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# Impact of chitin synthesis inhibitor on brown planthopper (BPH), *Nilaparvata lugens* (Stal.) and gundhi bug, *Leptocorisa acuta* (Thunberg) in rice

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ABSTRACT

An experiment was conducted during *Kharif* season of 2012, at the Agricultural Research Farm of Banaras Hindu University, Varanasi to evaluate the efficacy of chitin synthesis inhibitor, buprofezin in combination with acephate at different doses against the brown plant hopper and Gundhi bug in rice ecosystem. The treatments were sprayed thrice after transplanting. Results showed that among all the treatments, Buprofezin 15 per cent + Acephate 35 per cent WP was most effective against both the sucking pests and conversely protected the crop. When applied at 1500 ml/ha, the mixture significantly suppressed the population of BPH to 3.89 per 5 hills and gundhi bug to 1.66 per five sweeps. It also significantly increased the yield of rice (57%) over untreated control.

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## INTRODUCTION

The rice plant is subjected to attack by more than 100 species of insects, 20 of them can cause economic damage. Together they infest all parts of the plant at all growth stages, and a few transmit viral diseases (Pathak and Khan, 1994). Planthopper constitutes a large group of phytophagous insects in the Order Hemiptera. Distributed worldwide, all members of this group are plant-feeders and some species are considered pests. In Asia, brown planthopper (BPH), *Nilaparvata lugens* (Stål.) and Gundhi bug, *Leptocorisa acuta* (Thunberg) are of economic importance. They damage plants directly by sucking the plant sap and by ovipositing in plant tissues, causing plant wilting or hopper burn. The brown planthopper, *Nilaparvata lugens* (BPH), is one of the major pests of rice and damage to the rice crop is caused directly by feeding on the phloem (Sogawa, 1982) and indirectly by transmitting plant viral diseases like grassy stunt and wilted stunt viruses. Resurgence of brown planthopper (BPH), *Nilaparvata lugens* (Stål.) after insecticide application is a common phenomenon in rice in south east Asia including south India. Spraying of isoprocarb, carbofuran and fenobucarb resulted in significant reduction in the nymphal populations (Mishra and Sontakke, 1986). The pest was most susceptible to the pyrethroids at lower temperatures and to other insecticides at higher temperatures (Fabellar and Mochida, 1988). Zang and Zang (1996) stated that imidacloprid was very effective against BPH on rice. Heinrichs (1984) observed the resurgence of *N. lugens* after the application of methyl parathion and decamethrin at 55

and 65 days after planting. Brown planthopper, *Nilaparvata lugens* and Gundhi bug, *Leptocorisa acuta* (Thunberg) had caused serious outbreaks in several countries like China, Bangladesh, Nepal, Pakistan, Taiwan and Vietnam (Hu *et al.*, 2011) In India also, the serious outbreak of this pest has been reported from different states including Uttar Pradesh, Tamilnadu and Andhra Pradesh. In order to evolve effective and economic pest control, it is necessary to evaluate the new groups and new formulations of chemicals. Hence, the present study was undertaken.

## MATERIAL AND METHODS

The experiment was conducted during the *Kharif* season of 2012, at the Agricultural Research Farm, Banaras Hindu University in a Randomized Block Design with seven treatments, replicated thrice. The treatments were Buprofezin 15 per cent + Acephate 35 per cent WP (MAIBA-01 SC) (150+350 ml/ha), Buprofezin 15 per cent + Acephate 35 per cent WP (MAIBA-01 SC) (187.5+437.5 ml/ha), Buprofezin 15 per cent + Acephate 35 per cent WP (MAIBA-01 SC) (225+525 ml/ha), Acephate 75 SP (750 ml/ha), Buprofezin 25 per cent SC(200 ml/ha), Imidacloprid 17.8 per cent SL (22.5) including an untreated control against sucking pest BPH and gundhi bug. The insecticidal treatments were applied thrice at 58, 68 and 78 days after transplanting which coincided with the reproductive phase of the crop when maximum BPH and gundhi bug population was observed. The BPH and gundhi bug (*N. lugens* and *Leptocorisa acuta*, respectively) population was recorded one day before and three, seven and ten days after the spray. The BPH population was recorded on randomly selected five hills in each treatment and gundhi bug was recorded randomly five sweeps. The yield per plot was recorded and computed on hectare basis.

