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Eficacy of Pymetrozine 50 WG against brown planthopper *Nilaparvata lugens* (Stal) on paddy *Oryza sativa* L.

■ R. KIRANKUMAR

Department of Entomology, College of Agriculture, BHEEMRAYANGUDI (KARNATAKA) INDIA

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Corresponding author:
Email: kiran.r.cta@gmail.com

ABSTRACT

Efficacy of Pymetrozine 50 WG against brown planthopper of rice *Nilaparvata lugens* was evaluated under field conditions at Agricultural Research Station (AICRIP) Rice at, Siruguppa, Karnataka during *Kharif* 2011 and 2012. New insecticide Pymetrozine 50 WG was tested @200g, 250g, 300g, 350g and 400g a.i/ha against BPH *Nilapravata lugens* (Stal). Pymetrozine 50 WG @350g a.i/ha found significantly superior during the *Kharif* season of both the year 2011 and 12 and it is at par with Pymetrozine 50WG @400g.a.i/ha. Significant difference in natural enemy population recorded among all the treatments as compared to control. However population built up by natural enemies at 7DAS was at par with control and results revealed that Pymetrozine 50WG @ recommended dose of 350g a.i/ha was quite promising in reducing the population of brown plant hopper without any phytotoxicity symptoms and produced better yield.

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INTRODUCTION

Rice is a major food crop of India covering the largest area of about 44 million hecaters and with annual production of about 95 million tones. In ordered to meet the growing demand of every increasing population, we need to produce 1 million tones of more rice every year. But the rice production is limited by both biotic and abiotic stresses of which insect pests alone cause about 25 per cent of losses amounting to Rs. 240,138 million (Dhaliwal *et al.*, 2007). Hence we also need to reduce the yield losses due to major pest and diseases. Over 100 species of insect attack feed on rice crop from nursery to maturity and also in storage. Of these a dozen are consistently reported as major pests of economic importance, though the damage caused by them varies in time and space. The major reasons for low productivity in India are the losses due to insect pests, diseases and weeds. Insects pests alone are responsible for 10-25 per cent yield losses in India. Pest out break causing total loss of crop are occurring regularly albeit in small areas (Anonymous, 2008).

Rice planthopper *Nilaparvata lugens* occupy the major status as pest and cause considerable yield damage to the rice cultivation in almost all the seasons through out the rice growing stages. Three species of planthoppers reported on rice 1) Brown planthopper (BPH) *Nilaprvata lugens* (Stal), 2) White backed planthopper (WBPH) *Sogatella furcifera* (Horvath) and 3) Smaller brown plant hopper(SBPH), *Laodelphax striatellus* (Fallen) has also been reported (Shukla, 1979). First two of them are economic importance, besides direct damage to the crop, BPH and SBPH also transmit viral diseases like rice grassy stunt, rice ragged stunt and yellowing syndrome, their by causing very severe yield losses (Sogawan *et al.,* 2003). Chemical method is still a major method of suppressing *N. lugens* population in India, because *N. lugens* has developed significant resistance to imidaclopird and other conventional insecticides since 2005 in India and other Asian countries. So there is need for chemicals which is most effective on insects, less toxic to mammals and effective at lower quantity will be the best substitute to older chemicals in integrated pest management. Under present situation Pymetrozine 50 WG one such insecticide rice growers may use to apply in rice fields for control of *N. lugens*.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural Research Station, Siruguppa, Karnataka, in deep block soil under irrigated conditions during *Kharif* 2011 and 2012. The objective of the experiment was to determine the efficacy of pymetrozine 50 WG in comparison with other insecticides against brown planthopper, *Nilaparvata lugens* (Stal). The new insecticide, pymetrozine 50 WG was tested at five dosages *viz.,* @ 200g, 250g, 300g, 350g and 400g a.i/ha was compared with standard check, buprofezin 500 ml / ha and an untreated control. The experiment was laid out in Randomized Block Design with three replications. The rice seedlings of variety, BPT- 5204 (susceptible to BPH) was planted at 20 cm x 10 cm spacing. The crop was raised as per standard recommended package of University of Agricultural Sciences, Raichur. Treatments were imposed based on economic threshold level. Initial counts of nymphs and adults of rice plant hoppers were made a day before the application of insecticides. Five sample sites were fixed at equal intervals along the middle line of each plot. At each site, all nymphs and adults on two hills were gently tapped into a white tray and immediately counted. BPH adults were distinguished as much as possible from those of the white backed planthopper (WBPH), *Sogatella furcifera* (Howarth) at the time of counting, both their nymphs were pooled. After the application of insecticides, planthopper densities (count per two hill sample) were monitored at weekly interval. Field sampling was always terminated prior to 9:30 am. As insects tend to fall in to the paddy field, the counts of living ones were used for computing field efficacies of all treatments. The plant hopper counts were made at one day before and 3 days and 7 days after insecticidal application on 10 randomly selected hills in each plot starting from 30th DAP till 55th DAP to know the comparative efficacy of new insecticides Pymetrozine 50 WG. The yield was recorded separately from each plot and then converted into hectare basis.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented in Fig. 1 to 10 and Plate 1 to 5.

