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RESEARCH ARTICLE

Deterioration of rice grain quality due to rice earhead bug, (*Leptocorisa acuta*) Thunb. in Tripura

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ABSTRACT

Rice earhead bug, *Leptocorisa acuta* Thunberg (Hemiptera: Alydidae) is found in almost all the countries where rice crop is grown. It, however, becomes more prevalent in rainfed wetland or upland rice. In Tripura, rice earhead bug (REB) is one of the major pests of rice crop leading to considerable field losses. Experiments were conducted in the field to evaluate the efficacy of some insecticides against REB, *L. acuta*. The results in field evaluation showed that all the insecticides are having significantly reduced pest population. The mortality percentage of *L. acuta* caused by different insecticides ranged from 74.01 to 97.03%. Among all the treatments tested, Quinolphos 25 EC gave the highest mortality(97.03%) as compared to untreated control (5.48%).

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INTRODUCTION

Rice is the staple food of more than 60 per cent of the world's population especially for the people in South-East Asia. Among the rice growing countries, India has the largest area under rice crop and ranks second in production next to China. It occupies about 23.3 per cent of gross cropped area of the country and plays a vital role in the national food grain supply. Rice alone contributes 43 per cent of total food grain production and 46 per cent of total cereal production of the country. The average rice productivity in India was 3049.60 kg/ha (2004), which is 23.83 per cent below the world's average productivity of 4003.80 kg/ha during the same year. It is infested by many pests in which one of the enemy is rice earhead bug.

Rice earhead bug, *Leptocorisa acuta* Thunberg (Hemiptera: Alydidae) is found in almost of countries where rice crop is grown such as India, Bangladesh, Bhutan, Burma, Indonesia,Cambodia, Laos, Malaysia, Nepal, Pakistan, Philippines, Thailand, South of China, Japan, Korea and Vietnam. Rice earhead bug (REB) is more prevalent in rainfed wetland or upland rice.

Loss due to ear head bug in Tamil Nadu has been recoreded 152.67 tones Shanmugam *et al*., 2006). Both adults and nymphs do the damage. The nymphs start feeding 3 to 4 hours after hatching. They feed on the leaf sap near the tip/ on milky sap in developing spikelets at milky stage. Sucking of the milky sap causes ill-filled/ partial filled and chaffy grains. Serious infestation can reduce the yield by 50 per cent. Appearance of numerous brownish spots at the feeding sites / shrivelling of grains. In the case of heavy infestation, the whole earhead may become devoid of mature grains. Its presence in the field is made out by its strong smell. In Tripura, rice earhead bug (REB) is one of the major pests of rice crop leading to considerable field losses. Intensity and type of damage caused by REB depend on stage of rice crop, population density of the pest and ecological conditions. Both nymphs and adults are destructive to the crop, even though the damage by nymphs is more severe. Nymphs prefer grains at milky stage for feeding. They feed by the insertion of proboscis at points where glumes meet. During the process, the bug secretes a proteinaceous stylet sheath to form a feeding canal for its sucking mouthparts. Removal of stored assimilates from developing grain may result in either unfilled or partially filled grains with damage symptoms.

Quality of grains is also reduced by the insect attack. Smell of the infected grains lowers the market value. Damaged grains even after cooking retain the buggy smell (Dale,1994). The major measure to control this insect pest depends upon application of chemical pesticides. However, insecticidal control has led to several problems in insect pest management like insecticide resistance in pests, pest resurgence, undesirable toxic effects to natural enemies of pests and toxic residues in crop plants and environmental pollution. Consequently, the search for new environmentally safe methods is being intensified. Microbial control aims at biological suppression of insect pests, by the use of entomopathogens like viruses, fungi, bacteria, protozoa and nematodes which usually posses the special features required for implementation of IPM system *viz.*, host specificity, high virulence, safety to natural enemies of the target pest and ecologically non-disruptive. The present study has been taken up to evaluate the efficacy of some insecticides against rice bug, *L. acuta*.

MATERIALS AND METHODS

The experiment was laid out in ICRTA, Agartala to test different plant products dusts and insecticide dust for the control of rice earhead bug, *L. acuta*. Rice variety Sona Masuri was sown during *Kharif* 2011 by following the recommended package of practices. The Randomized Block Design (RBD) was adopted with seven treatments replicated three times. The individual plot size was 4.0 × 2.25 mm. Ten treatments were imposed at 50 per cent flowering stage of the crop. The insecticides were sprayed with the help of Knapsack sprayer when the attack of leaf folder reached two larvae per plant. Mortality of the insect larvae were calculated by counting the number of larvae from randomly selected 10 hills from each treatment 24 hours before and after the application of insecticides. The performance of each insecticide was based on the mortality of the pest after 24 h after spray and the yield. The yield of each plot was recorded and expressed in kgs/plot. The structure of the treatments used in this study is given in Table 1 and 2. The data were analyzed statistically by following the analysis of variance (ANOVA) for different dates of observation before and after the application of plant products. The decline in the larval population was expressed in percentage of reduction.

