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RESEARCH ARTICLE

Efficacy of new insecticide molecules against leaf hoppers and plant hoppers in rice (*Oryza sativa* L.)

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ABSTRACT

Field experiments were conducted during *Kharif* 2008-2009 to evaluate new insecticides against brown plant hopper (BPH), *Nilaparvata lugens* (Stal); white backed plant hopper (WBPH), *Sogatella furcifera* (Horvath) and green leaf hopper (GLH), *Nephotettix virescens* (Distant). Ethiprole (0.05 kg a.i./ha) and buprofezin (0.20 kg a.i./ha) were found to be highly effective against BPH and WBPH. Buprofezin (0.20 kg a.i./ha) and Thiamethoxam (0.025 kg a.i./ha) were highly effective against GLH. These new insecticides also gave higher rice grain yields *viz.,* 5.16 t/ha, 5.13 t/ha and 4.98 t/ha, respectively. All the insecticides tested, proved to be superior over control.

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INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food for more than half of human population. Rice constitutes 52 per cent of total food grain production and 55 per cent of total cereal production in India (Saxena and Singh, 2003). The insect pests are a major constraint in rice production. Yield loss due to insect pests of rice ranges from 25 to 51 per cent (Panda and Rath, 2003). Pathak and Dhaliwal (1981) considered 20 species of major significance out of 100 species damaging rice. Of pests, sucking insects *viz.,* leaf hoppers (*Nephotettix viresence* (Distant) and *Nephotettix nigropictus* (Stal.) and plant hoppers (*Nilaparvata lugens* (Stal.) and *Sogatella furcifera* (Horvath) cause devastating damage. Use of insecticides forms one of the most effective management tools besides tactics like cultural and biological means. With this holistic approach, new insecticide molecules were evaluated.

MATERIALS AND METHODS

Field trials were conducted at Agriculture College Farm, Bapatla, Guntur ($15^0$59"N and $80^0$13"E and 28 ft AMSL) during *Kharif* 2008-2009 in irrigated rice. The experiment was laid out in a Randomized Block Design using susceptible rice cultivar BPT-5204 (Samba mahsuri). Eight insecticides were evaluated with untreated control being replicated three times with plot size 25m^2. Two to three seedlings were planted per hill at 20×15 cm. The recommended doses of fertilizers were applied to maintain good plant stand throughout the crop period. Two sprays of each molecule were applied based on the economic threshold level.

Leaf and plant hopper density selected hills were gently tapped and those falling into the water were counted. The data on hopper density were recorded one day before (pre-treatment) and 1, 5, 10 and 15 days after imposing treatments.

Density of nymphs and adults of BPH, WBPH and GLH on ten randomly selected hills per treatment were recorded. Data on yield per plot were obtained by harvesting and threshing of individual treatments and yield per ha was calculated.

RESULTS AND DISCUSSION

The experimental findings of the present study have been presented in the following sub heads:

Brown plant hopper :

The overall mean efficacy of two sprays revealed that Ethiprole (0.05 kg a.i./ha) and Buprofezin (0.20 kg a.i./ha) were the most effective in reducing the BPH population (Table 1) to an extent of 78.30 and 77.36 per cent, respectively and were on par with each other. Kumaran *et al.* (2007) and Kendappa *et al.* (2005) also inferred that the above two molecules were effective. Thiamethoxam (0.025 kg a.i./ha) was the next best recording 72.23 per cent reduction over control. This is in agreement with of Vasanth Bhanu *et al.* (2007). This was followed by thiacloprid @ 0.12 kg a.i./ha (64.56%) and acetamiprid @ 0.020 kg a.i./ha(63.79%) which recorded more than 60 per cent reduction of BPH population over untreated control. Clothianidin @ 0.015 kg a.i./ha (59.10%) and acephate @ 0.56 kg a.i./ha (52.69%) were found to be moderately effective, recording more than 50 per cent reduction of BPH population over untreated control.

White backed plant hopper :

The overall mean efficacy of Ethiprole @ 0.05 kg a.i./ha (77.69%) and Buprofezin @ 0.20 kg a.i./ha (76.73%) being on par recorded highest reduction of WBPH population and remained significantly superior over all the other treatments and were followed by Thiamethoxam (0.025 kg a.i./ha) and Thiacloprid (0.12 kg a.i./ha) with 73.63 and 65.22 per cent reduction, respectively. These results are in conformity with Varma *et al.* (2003). The next best molecules were Acetamiprid @ 0.020 kg a.i./ha (62.96%), Clothianidin @ 0.015 kg a.i./ha (61.93%) and Acephate @ 0.56 kg a.i./ha (58.31%) with more than 55 per cent reduction in WBPH population over untreated control (Table 2).