Homogeneous populations of brown planthopper *Nilaparvata lugens* (Stall) observed one day before spray during *Kharif* 2011 (22.37- 26.37/hill) and *Kharif* 2012 (56.28-66.77/hill) (Table1); the significant reduction in population of *Nilaparvata lugens* observed in all the insecticidal treatments compared to control at 3 days and 7 days after application. Excellent result at 7 days after spray pymetrozine 50 WG @350 g a.i/ha established superiority over others by recording BPH population @ (6.00/hill) as compared to control (61.33/hill) with 90.22 per cent reduction and it is at par with pymetrozine 50 WG@ 400 g a.i/ha recorded population@ (5.75/hill). Population decreases with increase in dose of application of pymetrozine 50 WG from 200g - 400g a.i/ha noticed both at 3 days and 7 days after application. Similar observations were also recorded during *Kharif* 2012 at 7 days after spray pymetrozine 50 WG @350 g a.i/ha recorded significantly lowest population @6.75/hill and it is at par with pymtrozine 50 WG @400 g a.i/ha recorded population (6.48/hill) during *Kharif* 2012 with 90.58-90.96 per cent reduction over control. This treatment was followed by pymetrozine 50 WG@200g, 250g and 300 g a.i/ha recorded@72.21,75.09 and 90.23 per cent reduction over control at 7 days after spray. This result was also in conformity with Sato *et al.* (1996) in Japan, who observed excellent control of both BPH and WBPH under field conditions due to application of

