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Bio-efficacy of novel insecticides and pymetrozine 50% WG against insect pests of paddy

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ABSTRACT

A field experiment was conducted in Randomized Block Design with three replications of eight treatments during *Kharif* season 2014 at Chirori university research centre, SardarVallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to evaluate the effect of some novel insecticides against insect pests of paddy. Efficacy of seven insecticides *viz.*,Pymetrozine 50% WG (GSP sample) @ 250, 300 and 400 g/ha, Pymetrozine 50% WG (market sample) @ 300 g/ha, Imidacloprid 17.8% SL @ 125 ml/ha and Fipronil 5% SC@ 1500 ml/hatasted against green leaf hopper (*Nephotettixvirescens*), Brown plant hopper (*Nilaparvatalugens*) and White backed plant hopper (*Sogatellafurcifera*). The results of the experiment showed that Pymetrozine 50% WG (GSP sample) @ 300 and 400 g/ha and Pymetrozine 50% WG (Market sample) @ 300 g/ha effectively controlled BPH, GLH and WBPH pests followed by Imidacloprid 17.8% SL @ 125 ml/ha and Fipronil 5% SC @ 1500 ml/ha. No phytotoxicity symptoms on paddy crop and no adverse effect on natural enemies were recorded due to application of treatments. Since Pymetrozine 50% WG @ 300 g/ha was equally effective to 400 g/ha dose.

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INTRODUCTION

Paddy is one of the important *Kharif* crops in western Uttar Pradesh. The crop is not only suffered with a number of diseases and insect pests, it also competes with weeds to get its share of nutrients, water, sunlight etc. Rice is one of the most important and extensively grown foods in the tropical and subtropical regions of the world (Saxena and Shrivastava, 2007). Worldwide rice is grown on a total area of around 151 mha and total world production is about 602 mt annually (IRRI, 2006).India has the largest acreage under rice, about 44.6 m ha of land with a production of about 90 MT (Roy *et al.,* 2013). About 100 species of insects

have been reported to attack rice crop in India, out of which 20 have been found to be the major pest including brown plant hopper (BPH), *Nilaparvatalugens* (Stal), white backed plant hopper (WBPH), *Sogatellafurcifera* (Horvath), yellow stem borer (YSB), *Scirpophagain certulas* (Walker) and rice leaf folder, *Cnaphalocrocisme dinalis* (Guenee), which cause 21 to 51 per cent yield loss in different rice agro-ecosystems (Singh and Dhaliwal, 1994 and Mathur *et al.*, 1999). About 25-30 per cent reduction in yield of rice had been calculated caused by yellow stem borer (YSB), brown plant hopper (BPH), white backed plant hopper (WBPH) and rice leaf folder in India (Pasalu *et al.*, 2002).Amongst insect pests, stem borer, leaf folder, brown plant hopper, green leaf hopper, white backed plant hopper, gall midge, whorl maggot, etc. are most prevalent in the area, which are capable to reduce a substantial quantity of quality yield. To control the insect pests a number of insecticides have been evaluated and found effective. In the present study bio- efficacy of Pymetrozine 50 % WG (a newly introduced insecticide), was evaluated for the control of brown plant hopper (BPH), green leaf hopper (GLH) and white backed plant hoper (WBPH) in paddy. The evaluation of the product for phytotoxicity to the crop, if any and adverse effect on the natural enemies associated with the crop ecosystem was also carried out.

MATERIAL AND METHODS

The experiment was laid out in Randomized Block Design (RBD). The healthy nursery of rice variety 'PB 1121' manually transplanted on July 24, 2014. There were eight treatments along with untreated (control), each with three replications. Row to row and plant to plant spacing was 30 cm and 15 cm, respectively. Normal fertilizers doses and recommended agronomical practices were adopted. The treatments were applied on establishment of hoppers population in the experimental plots. Pymetrozine 50% WG (GSP sample) @ 250, 300 and 400 g/ha, Pymetrozine 50% WG (market sample) @ 300 g/ha, Imidacloprid 17.8% SL @ 125 ml/ha and Fipronil 5% SC @ 1500 ml/ha were sprayed on the crop by knapsack sprayer fitted with hollow cone nozzle using spray volume @ 500 lit/ha. The treatments were repeated two times more at an interval of 15 days. The populations of hopper pests for pre-treatment and at 1, 3, 7 and 14 days after each spray were recorded on randomly selected 5 hills per plot. The plot wise yield was recorded at harvest and converted to q/ha. The observations for the effect of Pymetrozine 50% WG (GSP sample) along with other treatments on the natural enemies were recorded by counting the population of prevailing predators/5 hills in all the plots one day before first spray and 3 and 7 days after each spray. The observations for phytotoxicity evaluation of Pymetrozine 50% WG (GSP sample) and other treatments on paddy crop were recorded visually for the parameters like leaf injury on tips/ surface, wilting, vein clearing, necrosis, epinasty and hyponasty at 1, 3, 7, 10 and 14 days after each spray. The data recorded during the course of investigation were subjected to statistical analysis by using analysis of variance technique (ANOVA) for Randomized Block Design to compare means of different treatments as suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Bio-efficacy of novel insecticides:

The population of BPH has been presented in Table 1 for each spray. The population recorded one day before spray was ranging from 77.67 to 96.00/5 hills. The data showed that difference in population was non-significant hence the hopper population was uniformly established in the experimental plots. The hopper population reduced by the application of treatments significantly. Next spray was applied when pest population started re-building up. Over all comparison of treatments showed that Pymetrozine 50% WG (GSP sample) @ 300 and 400 g/ha was equally effective. Next effective treatments were Pymetrozine 50% WG (Market sample) @ 300 g/ha, Fipronil 5% SC@1500 ml/ha and Imidacloprid 17.8% SL@125 ml/ha. The population decreased considerably during third spray and no population was recorded 14 days after third spray in all the treatments. The present finding in agreement with the findings of Pathak *et al.* (2003); Dhaka *et al.* (2011) and Prasad *et al.* (2005) who reported fipronil 5 SC as the best treatment in reducing the infestation of insect pests in rice.

The population of GLH has been presented in Table 2 for each spray. The population recorded one day before spray was ranging from 28.00 to 38.67/5 hills. The data showed that the incidence of the GLH was low as

compared to BPH. The difference in population was non-significant hence, the hopper population was uniformly established in the experimental plots before first spray. The hopper population reduced by the application of all the treatments significantly. Next spray was applied when pest population started re-establishment. Over all comparison of treatments showed that Pymetrozine 50% WG (GSP sample) @ 300 and 400 g/ha was equally effective to Pymetrozine 50% WG (Market sample) @ 300 g/ha. Next effective treatments were Fipronil 5% SC @ 1500 ml/ha and Imidacloprid 17.8% SL @ 125 ml/ha. The population decreased considerably during third spray in all the treatments. The present findings corroborated the findings of Panda *et al*. (2004); Satyanarayana *et al*. (2014) and Rath (2011) who reported that most of the new insecticides were effective in controlling the insect pest of paddy.

The population of WBPH has been presented in Table 3 for each spray. The population recorded one day before spray was ranging from 196.67 to 262.33/5 hills. The data showed that the incidence of the WBPH was low than BPH but higher than GLH. The difference in population was non-significant hence, the hopper population was uniformly established in the experimental plots before first spray. The hopper population reduced by the application of all the treatments significantly. Spray was repeated as the pest population started re-establishment. Over all comparison of treatments showed that Pymetrozine 50% WG (GSP sample) @ 300 and 400 g/ha was equally effective to Pymetrozine 50% WG (Market sample) @ 300 g/ha, Imidacloprid 17.8% SL @ 125 ml/ha and Fipronil 5% SC @ 1500 ml/ha. The population decreased considerably after second spray in all the treatments. Earlier workers like Uthamasamy and Kuruppuchamy (1988); Dash *et al.* (1996) and Firake and Karnatak (2010) had similar observation like present investigation of effective control of rice pests. No similar work of Pymetrozine 50% WG has been reported in case of paddy crop.

