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Evaluation of Some Insecticides on Brown Plant Hopper *Nilaparvata lugens* (Stal.) and its Predators in Rice

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Abstract

A field experiment was undertaken for two cropping seasons during *kharif* of 2007 and 2008 to evaluate the toxicity of some insecticides against rice brown plant hopper (BPH) and its predators in rice (variety Swarna). The insecticide treatments included buprofezin 25 SC, imidacloprid 17.8 EC, spinoteram 12 SC, thiamethoxam 20 WG, acetamiprid 20 SP, acephate 75 SP and at 200; 45; 100; 40; 40 and 400 g a.i./ha, respectively along with an untreated control. It was revealed that buprofezin followed by imidacloprid; thiamethoxam and acetamiprid were much effective in suppressing the BPH population in rice. BPH/MB ratio was lowest in buprofezin which is favorable for the predators in both the seasons. Spider population was not significantly different from each other. However in *kharif* of 2008 spider population was higher in spinoteram and buprofezin treated plots with control ranging from 2.3 to 3.3 than the rest of the treatments after 20 DAS.

Key words : Brown plant hopper, Insecticides, *Nilaparvata lugens*, Predators.

Large scale cultivation of high yielding, fertilizer responsive and semi dwarf varieties lead to large scale out break of insect pests of rice. In India, 221 insect species feeding on rice were reported by Arora and Dhaliwal (1). Among the various insect pests infesting rice crop, brown plant hopper, *Nilaparvata lugens* (Stal.) (BPH) is a serious pest in several rice growing tracts of India. Chemical control is one of the effective means of checking this insect pest. With the continuous and large scale application of broad spectrum insecticides, it is rather difficult to control this pest. Many natural enemies are almost always present in the rice fields. Their role in suppressing insect population has long been considered. Mirid bug, *Cyrtorhinus lividipennis* (MB) preys on the eggs, nymph and adults of rice leaf hopper and plant hopper and has been considered an effective predator of BPH (2). In India about 20 species of spiders were observed preying on BPH. It was believed that these spiders could play an important role in keeping down BPH population under control. *Lycosa pseudoannulata*, a wolf spider, is one of the predominant spiders in the paddy field. In India *Lycosa* could kill about 15 to 20 adult BPH per day (3). The population of natural enemies associated with brown plant hopper is endangered due to indiscriminate uses of broad spectrum insecticides. Therefore need based and judicious applications of safer chemicals is now the urgent need of time. The present investigation was carried out to evaluate the efficacy of some new insecticides against brown plant hopper infesting rice and their effects on predators.

Methods

Field experiment was under taken for two cropping seasons during *kharif* of 2007 and 2008 in a randomized block design with eight treatments replicated three times at Sahebganj village (block Bhatar, district Burdwan, West Bengal). The treatments included buprofezin 25 SC, imidacloprid 17.8 EC, spinoteram 12 SC, thiamethoxam 20 WG, acetamiprid 20 SP, acephate 75 SP and at 200; 45; 100; 40; 40 and 400 g a.i./ha, respectively along with an untreated control. Rice variety Swarna (MTU-7029) was grown in plot of size 10 m × 10 m at spacing of 20 cm × 15 cm with recommended package of practices excluding plant protection. The insecticides are sprayed after a sufficient population was built up with a high volume knack sac sprayer using 500 liters of spray fluid per hectare. The control plot was sprayed with water only. Observations were taken on the number of BPH nymphs

Table 1. Effect of insecticides on BPH and predators in rice during *kharif* of 2007. Figures in parentheses are square root transformed values. Means followed by a common letter in a column are not significantly different from each other by LSD. DAS=Day after spraying, BPH=brown plant hopper, MB=mirid bug.