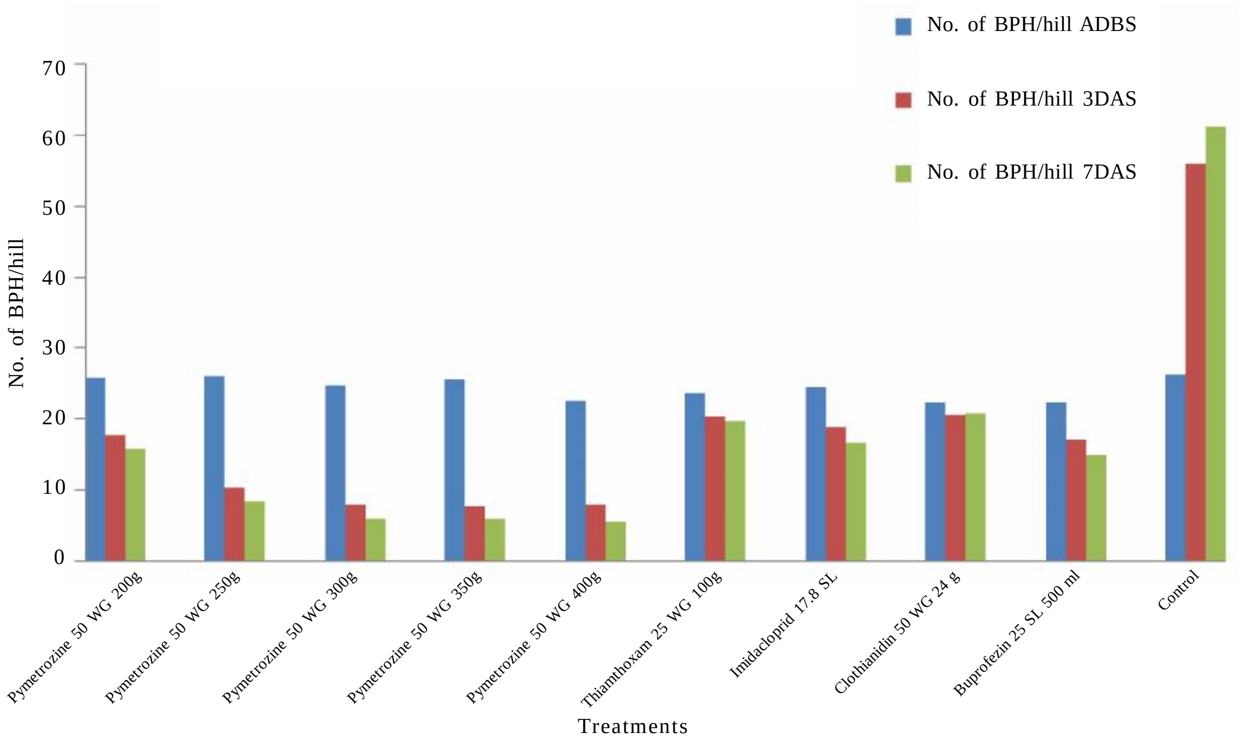

Fig. 1 : Bioefficacy of pymetrozine 50 WG against BPH on paddy k-2011

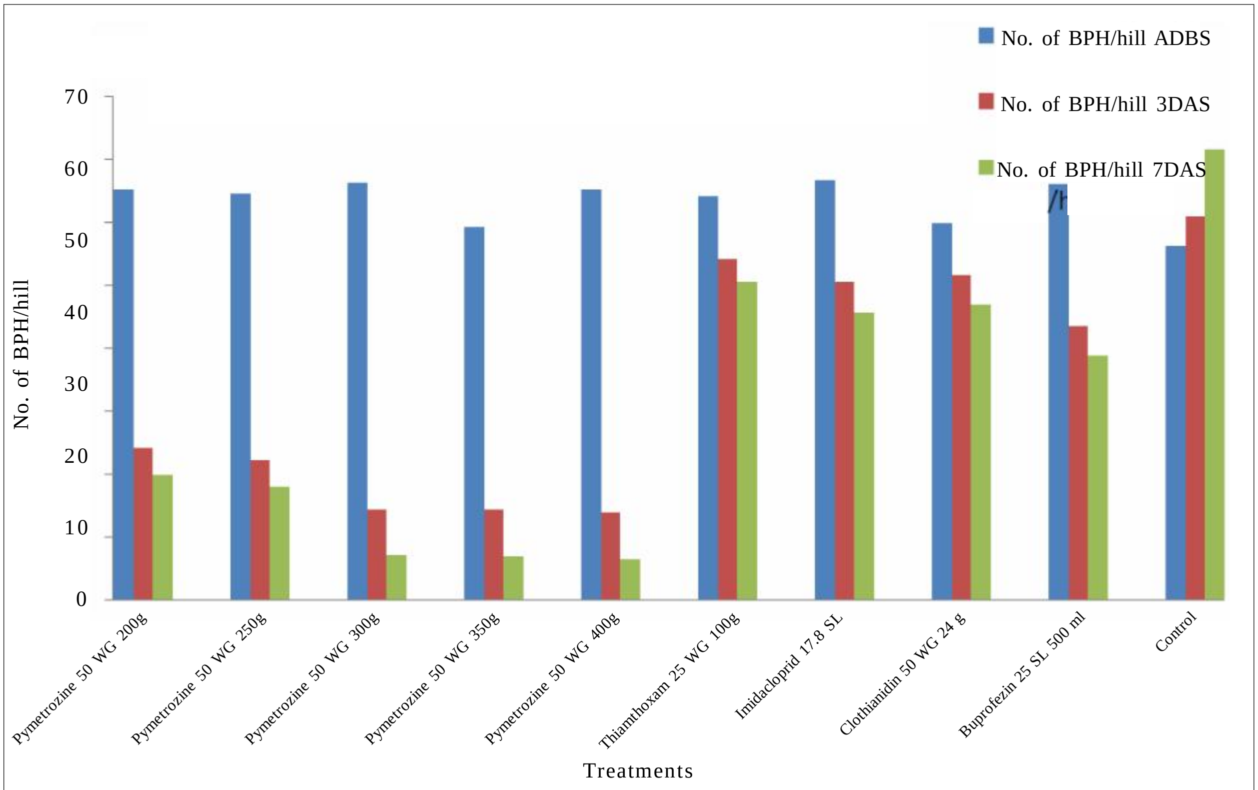

Fig. 2 : Bioefficacy of pymetrozine 50 WG against BPH on paddy k-2012

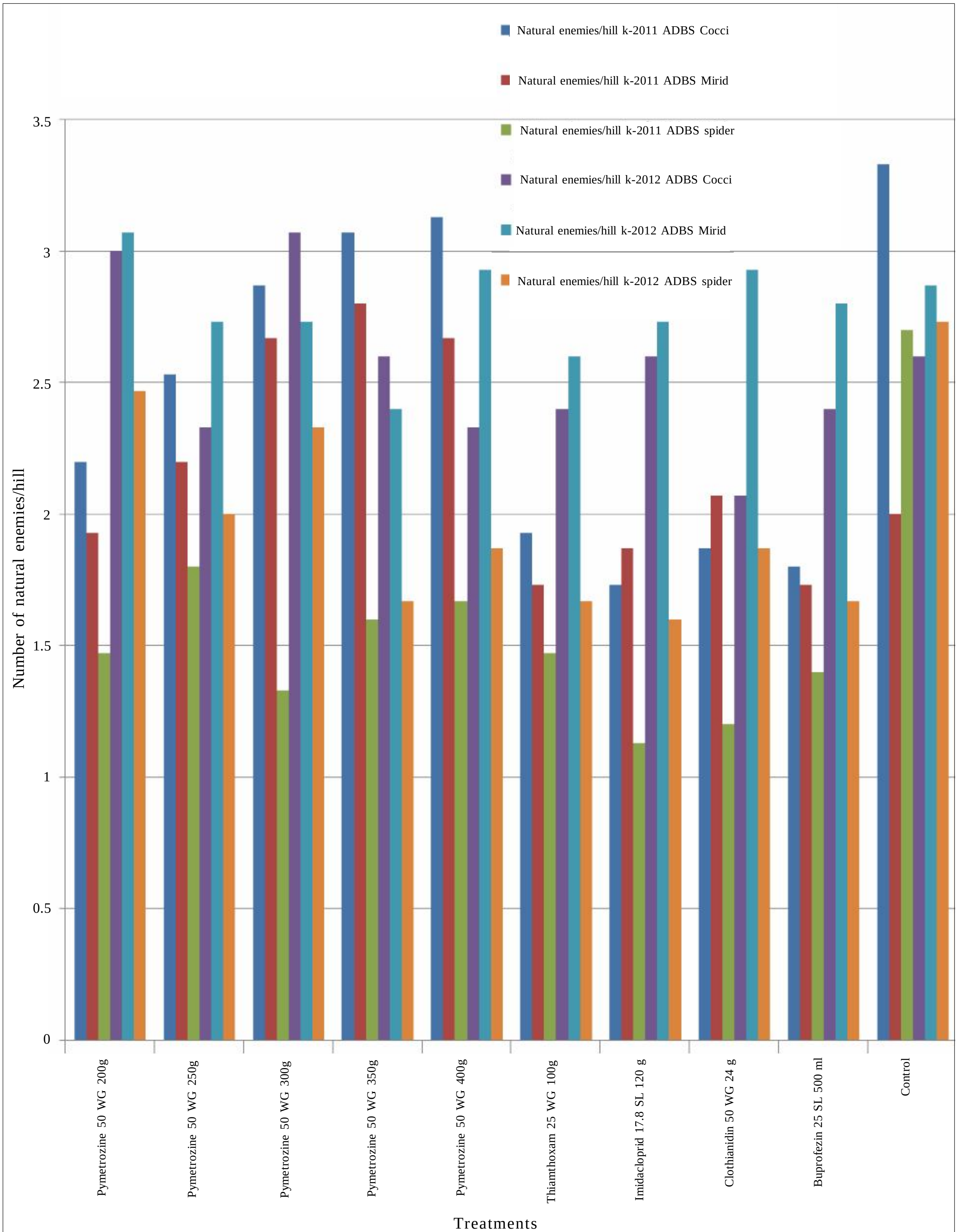