The paddy grain yield was recorded from each plot and for comparison of results yield also converted to q/ha (Table 4), the yield data has been presented in Table

Table 1: Bio efficacy of different insecticides on population of brown plant hopper (BPH) during *Kharif* 2014

Treatments	Formul-ation (ml or g/ha)	Pre spray	BPH population/5 hills											
			First spray				Second spray				Third spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
Pymetrozine 50% WG (GSP sample)	250	85.00 (9.21)	70.67 (8.40)	55.33 (7.41)	49.33 (7.02)	93.00 (9.61)	73.00 (8.51)	55.33 (7.42)	44.67 (6.67)	21.33 (4.59)	24.33 (4.98)	14.33 (3.84)	12.00 (3.50)	7.00 (2.69)
Pymetrozine 50% WG (GSP sample)	300	78.67 (8.86)	63.67 (7.97)	44.33 (6.64)	31.33 (5.59)	64.67 (7.94)	48.33 (6.94)	38.00 (6.16)	29.00 (5.38)	13.33 (3.62)	13.00 (3.67)	4.00 (1.93)	5.33 (2.39)	0.67 (1.00)
Pymetrozine 50% WG (GSP sample)	400	77.67 (8.77)	63.00 (7.90)	43.67 (6.60)	25.00 (4.97)	43.00 (6.53)	32.33 (5.67)	30.33 (5.49)	23.67 (4.83)	8.00 (2.80)	8.67 (3.02)	3.67 (1.83)	1.67 (1.39)	1.00 (1.10)
Pymetrozine 50% WG (market sample)	300	96.00 (9.79)	70.00 (8.35)	49.33 (7.01)	29.67 (5.42)	54.67 (7.37)	38.33 (6.16)	35.67 (5.96)	28.00 (5.28)	9.67 (3.09)	9.67 (3.15)	6.00 (2.54)	2.67 (1.72)	2.00 (1.56)
Imidacloprid 17.8% SL	125	97.00 (9.83)	80.67 (8.98)	54.67 (7.38)	33.33 (5.75)	64.67 (8.02)	41.00 (6.34)	35.33 (5.93)	31.33 (5.59)	19.00 (4.35)	16.00 (4.04)	10.00 (3.23)	3.00 (1.71)	1.67 (1.25)
Fipronil 5% SC	1500	91.33 (9.55)	70.00 (8.35)	50.33 (7.09)	33.67 (5.79)	60.00 (7.70)	38.67 (6.15)	35.00 (5.90)	30.67 (5.50)	20.00 (4.46)	12.33 (3.56)	7.00 (2.72)	5.67 (2.47)	1.67 (1.39)
Control (untreated)	–	85.33 (9.23)	111.00 (10.52)	116.00 (10.75)	131.00 (11.44)	236.33 (15.34)	248.33 (15.74)	242.00 (15.54)	214.33 (14.63)	201.67 (14.19)	166.00 (12.89)	128.67 (11.35)	101.67 (10.10)	83.67 (9.17)
S.E.±		(0.31)	(0.35)	(0.39)	(0.31)	(0.61)	(0.50)	(0.37)	(0.34)	(0.32)	(0.27)	(0.38)	(0.36)	(0.37)
C.D. (P=0.05)		(NS)	(1.08)	(1.20)	(0.95)	(1.88)	(1.53)	(1.13)	(1.04)	(1.00)	(0.82)	(1.16)	(1.12)	(1.13)

*Figures in parentheses are square root transformed values; DAS = Days after spraying; ** Average of three replications NS= Non-significant

Table 2: Bio efficacy of different insecticides on population of green leaf hopper (GLH) during *Kharif* 2014

