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Bio-Efficacy of newer insecticides against Rice Gundhi Bug, *Leptocorisa acuta* (Thunberg) in Varanasi region

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Abstract
Field trials were conducted during *kharif* season, 2016-17 with rice variety HUBR 10-9 to determine the bioefficacy of certain newer insecticides against Rice Gundhi Bug, *Leptocorisa acuta* (Thunberg). Results revealed that among all the insecticides sprayed pymetrozine@150g treated plot was observed to be best and the plots treated by this chemical gave a yield of 6.69 tons/ha, when we consider Rice Gundhi Bug as a sole pest in rice ecosystem. The overall treatments found in the order as pymetrozine@150g a.i.(5.82), pymetrozine 200g a.i.(6.29), Cartap Hydrochloride (7.08), Dinotefuran@150ga.i.(8.94), Dinotefuran@ 200g a.i.((9.07) and Thiocyclam hydrogen oxalate(9.89) Avg. no. of adult & nymph/5 sweep nets.

Keywords: Rice Gundhi Bug, *Leptocorisa acuta* (Thunberg) newer insecticides, bio-efficacy

Introduction
Rice is life and considered most important among the cereals. Rice, *Oryza sativa* L. (Family: Poaceae) is the most important food crop for more than two thirds of the population of India and more than fifty percent of the world population. India is the second largest producer of rice in the world. Since the onset of green revolution in the country, there has been a constant increase in the productivity but there is also increase in number of insect pests and also a concomitant shift in their pest status intensity, diversity, and spread in rice. Rice Gundhi Bug found in all rice environment. They are common in rain fed and upland rice and prefer flowering and milking stage of the crop growth.

Leptocorisa acuta (Thunberg) (Hemiptera: Coreidae) is typically found during the flowering stage of the rice crop, which coincides with rainfall and high humidity at the beginning of the wet season (Reji and Chander 2007) [2]. Nymphs and adults use their piercing-sucking mouthparts to feed on developing rice grains. The Rice Gundhi Bug sucks the sap from the peduncle, tender stem and milking grains making them to turn chaffy. These bugs prefer to feed when the host plants are young, at a time when the starches within the grains are not yet fully formed. Judicious use of insecticides and alternation of chemicals with different mode of action are suggested to reduce insecticide resistance. So, the newer insecticide molecules with diversified mode of action against these pests will significantly play a vital role in the insecticide resistance management. Keeping these conditions in view present study was focused on bio-efficacy of newer insecticides group along with the conventional insecticides against major insect pests of rice.

Materials and Methods
The research trial was complemented during *kharif* season of 2015-16, at the Agricultural Research Farm, B.H.U. Varanasi district of Uttar Pradesh. The variety under supervision was HUBR 10-9. Field experiment was put up in Randomized Block Design (RBD) with 3 replications and 8 treatments including untreated control during *kharif* 2016 to evaluate the bio-efficacy of certain insecticides against insect pests in rice crop. Twenty eight day old seedlings were transplanted in the experimental plots at a spacing of 20 × 15 cm. Experiment was conducted in an area of 250 m^2, which was divided into four blocks each of 2m wide and 22.5 m long. These blocks were further divided into 8 plots, each of 3m long and 2 m wide with a gap of 0.5m between the two plots.

Preparation of spray solution
Before spray operation to be conducted, a desired concentration of insecticide is freshly prepared as per each treatment. A desired concentration of insecticidal solution is made by mixing required amount of water in it.

Shirred it well and a final volume of formulation is made. In case of soluble concentrates the required quantities were first taken and mixed with a little quantity of water to dissolve and then the remaining quantity of water was added to obtain desired concentration and stirred well. In case of granular formulations were mixed with sand and applied to the three plots of treatment in three replications were treated at a time. All the sprays were given during evening hours. A hand compression sprayer of capacity 1ltr. Is used. A desired 500 ml. of spray solution was made and was sprayed in such a manner that the spray will cover most of the experimental treatment thoroughly. Proper precaution was maintained while handling pesticide solutions.