Fig. 3 : Bioefficacy of pymetrozine 50 WG against natural enemies of BPH on paddy at 1 day before spray k-2011-12

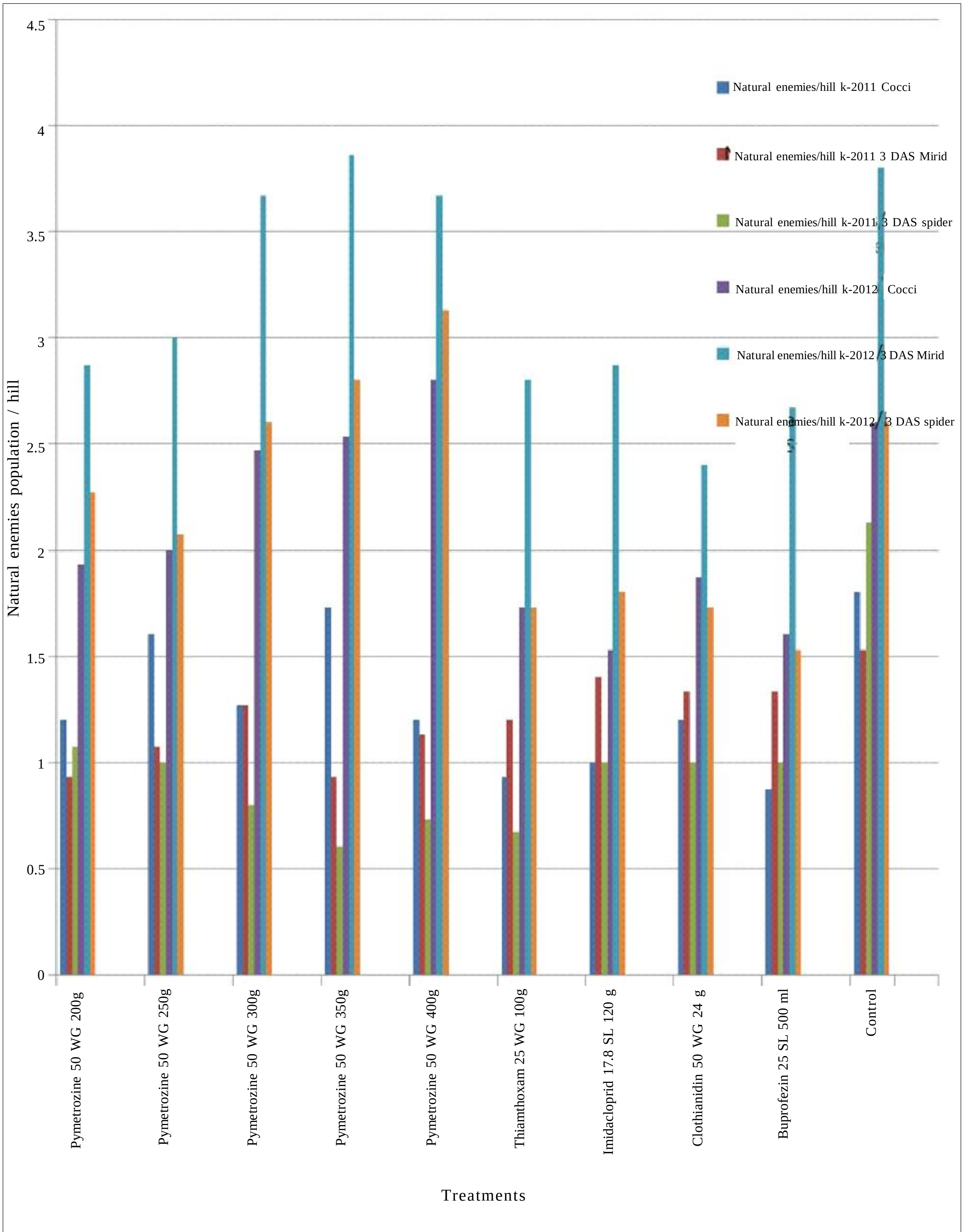

Fig. 4 : Bioefficacy of pymetrozine 50 WG against natural enemies of BPH on paddy at 3 day after spray k-2011-12