Green leaf hopper :

The overall mean efficacy of four observations recorded at one, five, ten and fifteen days after two sprays indicated that buprofezin @ 0.20 kg a.i./ha (75.08%) and Thiamethoxam @ 0.005 per cent (74.31%) recorded highest reduction of GLH population and remained significantly superior over all the other treatments and were followed by Ethiprole (0.05 kg a.i./ha) and Thiacloprid (0.12 kg a.i./ha) with 70.21 per cent and 65.27 per cent reduction, respectively and these results are supported by Sahithi and Misra (2006). The next best

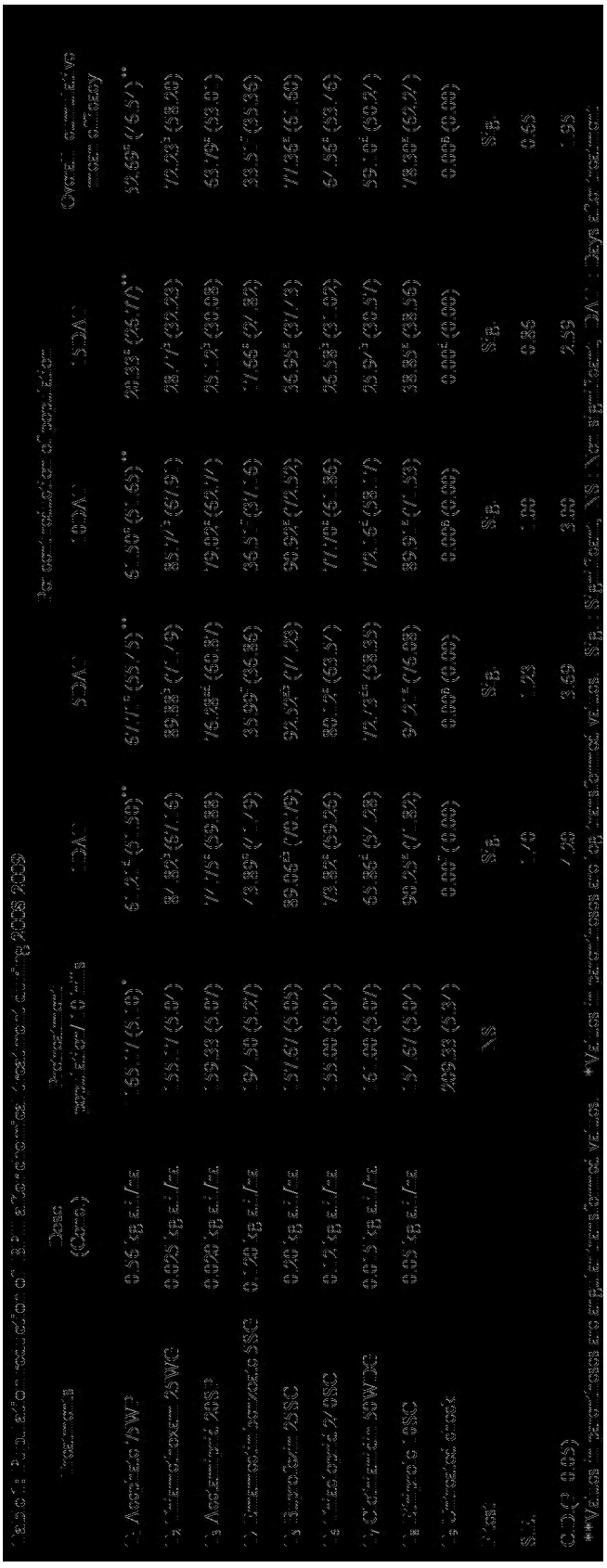

Table 2 : Population reduction of WBPH after chemical treatment during 2008-2009

Treatments	Dose (Conc.)	Pretreatment population/ 10 hills	Per cent reduction of population				
			1DAT	5DAT	10DAT	15DAT	Overall cumulative mean efficacy
T_1 Acephate 75WP	0.56 kg a.i./ha	180.83 (5.19)	64.29^{c} (53.31)**	73.26^{d} (58.87)**	70.36^{e} (57.03)**	25.35^{d} (30.21)**	58.31^{e} (49.79)**
T_2 Thiamethoxam 25WG	0.025 kg a.i./ha	131.00 (4.87)	82.72^{b} (65.46)	86.34^{b} (68.50)	83.94^{b} (66.39)	41.53^{a} (40.12)	73.63^{b} (59.11)
T_3 Acetamiprid 20SP	0.020 kg a.i./ha	144.83 (4.97)	70.51^{d} (57.12)	74.33^{d} (59.56)	76.92^{cd} (61.29)	30.10^{c} (33.26)	62.96^{d} (52.52)
T_4 Emamectin benzoate 5SG	0.120 kg a.i./ha	172.17 (5.15)	27.34^{f} (31.52)	37.16^{e} (37.54)	24.41^{f} (29.56)	10.68^{e} (19.08)	24.90^{f} (29.92)
T_5 Buprofezin 25SC	0.20 kg a.i./ha	134.50 (4.99)	88.03^{a} (69.78)	91.57^{a} (73.15)	89.54^{a} (71.15)	37.79^{b} (37.93)	76.73^{a} (61.16)
T_6 Thiacloprid 240SC	0.12 kg a.i./ha	144.83 (4.97)	75.07^{c} (60.05)	80.50^{c} (63.79)	78.84^{c} (62.62)	26.47^{d} (30.94)	65.22^{c} (53.86)
T_7 Clothianidin 50WDG	0.015 kg a.i./ha	147.33 (4.99)	69.97^{d} (56.77)	74.03^{d} (59.36)	73.63^{de} (59.12)	30.09^{c} (33.26)	61.93^{d} (51.90)
T_8 Ethiprole 10SC	0.05 kg a.i./ha	151.50 (5.02)	88.61^{a} (70.34)	92.05^{a} (73.67)	90.97^{a} (72.58)	39.15^{ab} (38.72)	77.69^{a} (61.83)
T_9 Untreated check		209.17 (5.34)	0.00^{g} (0.00)	0.00^{f} (0.00)	0.00^{g} (0.00)	0.00^{f} (0.00)	0.00^{g} (0.00)