		Pretreatment				3 DAS				20 DAS			
Treatments	Dose (g a.i./ha)	BPH/ hill	MB/ hill	BPH/ MB	Spider/ hill	BPH/ hill	MB/ hill	BPH/ MB	Spider/ hill	BPH/ hill	MB/ hill	BPH/ MB	Spider/ hill
Imidacloprid 17.8 SL	45	49.7 (7.0)	4.7 (2.2)	10.6	2.3 (1.5)	6.0 (2.4)b	1.0 (1.0)c	6.0	1.3 (1.1)	8.0 (2.8)b	1.3 (1.1)c	6.0	1.3 (1.1)
Spinoteram	100	48.0 (6.9)	4.3 (2.1)	11.1	1.7 (1.3)	29.3 (5.4)d	3.7 (1.9)b	8.0	2.3 (1.5)	13.3 (3.6)c	2.3 (1.5)bc	5.7	2.3 (1.5)
Buprofezin 25SC	200	49.7 (7.0)	4.7 (2.2)	10.6	1.3 (1.1)	1.7 (1.3)a	1.7 (1.3)c	1.0	2.3 (1.5)	2.3 (1.5)a	1.0 (1.0)c	2.3	1.7 (1.3)
Acetamiprid 20 SP	40	49.3 (7.0)	4.7 (2.2)	10.6	2.3 (1.5)	17.3 (4.2)c	1.3 (1.1)c	13.0	1.3 (1.1)	13.0 (3.6)c	2.3 (1.5)bc	5.6	1.7 (1.3)
Thiomethoxam 25 WG	40	50.0 (7.1)	4.7 (2.1)	10.7	2.7 (1.6)	18.3 (4.2)c	1.3 (1.1)c	13.8	1.3 (1.1)	11.0 (3.3)bc	2.0 (1.4)bc	5.5	1.3 (1.1)
Acephate 75 SP	400	52.0 (7.2)	3.7 (1.9)	14.2	1.7 (1.3)	18.7 (4.3)c	1.0 (1.0)c	18.7	1.7 (1.2)	25.3 (5.0)d	3.3 (1.8)ab	7.6	2.0 (1.4)
Control	–	50.3 (7.1)	5.3 (2.3)	9.4	2.7 (1.6)	48.0 (6.9)e	5.3 (2.3)a	9.0	2.7 (1.6)	50.0 (7.1)e	5.3 (2.3)a	9.4	3.3 (1.8)
SE (±)		0.15	0.23		0.23	0.33	0.16		0.19	0.34	0.23		0.22
CD (P=0.05)	–	NS	NS		NS	0.72	0.35		NS	0.75	0.51		NS

and adults, found at the base of rice plants from ten randomly and diagonally taken hill of each plot leaving the border rows at one day before spraying and 3 and 20 days after sprayings. Number of nymphs and adults of mirid bug and spider were also recorded. Data recorded before and after the sprayings are statistically analyzed after suitable transformation and means are separated by LSD method (4).

Results and Discussion

Table 1 shows that the brown plant hopper (BPH), mirid bug (MB) and spider populations recorded before the insecticides application were not significantly different from control during *kharif* of 2007. On 3 DAS, BPH population/hill in buprofezin (1.7) and imidacloprid (4.0) were significantly lower as compared to the rest of the insecticides and control. In general mirid bug population was lower in all insecticides treated plots than untreated control on 3 DAS. However, in buprofezin the BPH/MB rato is best (1.3), followed by imidacloprid (4.0), whereas in control it was 8.2. After 3 days of spraying, no significant difference in spider population was noticed among the treatments. Upto 20 DAS all the insecticides significantly brought down the BPH population compared to control. Lowest BPH population was recorded in buprofezin (1.3) followed by imidacloprid (6.0), thiamethoxam (12.3) and acetamiprid (16), whereas in control it was 39.0. Mirid bug population/hill is significantly lower in all the treatments as compared to control (4.0). Consequently BPH/MB ratio was significantly lower in buprofezin (1.0) followed by imidacloprid (6.0) as compared to control (10.2). Spider population was higher in spinoteram and buprofezin treated plots with control ranging from 2.3 to 3.3 than the rest of the treatments.

In the *kharif* season of 2008 similar trend was observed (Table 2). In pretreatment populations of BPH, mind bug and spider were not significantly varied from control and BPH/MB ratio varied from 9.4 to 14.2. On 3 DAS BPH was lowest in buprofezin (1.7) followed by imidacloprid (6.0). Mirid bug population was significantly highest in control on 3 DAS, followed by spinoteram (3.7). On 3 DAS BPH/MB ratio was lowest in buprofezin (1.0) and highest in acephate (18.7) whereas in control it was 9.0. However, spider population was not significantly different from each other. After 20 days of spraying, lowest BPH population/hill was observed in buprofezin (2.3) followed by imidacloprid (8.0) and thiamethoxam (11.0) and highest mirid bug population was recorded in acephate (3.3) after control (5.3) than the rest of the treatments. BPH/MB ratio is lowest in buprofezin (2.3) which is

Table 2. Effect of insecticides on BPH and predators in rice during *kharif* of 2008. Figures in parentheses are square root transformed values. Means followed by a common letter in a column are not significantly different from each other by LSD. DAS=Day after Spraying, BPH=brown plant hopper, MB=mirid bug.