Assessment of insect-pests

To study the efficacy of insecticide, pest population was recorded in different phase i.e. before and after spray. In case of Rice Gundhi Bug, the Avg. no. of adult & nymph per 5 sweep nets observed in each plot at 1st, 3rd, 7th, 10th and 14th day after spray. The percentage of leaf damage was calculated as observations were recorded by sweeping insect colleting nets five times across each treatment and the numbers of nymphs and adults bug are counted.

The ANOVA of data recorded during the experiment was made for the insect pests under study and the calculated 'F' was compared with tabulated 'F' at 5 % level of significance. The significance of difference between treatments was judged by CD at 5 % level of significance. (Gomez & Gomez). After drying of the crop threshing of the paddy was done and after that individual plot yield was recorded 5 days after harvesting. The yields of respective plots were exploited in quintal per hectare. The yield data in each treatment was recorded separately and subjected to statistical analysis to test the significance of mean yield variation in different treatments. The per cent increase in yield over control in various treatments was calculated by using the following formula.

$$\text{\% increase of yield in treatment over control} = \frac{\text{Yield in treatment - Yield in control}}{\text{Yield in control}} \times 100$$

Results

Effect of insecticidal treatments against *L. acuta* on rice

Comparative efficacy of different new insecticide molecules namely Dinotefuran, Pymetrozine in two formulations viz., 20%SG and 50%WP, Thiocyclam Hydrogen Oxalate 4%G and Cartap hydrochloride 4%GR were studied on major insect pests of paddy. The average number of insects recorded one day prior to the spray was in a range of 12.64 to 15.20/ 5 sweep nets (Table-1). On one day after treatment, Pymetrozine treated plots recorded a lowest count of 8.69 insects per 5 sweep nets and differed significantly from the average number of insects observed in rest of the insecticide treated plots (Table- 1). The observations on three days after spray showed that the average number of insects recorded per 5 sweep nets was lowest in plots treated with Pymetrozine @150g a.i./ha(6.47) and Pymetrozine@200g a.i./ha(7.19) which do not differ significantly with each other but significantly differs from rest of the insecticidal treatments. In Pymetrozine @150g a.i. /ha treated plots during 7th day after spray, a lowest number of 3.43 insects per 5 seep nets were observed. The plots treated with Pymetrozine@200g a.i. /ha (3.91) and Cartap hydrochloride (4.74) insects per 5 sweep nets were recorded and again observed to be non-significant with each other. On 14th days after spray, Pymetrozine treated plots had 4.71 insects per 5 sweep nets, respectively and differed significantly from the rest of the treatments (Table-2). The overall mean of average number of insects per 5 sweep nets after insecticidal spray was found to be lowest in shown in Pymetrozine with 5.82 and the rest were in the order as shown: Pymetrozine@150g a.i.(5.82) < Pymetrozine 200g a.i.(6.29) < Cartap Hydrochloride (7.08) < Dinotefuran @ 150ga.i.(8.94) < Dinotefuran@200g a.i.((9.07) < Thiocyclam hydrogen oxalate (9.89) (Table-1 & Fig.-1).

Table 1: Effect of insecticidal treatments against *L. acuta* after insecticidal spray.

