.26)	16.27 (9.06)	18.53 (9.67)	17.93 (9.52)	16.93 (9.25)	15.49
	SE(m)		0.168	0.246	0.222	0.157	0.224	0.236	0.236	0.202	
	CD at 5%		N/S	0.577	0.537	0.245	N/S	0.503	0.610	0.341	

Note: Figure in parenthesis is square transformed value. DAS – Days after spray.

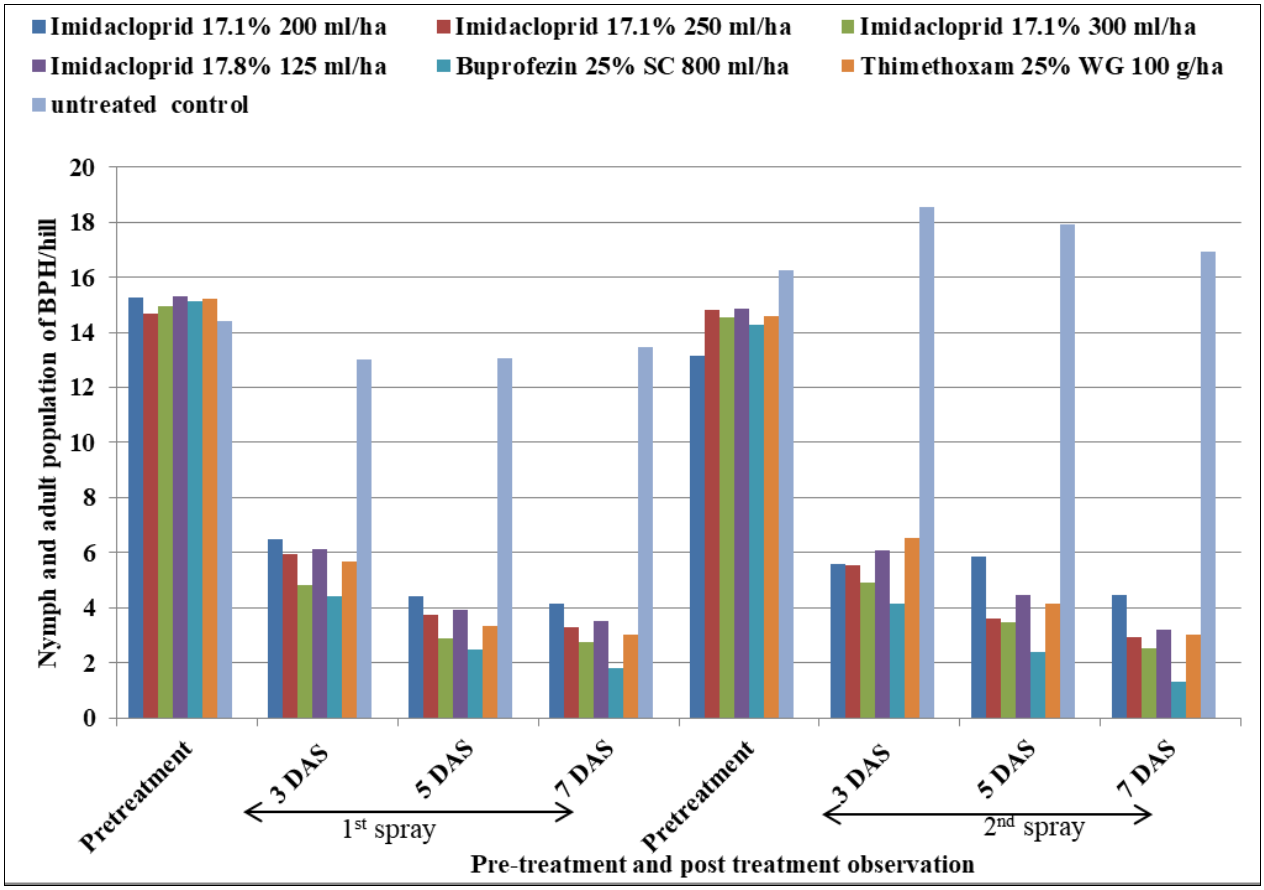

Fig 1: Population of brown plant hoppers in pre-treatment and post treatment observations.