		Pretreatment				3 DAS				20 DAS			
Treatments	Dose (g a.i./ha)	BPH	MB	BPH/ MB	Spider	BPH	MB	BPH/ MB	Spider	BPH	MB	BPH/ MB	Spider
Imidacloprid 17.8 SL	45	25.0 (5.0)	2.0 (1.4)	14.8	1.7 (1.3)	4.0 (2.0)a	1.0 (1.0)b	4.0	1.3 (1.1)	6.0 (2.4)b	1.0 (1.0)c	6.0	1.0 (1.0)b
Spinoteram	100	30.0 (5.5)	2.7 (1.6)	11.7	1.3 (1.1)	14.7 (3.8)b	2.0 (1.4)b	8.4	1.3 (1.1)	21.0 (4.6)d	2.3 (1.5)b	9.5	2.3 (1.5)a
Buprofezin 25SC	200	25.0 (5.0)	2.0 (1.4)	12.5	2.0 (1.4)	1.7 (1.3)a	1.3 (1.1)b	1.3	1.3 (1.1)	1.3 (1.1)a	1.3 (1.1)c	1.0	2.3 (1,5)a
Acetamiprid 20 SP	40	24.0 (4.9)	2.3 (1.5)	10.6	2.3 (1.5)	14.0 (3.7)b	1.0 (1.0)b	14.0	1.0 (1.0)	16.0 (4.0)cd	1.3 (1.1)c	12.8	1.3 (1.1)b
Thiomethoxam 25WG	40	23.3 (4.8)	2.7 (1.6)	12.6	1.7 (1.3)	14.0 (3.7)b	1.3 (1.1)b	12.7	1.3 (1.1)	12.3 (3.5)c	1.0 (1.0)c	12.3	1.3 (1.1)b
Acephate 75 SP	400	30.7 (5.5)	2.0 (1.4)	18.4	2.0 (1.4)	12.0 (3.4)b	1.0 (1.0)b	12.0	1.3 (1.1)	20.7 (4.5)d	1.7 (1.3)bc	13.5	1.3 (1.1)b
Control	–	28.3 (5.3)	2.7 (1.6)	16.6	2.3 (1.5)	31.3 (5.6)c	4.0 (2.0)a	8.2	2.3 (1.5)	39.0 (6.2)e	4.0 (2.0)a	10.2	3.3 (1.8)a
SE (±)	–	0.28	0.29	–	0.17	0.34	0.18	–	0.18	0.29	0.17	–	0.16
CD (*P*=0.05)	–	NS	NS	–	NS	0.75	0.39	–	NS	0.62	0.36	–	0.35

favorable for the predators. This might be due to prey density dependent nature of mirid bug, *C. lividipennis*. Krishnaiah and Kalode (5) also observed prey density dependent nature of mirid bug, *C. lividipennis.*

Buprofezin is an insect growth regulator (IGR), slow in action but high degree of persistent toxicity is exhibited to nymphs of the rice brown plant hopper *Nilaparvata lugens* (BPH). It is safe to nymphs and adults of the natural enemies (6). Heinrichs et al. (7) also observed that buprofezin exhibited good degree of safety of MB, *C. lividipennis.* Thang et al. (8) observed that topically-applied buprofezin, inhibited the survival, growth and fecundity of *N. lugens* and had the least adverse effect on *L. pseudoannulata*, either from contact with treated plant surfaces or from ingestion of treated delphacids. Acephate reduced the growth and predation of the spider to some extent. Lakshmi et al. (9) concluded that thiamethoxam at 50 and 25 ppm is as safe for mirid bug on rice. The impact of new molecule thiamethoxam on the spider population in sugarcane ecosystem was studied by Vijayaraghavan and Regupathy (10) at various locations in Tamil Nadu, India. No marked decrease in the population reduction of spiders was noticed upon the application of thiamethoxam and imidacloprid. Thus the present finding is in agreement with the findings of earlier worker.

Conclusion

Thus it was revealed that buprofezin followed by imidacloprid, thiamethoxam and acetamiprid were much effective in suppressing the BPH population in rice. They have least adverse effect on the natural enemies like mirid bug and spiders and may be used in BPH management programme. However, spinoteram and acephate were also with less harmful effects on beneficial but they are not potent in suppressing the target pest.

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