Treatments	Formul-ation (ml or g/ha)	Pre spray	First spray				Second spray				Third spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
Pymetrozine 50% WG (GSP sample)	250	28.00 (5.30)	20.00 (4.52)	13.67 (3.74)	28.67 (5.38)	64.33 (8.04)	50.67 (7.11)	37.67 (6.13)	34.33 (5.85)	84.33 (9.18)	56.33 (7.53)	33.67 (5.84)	10.33 (3.28)	1.33 (1.18)
Pymetrozine 50% WG (GSP sample)	300	30.33 (5.34)	15.00 (3.94)	10.67 (3.34)	12.33 (3.54)	34.67 (5.92)	26.00 (5.04)	21.00 (4.54)	18.67 (4.31)	54.67 (7.38)	35.33 (5.97)	21.33 (4.67)	1.33 (1.18)	0.00 (0.71)
Pymetrozine 50% WG (GSP sample)	400	33.00 (5.74)	12.00 (3.52)	4.33 (2.00)	9.00 (3.06)	26.33 (5.14)	21.67 (4.65)	15.67 (3.95)	12.67 (3.55)	36.67 (6.04)	27.33 (5.27)	17.67 (4.26)	2.67 (1.61)	0.00 (0.71)
Pymetrozine 50% WG (market sample)	300	38.67 (6.19)	18.33 (4.32)	11.00 (338)	11.67 (3.48)	32.00 (5.67)	22.67 (4.62)	19.00 (4.34)	22.67 (4.74)	55.33 (7.42)	34.33 (5.90)	25.00 (5.04)	4.00 (1.93)	0.00 (0.71)
Imidacloprid 17.8% SL	125	28.67 (5.39)	20.00 (4.52)	11.00 (3.38)	15.67 (3.97)	39.67 (6.34)	28.33 (5.31)	21.67 (4.63)	26.00 (5.09)	50.33 (7.06)	47.00 (6.88)	30.33 (5.55)	2.00 (1.32)	2.00 (1.32)
Fipronil 5% SC	1500	34.33 (5.83)	22.33 (4.73)	12.67 (3.62)	16.33 (4.08)	42.33 (6.52)	32.33 (5.64)	26.67 (5.16)	35.00 (5.89)	56.67 (7.48)	44.67 (6.71)	31.00 (5.57)	3.67 (1.79)	1.00 (1.10)
Control (untreated)	–	30.67 (5.49)	41.67 (6.40)	38.00 (6.20)	68.67 (8.31)	95.00 (9.76)	121.67 (11.03)	113.33 (10.61)	134.67 (11.59)	174.33 (13.19)	177.00 (13.32)	163.00 (12.79)	100.67 (10.04)	74.67 (8.66)
S.E ±		(0.65)	(0.42)	(0.33)	(0.31)	(0.36)	(0.45)	(0.37)	(0.31)	(0.43)	(0.26)	(0.24)	(0.52)	(0.37)
C.D.(P=0.05)		(NS)	(1.29)	(1.00)	(0.95)	(1.11)	(1.40)	(1.13)	(0.95)	(1.33)	(0.80)	(0.73)	(1.62)	(1.13)

*Figures in parentheses are square root transformed values; DAS = Days after spraying; ** Average of three replications NS= Non-significant

4. The yield in Pymetrozine 50% WG (GSP sample) @ 400 g/ha was maximum 55.19 q/ha) which was at par with Pymetrozine 50% WG (GSP sample) @ 300 g/ha 47.16 q/ha and Pymetrozine 50% WG (market sample) @ 300 g/ha 46.20 q/ha. The yields in other treatments were comparatively low but more than control. A similar result on yield component was reported by Jena and Mayabini (2004) and Dhaka *et al.* (2011).

Effect on natural enemies :

The population of natural enemies prevailing in the crop was observed periodically (Table 5). Spiders and coccinellids were more prevalent than other predators. Hence, observations recorded for these predators only have been presented in the report. The population before first spray and after 3 and 7 days of each spray are presented in Table 5. Population of spiders recorded before first spray was in the range of 5.00 to 10.33/5

Table 3: Effect of different insecticides on population of white backed plant hopper (WBPH) during *Kharif* 2014