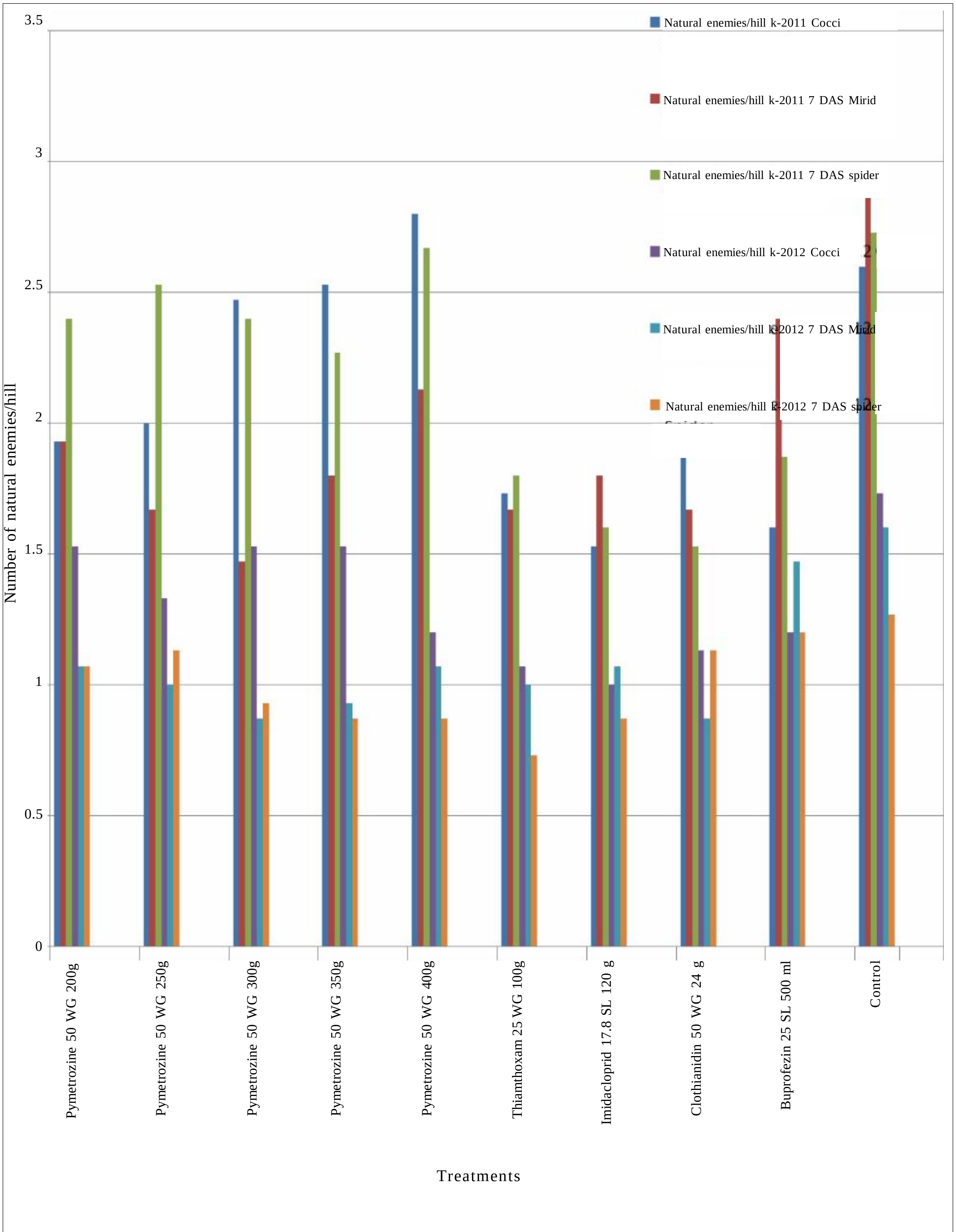

Fig. 5 : **Bioefficacy of pymetrozine 50 WG against BPH natural enemies on paddy at 7 DAS k-2011-12**

pymetrozine at as low as 63 g a.i/ha. The results were also in agreement with Kontsedalov and Horowitz, 2003) strongly confirmed the potential effectiveness and residual reduction of carbosulfan, pymetrozine and thiamethoxam to control aphids. The aphids have become important pest problem in vegitables world wide. After three days of its application thiamethoxam, carbosulfan and pymetrozine were the highest once giving >90 per cent residual reduction. These results were also in full agreement with Poloston and Sherwood (2003), who confirmed that pymetrozine, represents a new type of insecticides with a high selectivity for plant sucking insects. It can be applied in various ways after the feeding behaviour in all aphid species as well as whiteflies. After five days post treatment, thiamethoxam and pymetrozine were the most effective compound in reducing the infestation of *Bemisia tabaci* giving 81.52 per cent and 80.64 per cent, respectively. After 3, 5, 7 and 10 days thiamethoxam and pymetrozine were the most effective treatments in reducing the number of whitefly adult.