RESULTS AND DISCUSSION

Different insecticides *viz.,* Endosulphon 35 EC, Quinolphos 25 EC, DDVP, carbaryl, Abamectin, Phosphamidon 40SP, Malathion 5 per cent D, extract of 2.5kg garlic + 500g tobacco leaves + 500g washing powder and neem oil were tested against earhead bug. The mortality caused by the insecticides during *Kharif* 2011 is presented in Table 1. The mortality of the pest ranged from 74.01 to 97.03 per cent in treated plots. Quinolphos 25 EC gave the highest (97.03%) mortality followed by Endosulphon 35 EC (96.47%), DDVP (94.09%), abamectin (94.03%), phosphamidon 40SP (93.28%), carbaryl (90.50%), Malathion (80.65%), extract of 2.5kg garlic + 500g tobacco leaves + 500g washing powder (80.21%) and Neem oil (74.01%).The mortality caused by these insecticides was statistically at par. Malathion gave significantly lower mortality (80.65% for the year 2011) than the former pesticides. These results are comparable with those of Khan *et al*. (1989) who observed more than 90 per cent mortality of the rice leaf-folder after the application of various insecticides. Present results are in partial agreement with those of Mishra *et al*. (1998) who observed that monocrotophos and cypermethrin

Table 1: Effect of various insecticides on the larval population and mortality of rice earhead bug

Insecticides	Doses	No. of larvae		Mortality (%)
		Before spray	After spray	
T_1- Quinolphos 25 EC	1.5 litre in 500 litre water / ha	3.37	0.10	97.03
T_2- Endosulphon 35 EC	25 kg/ha	3.12	0.11	96.47
T_3- DDVP	500ml/ha	2.71	0.16	94.09
T_4- Carbaryl	2 kg/ha	2.43	0.23	90.50
T_5- Abamectin	500ml/ha	3.18	0.19	94.03
T_6- Phosphamidon 40SP	1 lit/ha	2.53	0.17	93.28
T_7- Malathion 5%D	25kg/ha	1.86	0.36	80.65
T_8- Extract of 2.5kg garlic + 500g tobacco leaves + 500g washing powder	@10%	1.87	0.37	80.21
T_9- Neem oil	@0.5%	2.27	0.59	74.01
T_{10}-Untreated control	-	2.19	2.07	5.48
S.E.±	-	0.05	0.04	0.04
C.D. (P = 0.05)	-	0.17	0.13	0.13
C.V. at 5%	-	5.68	5.08	5.49

Table 2: Economics of control operations of rice earhead bug

Insecticides	Increase in yieldover control (kg)	Yield (kgha-^{1})
T_1- Quinolphos 25 EC	410.53	3476.53
T_2- Endosulphon 35 EC	385.21	3451.21
T_3- DDVP	367.32	3433.32
T_4- Carbaryl	337.67	3403.67
T_5- Abamectin	358.19	3424.19
T_6- Phosphamidon 40SP	353.75	3419.75
T_7- Malathion 5%D	151.51	3217.51
T_8- Extract of 2.5kg garlic + 500g tobacco leaves + 500g washing powder	148.75	3214.75
T_9- Neem oil	125.61	3191.61
T_{10}-Untreated control	-	3066.00
S.E.±	-	1.68
C.D. (P = 0.05)	-	4.95
C.V. at 5%	-	6.41

gave good control of rice leaf folder and were at par statistically.

All insecticidal treatments significantly out yielded the untreated plots (Table 2). The highest paddy yield was obtained with the application of Quinolphos 25 EC (3476.53 kg ha^{-1}) followed by Endosulphon 35EC (3451.21kg ha^{-1}), DDVP (3433.32 kg ha^{-1}), abamectin (3424.19kg ha^{-1}), Phosphamidon 40SP (3419.75kg ha^{-1}), Carbaryl (3403.67kg ha^{-1}) Malathion 57 EC (Malathion) (3217.51 kg ha^{-1}), extract of 2.5kg garlic + 500g tobacco leaves + 500g washing powder (3214.75kg ha^{-1}) and Neem oil (3191.61kg ha^{-1}). These treatments were, however, at par statistically. The yield obtained by the application of Malathion (3217.51 kg ha^{-1}) was statistically lower than those of other insecticidal treatments. These results are similar to those of Saroja and Raju (1982 a, b) who obtained similar increase in yield by controlling *L. acuta* damage by the application of synthetic pyrethroids.

It is evident that exposure to botanical insecticides in the larval diet has significant effects on the activity of several enzymes found in the late instar larvae and adult of *L. acuta*. Botanical insecticides such as neem may interfere with the production of certain types of proteins. This activity is apparently strongest during pupation. Pupae were very susceptible after larvae were exposed to the botanical insecticides. Previous reports by several groups found that treatment with neem and botanical insecticides induced similar signs of toxicity (Senthil Nathan *et al*., 1999; Smirle *et al*., 1996). Active principles present in neem and NSKE (azadirachtin etc.) are responsible for such effects. The adult physiology is thus impaired after larvae are exposed to botanical insecticides and bacterial toxin These botanical insecticides may therefore, serve as effective alternatives to conventional synthetic insecticides in the control of agricultural pests.

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