F test		NS	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.			0.754	0.982	0.730	0.659	0.259
C.D.(P=0.05)			2.259	2.883	2.188	1.976	0.777

**Values in parentheses are angular transformed values. *Values in parentheses are log transformed values. Sig. : Significant, NS : Non significant, DAT : Days after treatment

Table 3 : Population reduction of GLH after chemical treatment during 2008-2009

Treatments	Dose (Conc.)	Pretreatment population/ 10 hills	Per cent reduction of population				
			1DAT	5DAT	10DAT	15DAT	Overall cumulative mean efficacy
T_1 Acephate 75WP	0.56 kg a.i./ha	231.50^{ab} (5.44)*	66.85^{f} (54.85)**	74.70^{f} (59.81)**	64.59^{f} (53.48)**	19.69^{d} (26.34)**	56.46^{f} (48.71)**
T_2 Thiamethoxam 25WG	0.025 kg a.i./ha	239.50^{def} (5.47)	86.31^{b} (68.29)	91.38^{b} (72.94)	85.55^{b} (67.66)	34.01^{b} (35.67)	74.31^{a} (59.55)
T_3 Acetamiprid 20SP	0.020 kg a.i./ha	223.83^{g} (5.41)	75.94^{d} (60.63)	84.55^{d} (66.86)	66.70^{e} (54.76)	26.66^{bc} (31.08)	63.46^{d} (52.81)
T_4 Emamectin benzoate 5SG	0.120 kg a.i./ha	263.83^{b} (5.57)	38.14^{g} (38.14)	43.09^{g} (41.02)	37.41^{g} (37.71)	12.48^{e} (20.64)	32.78^{g} (34.92)
T_5 Buprofezin 25SC	0.20 kg a.i./ha	229.16^{fg} (5.43)	88.57^{a} (70.24)	93.17^{a} (74.85)	89.06^{a} (70.69)	29.52^{a} (32.90)	75.08^{a} (60.05)
T_6 Thiacloprid 240SC	0.12 kg a.i./ha	242.66^{cd} (5.49)	76.87^{d} (61.26)	85.67^{d} (67.77)	73.84^{d} (59.25)	24.71^{c} (29.81)	65.27^{c} (53.89)
T_7 Clothianidin 50WDG	0.015 kg a.i./ha	250.00^{bc} (5.52)	73.53^{e} (59.04)	78.36^{e} (62.29)	64.27^{f} (53.29)	21.33^{d} (27.50)	59.37^{e} (50.40)
T_8 Ethiprole 10SC	0.05 kg a.i./ha	241.50^{cde} (5.48)	84.37^{c} (66.72)	89.54^{c} (71.15)	79.63^{c} (63.18)	27.30^{b} (31.50)	70.21^{b} (56.92)
T_9 Untreated check		277.33^{a} (5.62)	0.00^{h} (0.00)	0.00^{h} (0.00)	0.00^{h} (0.00)	0.00^{f} (0.00)	0.00^{h} (0.00)
F test		Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.		0.015	0.357	0.407	0.389	0.516	0.259
C.D.(P=0.05)		0.045	1.071	1.221	1.167	1.548	0.777