Treatment	Dose g a.i./ha	Avg. no. of adult & nymph/5 sweep nets one day before spray	Avg. no. of adult & nymph/5 sweep nets				
			1DAS	3DAS	7DAS	14DAS	Overall Mean
Dinotefuran	200g	15.2*(4.02)**	13.13(3.75)	9.78(3.28)	6.44(2.72)	6.92(2.81)	9.07(3.14)
Pymetrozine	150g	13.79(3.84)	8.69(3.11)	6.47(2.73)	3.43(2.10)	4.71(2.39)	5.82(2.58)
Cartap Hydrochloride	750g	14.30(3.91)	9.67(3.26)	7.80(2.96)	4.74(2.39)	6.12(2.66)	7.08(2.81)
Pymetrozine	200g	14.76(3.97)	9.16(3.18)	7.19(2.85)	3.91(2.21)	4.90(2.42)	6.29(2.66)
Dinotefuran	150g	12.64(3.69)	12.18(3.62)	9.88(3.29)	6.39(2.71)	7.31(2.88)	8.94(3.12)
Thiocyclam Hydrogen oxalate	500g	14.13(3.890)	12.16(3.62)	10.14(3.33)	8.17(3.02)	9.10(3.17)	9.89(3.28)
Neem	2L/ha	13.12(3.75)	13.09(3.75)	10.4(3.37)	7.78(2.96)	8.72(3.11)	10(3.29)
Control	-	13.64(3.82)	14.30(3.91)	15.73(4.09)	16.16(4.14)	17.14(4.25)	15.83(4.09)
C.D.	-	0.078	0.177	0.107	0.124	0.125	-
SE(m)	-	0.025	0.058	0.035	0.044	0.044	-

*Mean of three replication, ** Figures in the parenthesis are square root transform values, DAS – Days after spray

Discussion

Effect of insecticidal treatments against *L. acuta*

The results obtained during the evaluation of test insecticides against Gundhi Bug revealed that Pymetrozine (150g a.i./ha) treatment was significantly superior over the other insecticidal treatments. The second best chemical was Pymetrozine (200g a.i./ha) which was followed by Cartap hydrochloride, Dinotefuran and Thiocyclam hydrogen oxalate. They have more or less same per cent field bioefficacy. The above result is mainly due to the Gundhi bug, though a sucking pest is active and the movement of pest will be more over panicle and plant surface. This movement will increase the chance of coming in contact with Pymetrozine treated surface and the chemical being strong contact toxicant is found to be effective on *L. acuta*. Nearly similar result was found in case of Vasant Bhanu, 2015. Pymetrozine proved better performance up to day 15 of application when compared with the sole application of with other insecticide like Dinotefuran and Cartap hydrochloride.

The yield was found to be highest in Thiocyclam hydrogen oxalate treated plots (7.69 tonn/ha) and was followed by Cartap hydrochloride (7.19 tonn/ha) and Pymetrozine 150g a.i. /ha (6.69 tonn/ha) treated plot. But pymetrozine@150g treated plot was observed to be best and the plots treated by this chemical gave a yield of 6.69 tonn/ha, when considered Rice Gundhi Bug as a sole pest in rice ecosystem.