**Statistical analysis :**

The ANOVA of data recorded during the experiment was made for the insect under study and the calculated 'F' was compared with tabulated 'F' at 5 per cent level of significance. The significance of difference between treatments was judged by CD at 5 per cent level of significance. The per cent reduction of brown planthopper population over control was worked out in order to judge and express the efficacy of the respective treatments against it. The per cent reduction in the pest population was calculated by using Henderson and Tilton's (1955) formula :

$$\text{Per cent reduction in pest population} = 1 - \left(\frac{Ta}{Tb} \cdot \frac{Cb}{Ca}\right) \cdot 100$$

where,

$T_a$ = Population in the treated plot after spray
$T_b$ = Population in the treated plot before spray
$C_a$ = Population in the control plot after spray
$C_b$ = Population in the control plot before spray.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

**Bioefficacy of buprofezin against bph :**

Bioefficacy of all the treatments after first spray against BPH is shown in Table 1. All the treatments exhibited significant reduction in population of BPH after 3 days spray over average precount. Buprofezin 25 per cent SC (800 ml/ha) followed by MIABA-01 SC (1000 ml/ha) were found most effective among all the treatments after 3 DAS. They showed reduction of BPH population from 58.00 to 28.31 and 58.10 to 30.29 per 5 hills after 3 DAS, respectively. At 7

**Table 1 : Impact of newer insecticides on brown planthopper, *Nilaparvata lugens* in rice**

| Treatment details | Dose (ml/lit) | DBS | Avg. population of *Nilaparvatha lugens*/5 hills | | | | | | | | | Yield (kg/ha) | (%) Increase in yield over control |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Days after first spray | | | Days after second spray | | | Days after third spray | | | | |
| | | | 3 | 7 | 10 | 3 | 7 | 10 | 3 | 7 | 10 | | |
| Buprofezin 15 (%) + Acephate 35(%) WP | 1000 | 58.10 | 30.29 | 10.30 | 10.45 | 9.43 | 8.30 | 6.6 | 4.83 | 3.92 | 1.69 | 4945 | 39.68 |
| Buprofezin 15 (%) + Acephate 35(%) | 1250 | 50.13 | 26.84 | 8.87 | 6.91 | 6.89 | 4.93 | 3.99 | 2.53 | 1.41 | 0.97 | 5255 | 48.44 |
| Buprofezin 15 (%) + Acephate 35(%) WP | 1500 | 52.57 | 26.53 | 8.53 | 6.60 | 5.50 | 4.77 | 3.89 | 2.21 | 1.13 | 0.81 | 5545 | 56.63 |
| Acephate 75 SP | 1000 | 54.97 | 31.17 | 13.69 | 12.97 | 10.53 | 9.81 | 8.03 | 6.26 | 5.45 | 3.80 | 4810 | 35.87 |
| Buprofezin 25 (%) SC | 800 | 58.00 | 28.31 | 10.63 | 8.40 | 8.22 | 6.6 | 5.83 | 4.10 | 3.77 | 1.27 | 4765 | 34.61 |
| Imidacloprid 17.8 (%) SL | 125 | 58.27 | 30.83 | 12.80 | 10.53 | 9.63 | 8.92 | 7.10 | 5.22 | 4.74 | 2.21 | 4520 | 27.68 |
| Untreated | -- | 54.23 | 68.83 | 80 | 88.03 | 92.7 | 97.1 | 104.9 | 109.53 | 132.10 | 150.00 | 3540 | |
| CD (P = 0.05) | | NS | 2.07 | 2.4 | 1.64 | 1.65 | 2.08 | 2.33 | 1.08 | 2.07 | 1.99 | | |