**Values in parentheses are angular transformed values. *Values in parentheses are log transformed values. Sig. : Significant, NS : Non significant, DAT : Days After Treatment

Table 4 : Grain yield in different chemical treatments in rice *Kharif* 2008-2009

Treatments	Dose	Mean yield per $25m^2$ (kg)	Mean yield per hectare (tonnes)	Per cent increase over control
T_1 Acephate 75WP	0.56 kg a.i./ha	10.60^{e}	4.24	36.07
T_2 Thiamethoxam 25WG	0.025 kg a.i./ha	12.47^{b}	4.98	60.03
T_3 Acetamiprid 20SP	0.020 kg a.i./ha	11.30^{d}	4.52	45.06
T_4 Emamectin benzoate 5SG	0.120 kg a.i./ha	9.07^{f}	3.62	16.39
T_5 Buprofezin 25SC	0.20 kg a.i./ha	12.83^{ab}	5.13	64.74
T_6 Thiacloprid 240SC	0.12 kg a.i./ha	11.87^{c}	4.75	52.33
T_7 Clothianidin 50WDG	0.015 kg a.i./ha	11.20^{d}	4.48	43.77
T_8 Ethiprole 10SC	0.05 kg a.i./ha	12.90^{a}	5.16	65.60
T_9 Untreated check		7.97^{g}	3.19	-
F test		Sig	-	-
S.E.±		0.19	-	-
C.D.(P=0.05)		0.56	-	-

Sig.- Significant

treatments were Acetamiprid @ 0.020 kg a.i./ha(63.45%), Clothianidin @ 0.015 kg a.i./ha (59.37%) and acephate @ 0.56 kg a.i./ha (56.46%) with more than 56 per cent reduction in GLH population over untreated control. Emamectin benzoate (0.12 kg a.i./ha) was the least effective with only 32.78 per cent reduction over control (Table 3).

Grain yield :

Ethiprole (0.05 kg a.i./ha) and Buprofezin (0.20 kg a.i./ha) recorded the highest grain yields of 5.16 t/ha, respectively and 5.13 t/ha and were on par with each other (Table 4). These results are in agreement with Varma *et al.* (2003). Bhavani and Rao (2005) reported buprofezin 25WP @ 50 g a.i./ha and 100 g a.i./ha to record higher yields (5.06 t/ha and 5.14 t/ha). The treatments which also recorded higher yields were Thiamethoxam (0.025 kg a.i./ha) (4.98 t/ha), Thiacloprid (0.12 kg a.i./ha) (4.75 t/ha), Acetamiprid (0.020 kg a.i./ha) (4.52 t/ha) and Clothianidin (0.015 kg a.i./ha) (4.48 t/ha).

The overall results on incidence of leaf and plant hoppers and grain yields revealed that Ethiprole (0.05 kg a.i./ha) and Buprofezin (0.20 kg a.i./ha) were found to be highly effective against BPH and WBPH. Buprofezin (0.20 kg a.i./ha) and Thiamethoxam (0.025 kg a.i./ha) were found to be highly effective against GLH. They also recorded higher yield *viz.,* 5.16 t/ha, 5.13 t/ha and 4.98 t/ha, respectively. Selective, need based applications with these newer insecticides molecules would accrue economic and sustainable rice yields to the farmers.

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