Among the insecticides tested thiamethoxam @100 g a.i/ha and clothianidin@24 g a.i/ha were least effective followed by imidacloprid@125 g a.i/ha. Earlier Misra (2005) who reported that clothianidin @25 g a.i/ha and ethiprole @50 g a.i/ha were the best in suppressing BPH at 15 DAS. Raghu Ramudu and Misra (2006) found that clothianidin @25 g a.i/ha was the best and combination product acetaimiprid 0.4 per cent+ chlorpyriphos 20 per cent EC was on par with clothianidin.

The population of natural enemies *viz.*, coccinellids, mirid bugs and spider populations are recorded separately. Showed no significant differences among the insecticidal treatments and untreated control at 1 day before pray and at 3 and 7 days after spray during both the years of the same seasons (Table 2). Significant difference in natural enemies populations recorded among all the treatments as compared to untreated control at 3 DAS. However population built up by natural enemies at 7 DAS was at par with untreated control. Observations recorded by Misra and Parida (2004) noticed that initial reduction

Table 1 : Bioefficacy of Pymetrozine 50 WG aginst brown planthopper *Nilaparvatha lugens*(Stal) on paddy

Sr. No.	Treatments	Dosage g/ml/ha	No. of BPH/hill k-2011			% reduction over control	No. of BPH/hill k-2012			% reduction over control	Yield kg/ha 2011	Yield kg/ha 2012
			ADBS	3DAS	7DAS		ADBS	3DAS	7DAS			
1.	Pymetrozine 50WG	200g	25.95 (5.14)	17.92 (4.30)	15.83 (4.04)	74.19	65.22 (8.11)	24.17 (5.00)	19.91 (4.52)	72.21	5431.47	4444.42
2.	Pymetrozine 50WG	250g	26.22 (5.17)	10.52 (3.32)	8.48 (3.00)	86.18	64.73 (8.08)	22.15 (4.76)	17.85 (4.30)	75.09	5568.14	4640.48
3.	Pymetrozine 50WG	300g	24.95 (5.04)	8.17 (3.01)	6.10 (2.57)	90.06	66.45 (8.19)	14.40 (3.90)	7.00 (2.74)	90.23	6247.77	4682.20
4.	Pymetrozine 50WG	350g	25.75 (5.12)	7.90 (2.90)	6.00 (2.55)	90.22	59.37 (7.80)	14.28 (3.85)	6.75 (2.70)	90.58	6898.14	5011.64
5.	Pymetrozine 50WG	400g	22.75 (4.90)	8.07 (2.93)	5.75 (2.50)	90.63	65.28 (8.12)	13.78 (3.78)	6.48 (2.65)	90.96	7315.17	5502.69
6.	Thiamthoxam 25 WG	100g	23.78 (5.00)	20.60 (4.60)	19.77 (4.81)	67.77	64.20 (8.04)	54.10 (7.40)	50.66 (7.15)	29.28	5654.43	4281.92
7.	Imidacloprid 17.8 SL	125g	24.60 (5.01)	18.92 (4.41)	16.76 (4.15)	72.68	66.77 (8.21)	50.60 (7.15)	45.76 (6.80)	36.12	5558.88	4439.14
8.	Clothianidin 50 WG	24g	22.40 (4.80)	20.77 (4.62)	20.90 (4.63)	65.93	59.93 (7.80)	51.52 (7.22)	46.91 (6.90)	34.24	5498.88	4244.70
9.	Buprofezin 25SL	500ml	22.37 (4.80)	17.27 (4.22)	15.13 (4.00)	75.34	66.05 (8.16)	43.45 (6.63)	38.86 (6.30)	45.53	4361.47	5164.42
10.	Control	------	26.37 (5.18)	56.00 (7.52)	61.33 (7.90)		56.28 (7.54)	61.00 (7.84)	71.63 (8.50)		3854.44	3159.70
	S.E.±	-----	1.38	1.24	1.05		3.28	0.63	0.89		538.14	123.04
	C.D. (P=0.05)	-----	NS	3.67	3.13		NS	1.88	2.65		737.38	371.76
	CV	-----	9.79	11.50	10. 36		8.97	5.64	7.95		8.06	4.72

Note: Values in bracket are √ X+0.5 square root transformed values, DAS: Days after spray, NS=Non-significant