DBS: Day before spray

days after spray, MIABA-01 SC (1000 ml/ha) followed by Imidacloprid 17.8 per cent SL (125) were found most effective among all treatments. They showed reduction of BPH population to 10.30 and 12.30 per 5 hills, respectively. All other treatments were at par themselves except MIABA-01 SC (1250 ml/ha) which was least effective among all treatments showing 26.84 and 8.87 BPH population per 5 hills after 3 DAS and 7 DAS, respectively. However, Acephate 75 per cent (1000 ml/ha) showed 31.17 and 13.69 BPH population per 5 hills after 3 DAS and 7 DAS, respectively. After first spray the performance of all treatments was in the order of Buprofezin 25 per cent SC (800 ml/ha) > MIABA-01 SC (1000gm/ha) > Imidacloprid 17.8 per cent SL (125ml/ha) MIABA-01 SC (1500gm/ha) > Acephate 75 per cent (1000 g/ha) > MIABA-01 SC (1250 g/ha).

All the treatments showed significant reduction in population of BPH after 3 days after spray over average precount. Acephate 75 SP (1000 ml/ha) followed by MIABA-01 SC (1500ml/ha) was found most effective among all the treatments after 3 DAS. They showed reduction of BPH population from 12.97 to 10.53 and 6.60 to 5.50 per 5 hills after 3 DAS, respectively. At the 7 Days after Spray MIABA-01 SC (1250 ml/ha) followed by Buprofezin 25 per cent SC (800 ml/ha) were found most effective among all treatments. They showed reduction of BPH population to 4.93 and 6.60 per 5 hills, respectively. All other treatments were at par except Imidacloprid 17.SL (125 ml/ha), which was least effective among all treatments showing 9.63 and 8.92 BPH population per 5 hills after 3 DAS and 7 DAS, respectively. However, MIABA-01 SC (1000 ml/ha) showed 9.43 and 8.30 BPH population per 5 hills after 3 DAS and 7 DAS, respectively.

During the third spray, all the treatments showed significant reduction in population of BPH after 3 days spray over average precount. Imidacloprid 17.8 per cent SL (125 ml/ha) followed by MIABA-01 SC (1000 ml/ha) was found most effective among all the treatments after 3 DAS. They showed reduction of BPH population from 7.10 to 5.22 and 6.60 to 4.83 per 5 hills after 3 DAS, respectively. At the 7 Days After spray MIABA-01 SC (1250 ml/ha) followed by MIABA-01 SC (1500 ml/ha) were found most effective among all treatments. They showed reduction of BPH population to 1.41 and 1.13 per 5 hills, respectively. All other treatments were at par themselves except Buprofezin 25 per cent SC (800 ml/ha), which was least effective among all treatments showing 4.10 and 3.77 BPH population per 5 hills after 3 DAS and 7 DAS, respectively. However, Acephate 75 per cent (1000 ml/ha), showed 6.26 and 5.45 BPH population per 5 hills after 3 DAS and 7 DAS, respectively.

Results showed that among all the treatments Buprofezin 15 per cent + Acephate 35 per cent WP (MAIBA-01 SC) (187.5+437.5 a.i./ha) (1500 ml/ha) was most effective after first, second and third spray. It also showed highest percentage increase (56.63) in yield over untreated control. The efficacy of Buprofezin, which is a chitin synthesis inhibitor, in combination with acephate has been reported by Mesquita *et al*. (2007); Ming *et al*. (2004) and Ghosh *et al*. (2010) reported imidacloprid was promising in reducing the BPH population up to 94.97 per cent over control. A similar observation was made in the present study, but it was not as efficient as that of the growth regulator, *i.e*. buprofezin. Bhavani *et al*. (2005) found that application of acephate was more pronounced in restricting the planthopper population to a minimum level at its peak activity period. Similar results are also obtained in the present trial.