Treatments	Formul-ation (ml or g/ha)	Pre spray	First spray				Second spray				Third spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
Pymetrozine 50%	250	236.00	201.00	163.00	113.00	210.67	135.33	75.33	43.00	21.67	16.00	7.33	0.00	0.00
WG (GSP sample)		(15.34)	(14.12)	(12.70)	(10.63)	(14.49)	(11.65)	(8.70)	(6.59)	(4.70)	(4.04)	(2.79)	(0.71)	(0.71)
Pymetrozine 50%	300	226.67	151.67	118.00	84.00	174.33	98.67	54.67	28.00	7.67	0.67	0.00	0.00	0.00
WG (GSP sample)		(15.04)	(12.31)	(10.86)	(9.15)	(13.16)	(9.94)	(7.40)	(5.33)	(2.54)	(1.00)	(0.71)	(0.71)	(0.71)
Pymetrozine 50%	400	196.67	136.67	97.33	70.00	156.33	81.67	45.00	16.00	3.67	0.00	0.67	0.00	0.00
WG (GSP sample)		(13.98)	(11.67)	(9.85)	(8.36)	(12.47)	(9.05)	(6.74)	(3.99)	(1.87)	(0.71)	(1.00)	(0.71)	(0.71)
Pymetrozine 50% WG (market sample)	300	242.00 (15.52)	156.00 (12.48)	111.00 (10.52)	82.00 (9.05)	165.33 (12.85)	102.67 (10.13)	58.00 (7.64)	21.67 (4.61)	9.00 (2.63)	1.67 (1.39)	1.67 (1.25)	0.00 (0.71)	0.00 (0.71)
Imidacloprid	125	262.33	207.67	150.67	99.00	186.33	101.33	71.00	32.67	15.33	9.33	3.67	0.00	0.00
17.8% SL		(16.19)	(14.39)	(12.26)	(9.94)	(13.62)	(10.06)	(8.44)	(5.73)	(3.93)	(3.13)	(1.86)	(0.71)	(0.71)
Fipronil 5% SC	1500	217.00	199.67	152.33	108.00	223.33	129.00	66.67	33.67	22.00	16.00	7.00	0.00	0.00
		(14.72)	(14.11)	(12.34)	(10.37)	(14.89)	(11.37)	(8.15)	(5.81)	(4.72)	(4.03)	(2.60)	(0.71)	(0.71)
Control (untreated)	–	231.33	250.67	276.67	216.33	316.67	250.33	191.67	171.67	132.67	99.67	91.67	75.67	57.33
		(15.20)	(15.83)	(16.63)	(14.58)	(17.77)	(15.83)	(13.85)	(13.10)	(11.53)	(10.00)	(9.58)	(8.72)	(7.60)
S.E. ±		(0.57)	(0.49)	(0.50)	(0.63)	(0.71)	(0.40)	(0.37)	(0.47)	(0.68)	(0.26)	(0.42)	(0.12)	(0.06)
C.D. (P=0.05)		(NS)	(1.50)	(1.53)	(1.95)	(2.19)	(1.25)	(1.15)	(1.45)	(2.09)	(0.79)	(1.29)	(0.37)	(0.18)

*Figures in parentheses are square root transformed values; DAS = Days after spraying; ** Average of three replications NS= Non-significant

Table 4: Paddy grain yield in different treatments during *Kharif* 2014

Treatments	Formulation (ml or g/ha)	Paddy grain yield	
		kg/plot	q/ha
Pymetrozine 50% WG (GSP sample)	250	9.90 (3.15)	39.61 (6.29)
Pymetrozine 50% WG (GSP sample)	300	11.79 (3.43)	47.16 (6.87)
Pymetrozine 50% WG (GSP sample)	400	13.80 (3.71)	55.19 (7.43)
Pymetrozine 50% WG (market sample)	300	11.55 (3.40)	46.20 (6.79)
Imidacloprid 17.8% SL	125	11.06 (3.33)	44.25 (6.65)
Fipronil 5% SC	1500	10.82 (3.29)	43.29 (6.58)
Control (untreated)	–	8.24 (2.87)	32.96 (5.74)
S.E. ±		(0.06)	(0.12)
C.D. (P=0.05)		(0.18)	(0.37)

*Figures in parentheses are square root transformed values; ** Average of three replications

hills. There was no adverse effect of treatments on the population of spiders after 3 and 7 days of first and second spray as in most of the cases difference was not significant. During third spray the population was low which may be due to low population of pests and maturity of crops. The population of coccinellids was low than spiders in the experimental plots before first spray. Which was in the range of 2.47 to 4.67/5 hills. There was no significant difference in the population during first and second spray in different treatments. Similar to the population of spider, the population of coccinellids was also low during third spray. It may be stated Pymetrozine 50% WG (GSP sample) and also other treatments were not toxic to natural enemies prevailing in the paddy crop ecosystem.The present studies are in conformity with several workers *viz.*, Bhavani and Rao (2005) and Kadam *et al.* (2005) and who reported the maximum number of spider populations in the plot treated with neem oil spray and NSKE and also with Pandey *et al.* (1992) and Dhaka *et al.* (2011) who also reported fipronil 0.3 GR and cartap hydrochloride 4G a bit safer for the spiders.

Phytotoxicity :

The crop was observed after application of treatments for phytotoxicity parameters. The symptoms like leaf injury on tips/ surface, wilting, vein clearing, necrosis, epinasty and hyponasty were not noticed in the crop when observed 1, 3, 7, 10 and 14 days after each spray visually. Thus, Pymetrozine 50% WG (GSP sample) also applied @ 600 g/ha and all other treatments were not phytotoxic to paddy crop. Similar work releted to the present ivestigation was also carried out by Bhavani and Rao (2005); Firake and Karnatak (2010); Jena and Mayabini (2004); Pandey *et al*. (1992); Pathak *et al.* (2003) and Satyanarayana *et al*. (2014).