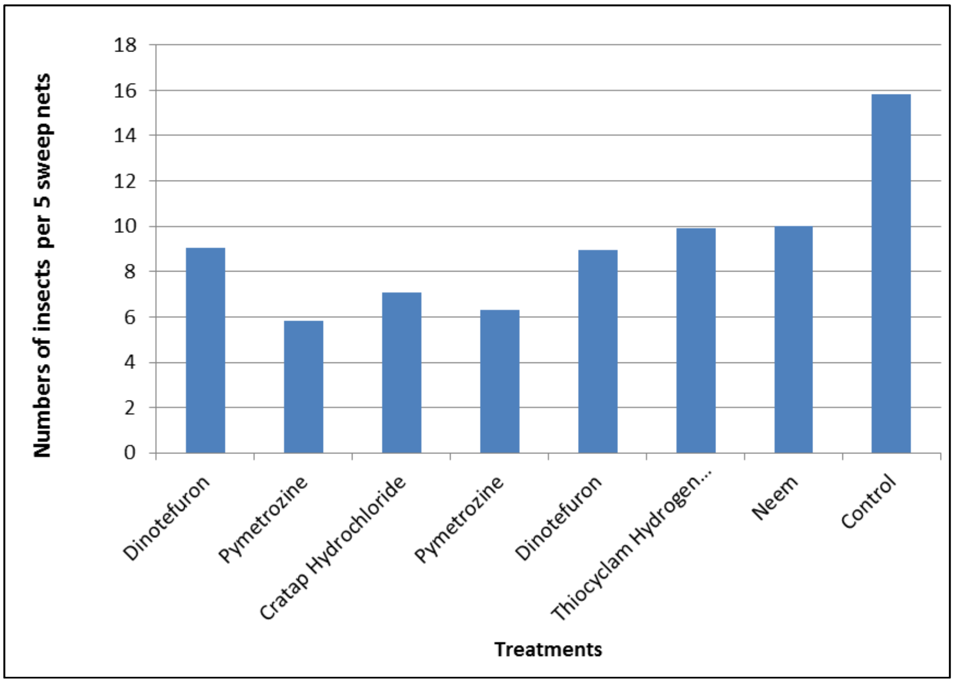

Fig 1: Response of insecticidal treatments against *L. acuta* on paddy

Table 2: Impact of insecticidal treatments on paddy yield

Treatment	Dose g a.i./ha	Yield (Kg/plot)	Yield (tonn/ha)	% Increase over control
Dinotefuran	200g	3.75	6.24	38.14
Pymetrozine	150g	4.02	6.69	42.30
Cartap Hydrochloride	750g	4.32	7.19	46.31
Pymetrozine	200g	3.96	6.59	41.42
Dinotefuran	150g	3.64	6.06	36.30
Thiocyclam Hydrogen oxalate	500g	4.62	7.69	49.80
Neem	2l/ha	3.86	6.43	39.96
Control	--	2.32	3.86	--

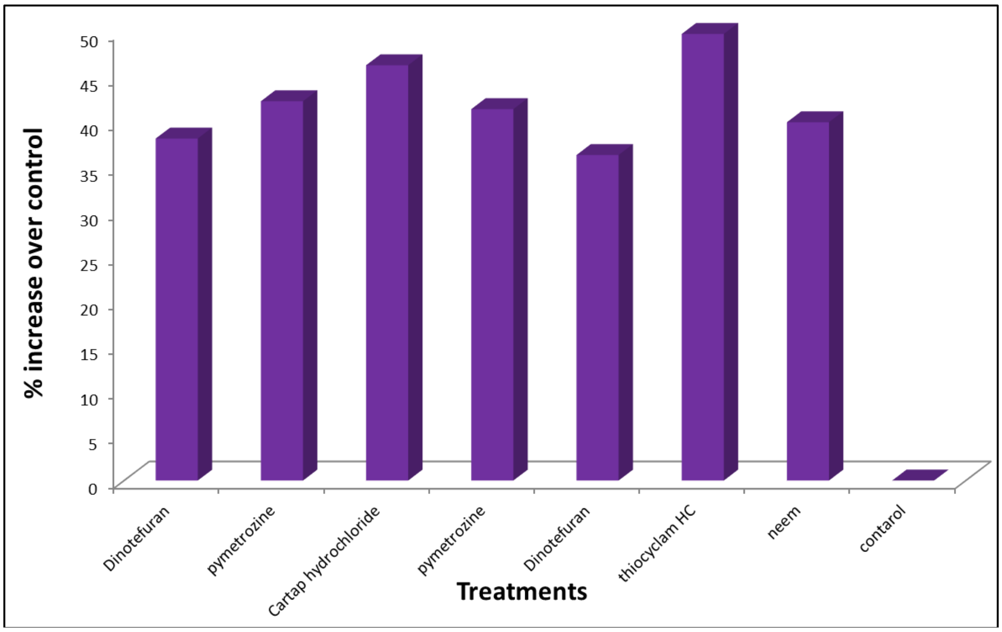

Fig 2: Impact of insecticidal treatments on paddy grain yield

Conclusion

Bio-efficacy of insecticidal treatments against major pests of paddy showed that pymetrozine@150g was first best insecticidal treatment against Rice Gundhi Bug followed by pymetrozine @200g a.i./ha, Cartap hydrochloride, Dinotefuran, Thiocyclam hydrogen oxalate and Neem. pymetrozine@150g can be incorporated in integrated pest management practices as it showed persistent toxic effects and gave an effective control Rice Gundhi Bug and also improved the yield. Alternatively, Pymetrozine can be used both for chewing and sucking pests and it also had persistence toxicity till seven days of treatments.

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