**Bioefficacy of buprofezin against gundhi bug :**

Field efficacy of buprofezin in combination with

**Table 2 : Impact of newer insecticides on gundhi bug, *Leptocorisa acuta* in rice**

| Treatment details | Dose (ml/litter) | DBS | Avg. population of *Leptocorisa acuta*/5 sweeps: Days after first spray | | | Days after second spray | | | Days after third spray | | | Yield (kg/ha) | (%) Increase in yield over control |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 3 | 7 | 10 | 3 | 7 | 10 | 3 | 7 | 10 | | |
| Buprofezin 15(%) + Acephate 35(%) WP | 1000 | 11.99 | 9.80 | 9.20 | 8.99 | 7.10 | 6.80 | 5.0 | 4.10 | 3.00 | 1.70 | 4945 | 39.68 |
| Buprofezin 15(%) + Acephate 35(%) WP | 1250 | 14.66 | 7.89 | 5.66 | 3.33 | 2.79 | 2.53 | 1.77 | 1.33 | 1.21 | 0.68 | 5255 | 48.44 |
| Buprofezin 15(%) + Acephate 35(%) WP | 1500 | 14.10 | 7.66 | 5.33 | 3.00 | 2.33 | 2.33 | 1.66 | 1.21 | 1.00 | 0.55 | 5545 | 56.63 |
| Acephate 75 SP | 1000 | 15.77 | 10.10 | 9.80 | 9.20 | 8.33 | 7.10 | 6.23 | 5.33 | 3.80 | 2.00 | 4810 | 35.87 |
| Buprofezin 25(%) SC | 800 | 15.10 | 9.210 | 8.66 | 7.0 | 6.33 | 5.53 | 4.10 | 3.00 | 2.60 | 1.60 | 4765 | 34.61 |
| Imidacloprid 17.8(%) SL | 125 | 13.33 | 9.50 | 9.20 | 8.99 | 8.33 | 7.66 | 6.20 | 5.00 | 3.80 | 2.33 | 4520 | 27.68 |
| Untreated | | 12.9 | 12.1 | 13.0 | 16.0 | 20.33 | 22.0 | 23.66 | 25.0 | 26.20 | 28.30 | 3540 | -- |
| C.D. (P=0.05) | | NS | 1.2 | 1.11 | 1.57 | 1.17 | 2.19 | 1.07 | 2.27 | 2.18 | 1.14 | | |

DBS: Day before spray

acephate against gundhi bug (Table 2) showed that among all the treatments MIABA-01 SC (1500 ml/ha) showed superior control over the gundhi bug after first spray. However, MIABA-01 SC (1000 ml/ha) was superior among all treatments after second spray. MIABA-01 SC (1500 ml/ha) showed highest percentage (56.63%) increase in yield over untreated control. However, the untreated plot recorded a yield of 3540 kg/ha. The performance of treatments to per cent increase in yield over untreated control was in order of MIABA-01 SC (1500 ml/ha) > MIABA-01 SC (1250 ml/ha) > MIABA-01 SC (1000 ml/ha) > acephate 75 per cent (1000 ml/ha) ~ buprofezin 25 per cent SC (800 ml/ha) > imidacloprid 17.8 per cent SL (125 ml/ha). The performance of treatments to per cent increase in yield over untreated control were in order of MIABA-01 SC (1500 ml/ha) > MIABA-01 SC (1250 ml/ha) > MIABA-01 SC (1000 ml/ha) > Acephate 75 per cent (1000 ml/ha) ~ Buprofezin 25 per cent SC (800 ml/ha) > Imidacloprid 17.8 per cent SL (125 ml/ha). (Rath, 1999) reported that imidacloprid 17.8 SL (22.5 ai (g) @ 125 ml/ha showed reduction in the gundhi bug 29.91 per cent population over control. However, in present study it was found that imidacloprid 17.8 SL was effective by reducing gundhi bug population after first, second and third spray. In the present studies it was found that buprofezin was very effective in suppressing gundhi bug population when combined with acephate, as observed by Patel *et al*. (2010). Acephate 75 WP was also effective against a gundhi bug, which is on line with the findings of Tewari and Yadav (2005). They showed the effectiveness of acephate on different sucking pests of rice. It can be concluded that insecticide mixture formulation containing soft pesticide like buprofezin can be used in combination with acephate as an important component of pest management programme for suitable management of brown planthopper and gundhi bug in rice.

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