Conclusion:

The results of the experiment showed that Pymetrozine 50% WG (GSP sample) @ 300 and 400 g/ha and Pymetrozine 50% WG (Market sample) @ 300 g/ha effectively controlled BPH, GLH and WBPH pests followed by Imidacloprid 17.8% SL @ 125 ml/ha and Fipronil 5% SC @ 1500 ml/ha. No phytotoxicity symptoms on paddy crop and no adverse effect on natural enemies were recorded due to application of treatments. Since

Table 5: Population of spiders during different sprays during *Kharif* 2014

Treatments	Formulation (ml or g/ha)	Spiders population/5 hills							Coccinellids population/5 hills						
		Pre spray	First spray		Second spray		Third spray		Pre spray	First spray		Second spray		Third spray	
			3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS		3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS
Pymetrozine 50% WG (GSP sample)	250	10.33 (3.25)	4.67 (2.26)	4.33 (2.18)	3.67 (2.02)	1.33 (1.27)	2.00 (1.47)	1.33 (1.29)	4.33 (2.18)	4.67 (2.26)	3.67 (2.02)	3.00 (1.86)	2.00 (1.56)	0.67 (1.00)	1.33 (1.29)
Pymetrozine 50% WG (GSP sample)	300	5.00 (2.23)	5.67 (2.47)	4.33 (2.16)	1.67 (1.39)	3.33 (1.93)	1.67 (1.39)	1.67 (1.44)	5.67 (2.47)	4.33 (2.18)	5.33 (2.39)	3.00 (1.81)	1.67 (1.39)	0.33 (0.88)	1.33 (1.27)
Pymetrozine 50% WG (GSP sample)	400	5.67 (2.47)	3.67 (1.91)	4.67 (2.18)	2.33 (1.57)	2.00 (1.47)	2.00 (1.43)	2.00 (1.47)	5.33 (2.39)	3.33 (1.94)	4.67 (2.26)	3.33 (1.93)	2.00 (1.52)	1.00 (1.17)	0.67 (1.00)
Pymetrozine 50% WG (market sample)	300	6.33 (2.49)	4.00 (1.93)	3.33 (1.88)	2.33 (1.54)	3.67 (2.00)	2.33 (1.57)	2.67 (1.72)	4.67 (2.22)	2.67 (1.77)	2.67 (1.61)	3.33 (1.90)	2.67 (1.77)	0.33 (0.88)	1.00 (1.17)
Imidacloprid 17.8% SL	125	5.33 (2.18)	6.00 (2.53)	3.00 (1.86)	3.67 (2.04)	3.00 (1.71)	2.00 (1.56)	1.00 (1.10)	5.33 (2.36)	3.33 (1.85)	4.67 (2.26)	4.33 (2.18)	1.67 (1.39)	0.00 (0.71)	1.67 (1.46)
Fipronil 5% SC	1500	7.33 (2.76)	2.00 (1.56)	3.67 (1.97)	0.33 (0.88)	1.67 (1.35)	2.00 (1.47)	2.33 (1.64)	5.67 (2.48)	4.00 (2.10)	2.67 (1.74)	3.00 (1.79)	2.67 (1.74)	1.33 (1.27)	1.00 (1.17)
Control (untreated)	–	7.67 (2.84)	8.67 (3.02)	7.00 (2.72)	5.33 (2.39)	5.00 (2.32)	3.33 (1.93)	3.33 (1.88)	5.33 (2.39)	6.33 (2.60)	6.33 (2.61)	5.00 (2.32)	4.67 (2.26)	2.67 (1.76)	1.67 (1.39)
S.E. ±		(0.45)	(0.37)	(0.33)	(0.32)	(0.39)	(0.40)	(0.35)	(0.28)	(0.22)	(0.22)	(0.30)	(0.28)	(0.23)	(0.30)
C.D. (P=0.05)		(NS)	(NS)	(NS)	(0.98)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)

*Figures in parentheses are square root transformed values; DAS = Days after spraying; ** Average of three replications NS= Non-significant

Pymetrozine 50% WG @ 300 g/ha was equally effective to 400 g/ha dose, it is suggested to use the product @ 300 g/ha control BPH, WBPH and GLH in paddy crop as there will be no advantage to use the product at higher dose.

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