Discussions

In the present study, Buprofezin 25% SC @ 800 ml/ha was most effective and superior over the other insecticidal treatments, after first and second spray. The second best insecticide was Imidacloprid 17.1% w/w SL @ 300 ml/ha followed by Imidacloprid 17.1% w/w SL @ 250 ml/ha and Thiamethoxam 25% WG @ 100 g/ha. These results are in close concurrence with the results obtained in the study of [21] reported that the overall mean efficacy of two sprays revealed that Buprofezin (0.20 kg a.i./ha) were the most effective in reducing the BPH population to an extend of 78.30 and 77.76 percent respectively [13]. Also inferred that the above molecules were effective [22]. Reported that the efficacy of Buprofezin tested at different dosages under field conditions and was compared with already recommended insecticides. Buprofezin 25 SC (750 and 825 ml/ha) was found to be at par with standard check Imidacloprid 17.8 SL but better than Chlorpyriphos 20 EC at 7 and 10 DAS. [4, 21] who also reported that Buprofezin 25 SC @ 200 g a.i./ha (800 ml/ha) was effective in suppressing BPH and WBPH populations. The superiority of Buprofezin for the control of *Nilaparvata lugens* under field trials has also been observed earlier by [24] reported Buprofezin to be effective against *Nilaparvata lugens* with very low risks to environment and human beings.

The present studies also corroborate with findings of [16] who also reported that Imidacloprid 17.8 SL @ 30 g. a.i./ha and Buprofezin 25

SC @ 200 g. a.i./ha, were highly effective in checking the population of green leaf hopper and brown plant hopper by registering almost percent control after three round of spray [7]. Evaluated that the bio-efficacy of Buprofezin, a chitin synthesis inhibitor Buprofezin in combination with Acephate at different doses against the brown plant hopper (BPH) and Gandhi bug in rice ecosystem. Result showed that among all the treatments Buprofezin 15%+Acephate 35% WP was most effective against both the sucking pests and conversely protected the crop. When applied at 1500 l/ha, the mixture significantly suppressed the population of BPH to 3.89 per 5 hills respectively and Gandhi bug to 1.66 per five sweeps [11]. Reported that the Buprofezin 1.0 ml/l. registered its superiority over rest of the treatment by recording lowest hopper population and higher grain yield followed by Acephate 75 SP @ 1g/l and Thiamethoxam 25 WG @ 0.3g./l. respectively [25]. present investigation, Buprofezin was evaluated against sucking pests and natural enemies in rice ecosystem. Buprofezin 25 SC @ 225 g.a.i./ha recorded lowest brown plant hopper population of 8.06 BPH/hill and percent reduction of BPH population was 74.19% 15 days after second spray [10]. evaluated that the toxicity of some insecticides against rice brown plant hopper (BPH) and its predators in rice (variety Swarna). It was revealed that Buprofezin followed by Imidacloprid, Thiamethoxam and Acetamiprid were much effective in suppressing the BPH population in rice [12]. Studied that the effect of Buprofezin 25 SC different concentration against plant hopper (brown plant hopper and white backed hopper) and their mirid predator, *Cyrtorhinus lividipennis* (Reuter). The results clearly indicated that Buprofezin 25 SC @ 1ml/ha recorded the lowest plant hopper population at 10 days after spray [18]. studied that the resurgence effect of certain insecticides against brown plant hopper and effect on mirid bug and spiders. The results clearly indicated that Buprofezin 25 SC @1.6 ml/l recorded the lowest brown plant hopper and highest predator population at 5 and 10 days after first and second spraying.

Conclusion

Thus, the present study revealed that all the tested insecticides were effective for BPH management but among the insecticides Buprofezin 25% SC @ 800 ml/ha proved to be the best insecticide in comparison to other tested insecticides to control the population of BPH followed by Imidacloprid 17.1% w/w SL @ 300 ml/ha, Imidacloprid 17.1% w/w SL @ 250 ml/ha and Thiamethoxam 25% WG @ 100 g/ha were found effective in management of BPH.

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References:

1. Anonymous. Ministry of Agriculture and Farmers Welfare, Government of India, (ON2331) 2019.
2. Anonymous. Package of practices for *Kharif* crops of Punjab. Punjab Agricultural University, Ludhiana, Punjab, India, 2019, 01.
3. Behura N, Sen MK, Kar MK. Intogression of yellow stem borer resistance gene, it cultivated rice from wild spp. Indian Journal of Agricultural Sciences 2011;81:359-362.
4. Bhavani B, Rao PRM. Bioefficacy of certain insecticides against rice plant hoppers vis-à-vis natural enemies under field condition. Indian Journal of Plant Protection 2005;33(1):64-67.
5. Chander S, Sujithra M, Palta RK. Efficacy of a Novel Insecticide and Combination Product against Rice Insect Pests. Pesticide research journal 2012;24(2):235-237.
6. Chaudhari PR, Tamrakar 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.
7. Chaudhary S, Raghuraman M, Yadav A. Management of brown plant hopper (BPH), *Nilaparvata lugens* (stål) and gundhi bug *Leptocorisa acuta*, (Thunberg) with newer insecticides in rice. Ecology, Environment and Conservation 2015;21:S339-S343.
8. Dhaliwal GS, Jindal V, Dhawan AK. Insect pest problems and crop losses: Changing trends. Indian Journal of Ecology 2010;37(1):1-7.
9. Dhawan AK, Matharu KS, Kumar V. Impact of integrated pest management strategies on pest complex and economics of basmati rice. Journal of Insect Science 2011;24(3):219-224.
10. Ghosh A, Samanta A, Chatterjee ML. Evaluation of some insecticides on brown plant hopper *Nilaparvata lugens* (Stal.) and its predators in rice. Environment and Ecology 2009;27(4):1653-1656.
11. Girish VP, Balikai RA, Mallapur CP. Efficacy of newer insecticide molecules and botanicals against paddy hopper population and effect on yield. Journal of Experimental Zoology, India 2016;19(1):571-574.
12. Hegde M, Nidagund J. Effect of newer chemicals on plant hoppers and their mirid predator in rice. Karnataka Journal of Agriculture Science 2009;22(3):511-513.
13. Kendappa GN, Mallikarjunappa S, Shankar G, Mithyantha MS. Evaluation of new insecticide applaud 25 EC (Buprofezin) against brown plant hoppers, *Nilaparvata lugens* (Stal.) (Family: Delphacidae, Order: Homoptera). Pestology 2005;29(2):5-8.
14. Krishnaiah, Varma, NRG. Changing insect pest scenario in the rice ecosystem – A National Perspective. IRRRI Book 2015, 31-42.
15. Kumar H, Maurya RP, Tiwari SN. Study on antibiosis mechanism of resistance in rice against brown plant hopper, *Nilaparvata lugens* (Stal.). Annals of Plant Protection Sciences 2012;20:98-101.
16. Kumar BV. Management of hoppers in the high altitude rainfed rice agroecosystem. Indian Journal of Plant Protection 2014;42(1):48-54.
17. Mohanta PK, Raju SVS, Giri GS. Bio-efficacy of certain insecticidal molecules against sucking pests of rice. Journal of Pharmacognosy and Phytochemistry 2020;9(1): 2107-2113.
18. Reddy AV, Devi RS, Reddy DVV, Dhuruva S. Insecticides causing resurgence in brown plant hopper, *Nilaparvata lugens* in irrigated rice. Indian Journal of Plant Protection 2015;43(2):150-153.
19. Sarao PS, Kaur H. Efficacy of Ferterra 0.4% GR (Chlorantraniliprole) against stem borers and leaf folder insect-pests of basmati rice. Journal of Environmental Biology 2014;35:815-19.
20. Selvaraj K, Chander S, Sujithra M. Determination of multiple-species economic injury levels for rice insect pests. Crop Protection 2012;32:150-60.
21. Shashank V, Mallikarjuna J, Chalam MSV, Madhumthi T. Efficacy of new insecticide molecules against leaf hopper and plant hoppers in rice (*Oryza Sativa* L.). International Journal of plant protection 2012;5(2):397-400.
22. Shera PS, Sarao PS. Field efficacy of an insect growth regulator, Buprofezin 25 SC against plant hoppers infesting paddy crop. The Bioscan 2016;11(1):127-132.
23. Srivastava C, Chander S, Sinha SR, Palta RK. Toxicity of various insecticides against Delhi and Palla population of

brown plant hopper (*Nilaparvata lugens*). Indian Journal of Agricultural Sciences 2009;79(12):1003-1006.
24. Wang Y, Gao C, Shen J, Zhang J, Huang Y, Li W *et al*. Buprofezin resistance selection, susceptibility survey and analysis of fitness costs in *Nilaparvata lugens* (Homoptera: Delphacidae). Management Science 2008;64:1050-1056.
25. Yaligar R, Kalmath BS, Guruprasad GS. Bio-efficacy of Buprofezin 25% SC against sucking pests in paddy ecosystem in Karnataka. Journal of Applied Zoology Research 2017;28(2):164-172.
26. Yarasi B, Sadumpati V, Immanni CP, Vudem DR, Khareedu VR. Transgenic rice expressing *Allium sativum* leaf agglutinin (ASAL) exhibits high-level resistance against major sap-sucking pests. BMC Plant Biology 2008;8:102-115.