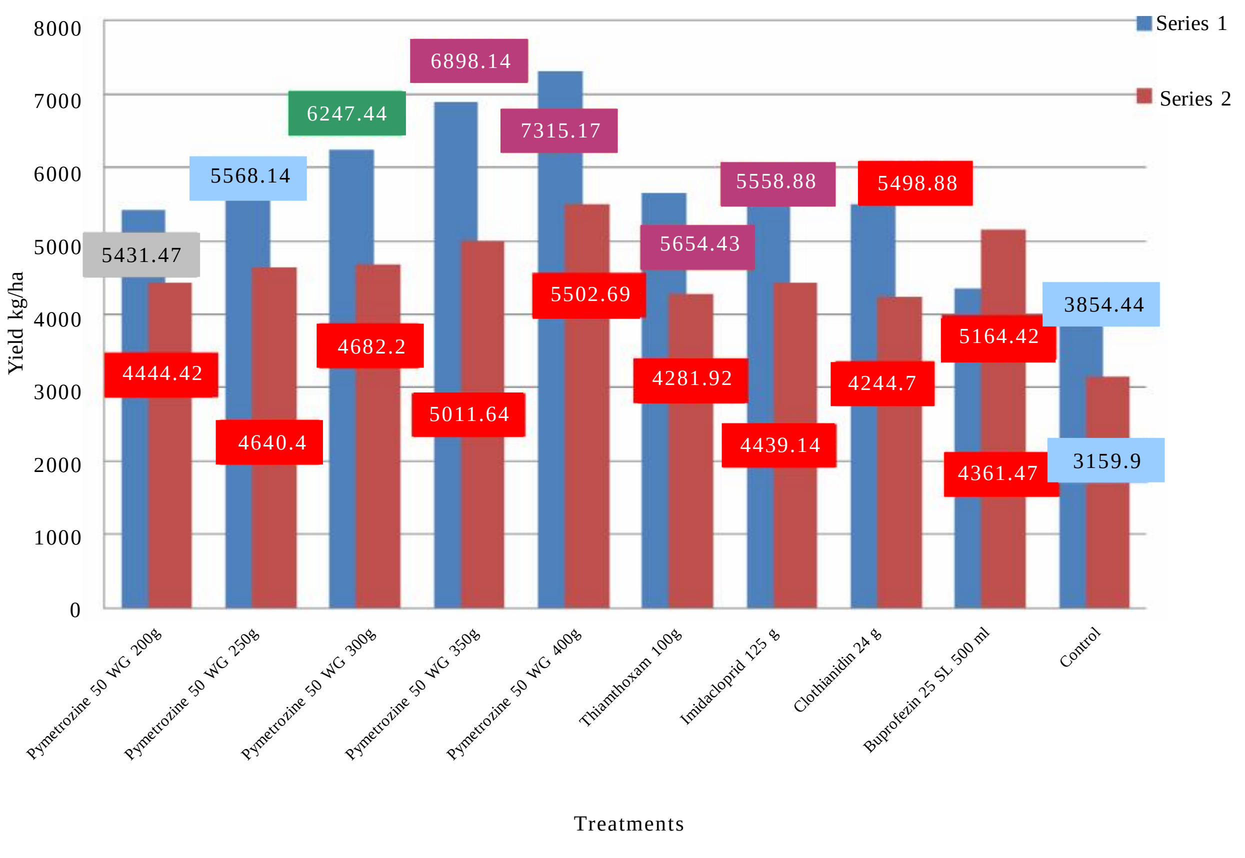

Fig. 6 : Bioefficacy of pymetrozine 50 WG against BPH yield kg/ha k-2011-12

Plate 1 : BPH infested paddy plot showing hopper burn symptom

Plate 2 : BPH infested paddy crop with hopper burn

Table 2 : Bio efficacy of Pymetrozine 50WG against natural enemies on paddy *Kharif*-2011 and 12

Sr. No.	Treatments	Dosage gm/ ml/ha	ADBS K-2011			Natural enemies k-2011						ADBS K-2012			Natural enemies k-2012					
						3DAS			7DAS						3DAS			7DAS		
			Cocci	Mirid	Spider	Cocci	Mirid	Spider	Cocci	Mirid	Spider	Cocci	Mirid	Spider	Cocci	Mirid	Spider	Cocci	Mirid	Spider
1.	Pymetrozine 50WG	200g	2.20	1.93	1.47	1.20	0.93	1.07	1.93	1.93	2.40	3.00	3.07	2.47	1.53	1.07	1.07	1.93	2.87	2.27
			(1.64)	(1.56)	1.40	(1.30)	(1.19)	(1.25)	(1.56)	(1.56)	(1.71)	(1.88)	(1.90)	(1.72)	(1.42)	(1.25)	(1.25)	(1.56)	(1.84)	(1.67)
2.	Pymetrozine 50WG	250g	2.53	2.20	1.80	1.60	1.07	1.00	2.00	1.67	2.53	2.33	2.73	2.00	1.33	1.00	1.13	2.00	3.00	2.07
			(1.74)	(1.64)	1.51	(1.45)	(1.25)	(1.22)	(1.59)	(1.48)	(1.74)	(1.69)	(1.80)	(1.59)	(1.36)	(1.22)	(1.28)	(1.59)	(1.83)	(1.60)
3.	Pymetrozine 50WG	300g	2.87	2.67	1.33	1.27	1.27	0.80	2.47	1.47	2.40	3.07	2.73	2.33	1.53	0.87	0.93	2.47	3.67	2.60
			(1.84)	(1.80)	1.36	(1.31)	(1.33)	(1.14)	(1.72)	(1.40)	(1.71)	(1.90)	(1.80)	(1.69)	(1.42)	(1.18)	(1.19)	(1.72)	(2.04)	(1.77)
4.	Pymetrozine 50WG	350g	3.07	2.80	1.60	1.73	0.93	0.60	2.53	1.80	2.27	2.60	2.40	1.67	1.53	0.93	0.87	2.53	3.80	2.80
			(1.90)	(1.82)	1.45	(1.50)	(1.19)	(1.04)	(1.74)	(1.51)	(1.67)	(1.77)	(1.71)	(1.48)	(1.42)	(1.19)	(1.18)	(1.74)	(2.07)	(1.82)
5.	Pymetrozine 50WG	400g	3.13	2.67	1.67	1.20	1.13	0.73	2.80	2.13	2.67	2.33	2.93	1.87	1.20	1.07	0.87	2.80	3.67	3.13
			(1.91)	(1.80)	1.48	(1.31)	(1.28)	(1.40)	(1.82)	(1.62)	(1.80)	(1.69)	(1.86)	(1.54)	(1.30)	(1.25)	(1.18)	(1.82)	(2.04)	(1.91)
6.	Thiamthoxam 25 WG	100g	1.93	1.73	1.47	0.93	1.20	0.67	1.73	1.67	1.80	2.40	2.60	1.67	1.07	1.00	0.73	1.73	2.80	1.73
			(1.56	(1.50)	1.40	(1.20)	(1.30)	(1.09)	(1.50)	(1.48)	(1.51)	(1.71)	(1.77)	(1.48)	(1.25)	(1.22)	(1.11)	(1.50)	(1.82)	(1.56)
7.	Imidacloprid 17.8 SL	125g	1.73	1.87	1.13	1.00	1.40	1.00	1.53	1.80	1.60	2.60	2.73	1.60	1.00	1.07	0.87	1.53	2.87	1.80
			(1.50)	(1.54)	1.78	(1.25)	(1.38)	(1.22)	(1.42)	(1.51)	(1.45)	(1.77)	(1.80)	(1.45)	(1.22)	(1.25)	(1.18)	(1.42)	(1.84)	(1.51)
8.	Clothianidin 50 WG	24g	1.87	2.07	1.20	1.20	1.33	1.00	1.87	1.67	1.53	2.07	2.93	1.87	1.13	0.87	1.13	1.87	2.40	1.73
			(1.54)	(1.60)	1.30	(1.31)	(1.36)	(1.22)	(1.54)	(1.48)	(1.42)	(1.60)	(1.86)	(1.54)	(1.28)	(1.18)	(1.28)	(1.54)	(1.71)	(1.50)
9.	Buprofezin 25SL	500ml	1.80	1.73	1.40	0.87	1.33	1.00	1.60	2.40	1.87	2.40	2.80	1.67	1.20	1.47	1.20	1.60	2.67	1.53
			(1.51)	(1.50)	1.38	(1.17)	(1.36)	(1.22)	(1.45)	(1.71)	(1.54)	(1.71)	(1.82)	(1.48)	(1.30)	(1.40)	(1.30)	(1.45)	(1.80)	(1.42)
10.	Control	------	3.33	2.00	20.7	1.80	1.53	2.13	2.60	2.87	2.73	2.87	2.53	2.87	1.73	1.60	1.27	2.60	3.80	2.60
			(1.96)	(1.59)	(1.60)	(1.52)	(1.42)	(1.62)	(1.77)	(1.84)	(1.80)	(1.84)	(1.74)	(1.84)	(1.50)	(1.45)	(1.33)	(1.77)	(2.07)	(1.77)
S.Em±		-----	0.13	0.08	0.23	0.13	0.17	0.13	0.09	0.09	0.10	0.83	0.95	1.04	0.14	0.11	0.15	0.15	0.17	0.09
CD(P= 0.05)		-----	NS	NS	NS	0.41	0.50	0.41	NS	NS	NS	NS	NS	NS	0.44	0.34	0.46	NS	NS	NS

Note: Values in parantheses are $\sqrt{x+0.5}$ square root transformed values, DAS: Days after spray, NS=Non-significant

Plate 3 : Paddy hill infested by BPH

Plate 5 : BPH infested paddy field with "Hopperburn" symptom

Plate 4 : BPH nymph and adult infested hill

in spider population in rice after sparaying several combination of insecticides, but natural enemy population built up asusual two weeks after imposition of treatments.

It is reported that clothianidin @ 25g.a.i/ha was effective in suppressing WBPH population. Insecticidal evaluation trial of All India Co-ordinated Entomology programme (DRR, 2003) revealed that neonicotinoid *viz.*, imidacloprid @ 25g.a.i/ha and clothianidin @12.5g.a.i/ha were superior in controlling brown planthoppers.

Thus it may concluded that the new molecule pymetrozine 50WG @350.g.a.i/ha was the most effective insecticide in controlling BPH of rice and it is at par with its higher dose (400g.a.i/ha). Buprofezin @500ml/ha, imidacloprid 125g.a.i/ha, clothianidin 24g.a.i/ha and thiamethoxam 100g.a.i/ha were the next best effective treatments. However all the insecticides tested were found safer to the natural enemies at 3DAS and 7DAS during the same seasons of the both the year 2011-12.

Findings of the second season related to efficacy lend further supported to the observations recorded in the first season that pymterozine 50 WG @ 350- 400 ga.i/ha provided excellent control of BPH along with significant increase in yield over untreated control. Both the dosage recorded yield @ 6898.14-7315.17kg/ha and 5011.64- 5502.69 kg/ha during the year 2011 and 12 kharif season, respectively.

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