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Original Research Article

Bio-efficacy of Spinetoram 0.8% GR against Paddy Yellow Stemborer *Scirphophaga incertulus* (Order: Lepidoptera Family: Pyralidae)

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A B S T R A C T

The present investigation was conducted in *kharif* 2017 and 2018 at ARS, Gangavathi, to evaluate the efficacy insecticide, *viz*., Spinotetram 0.8% GR at different dose rates against yellow stem borer, *Scirpophaga incertulas* infesting rice. The pooled data on the efficacy of different treatment schedules of Spinotetram 0.8% GR against major insect pest of Rice *i.e.* Stem borer. All the treated plots provided significant reduction of pest infestation along with significant yield increase but the best protection was obtained from the plots treated with Spinotetram 0.8% GR @ 70g/ha and Spinotetram 0.8% GR @ 65g/ha followed by Spinotetram 0.8% GR @ 60g/ha and Cartap Hydrochloride 4% GR @ 1000g/ha. All the treatments were on par with each other and significantly superior over the other comparative treatments and untreated control regarding pest control.

Keywords

Cartap hydrochloride, Efficacy, Spinetoram, Yellow stem borer

Introduction

Rice is the staple food crop in India and stood first among the various other food crop cultivated in India and on rice grains are rich in protein (gluten (8.1%), vitamins, minerals, fibers (2.2%) and with a major component of carbohydrates (77.1%) with a total of 349 calories. Rice crop is highly sensitive to many insect pests (Singh and Singh, 2015 & Singh and Singh, 2017). Fletcher (1920) listed 35 species including 10 serious ones feeding on paddy in India. Insect pests that are of major economic significance in Karnataka are yellow stem borer (*Scirpophaga incertulas* Walker), leaf folder (*Cnaphalocrocis medinalis* Guenee), brown planthopper (*Nilaparvata lugens* Stal.), white backed planthopper (*Sogatella furcifera* Horvath), case worm (*Nymphula depunctalis* Guenee) and green leafhopper (*Nephotettix virescens* Dist.) etc. Major factor attributes towards changes in the pest infestation are extensive cultivation of high yielding varieties, growing varieties lacking resistance to major pests, intensified rice cultivation throughout the year providing constant niches for pest multiplication. Indiscriminate use of fertilizers, particularly the application of high level of nitrogenous fertilizers, non-judicious use of insecticides resulting in pest resistance to insecticides, and pest resurgence lead to the outbreak of minor become major pest (Prakash *et al*., 2014). The major insect pests of rice are stemborer like yellow stem borer – YSB (*Scirphophaga incertulas*) is the most destructive pest found all over the world. In India, the losses incurred by different insect pests are reported to the tune of 55.12 million rupees which in turn workout to 18.16 per

cent of total losses. Out of this, 20 to 30 per cent damage is alone done by yellow stem borer, *Scirpophaga incertulas* (Walker) (Lal, 1996). The yellow stem borer *Scirpophaga incertulas* (Walker) has assumed the number one pest status and attacks the rice crop at all stages of its growth (Pasulu *et al*., 2002). It causes dead hearts at the active tillering stage and white ears at the harvest stage, which can lead to complete failure of the crop (Karthikeyan and Purushothaman, 2000). The infestation of these insects in our field is easily diagnosed by dead heart or white ear in hills at vegetative stage and panicle at reproductive stages respectively (Sulagitti *et al.,* 2018). In the early seventies and eighties organophosphates like monocrotophos and acephate, carbamate like carbaryl and fenobucarb and other derivatives like ethofenprox have been extensively used in India as well as other countries. Nevertheless, these pests became resistant to these insecticides in most of the countries including India (Sarupa *et al.*, 1998), along with this insecticides have created several environmental problems, as a result, the concept of integrated pest management (IPM) has gained importance over the years. But still, farmers are showing more reliance on insecticides as they show an immediate result. The indiscriminate use of many insecticides forced the government to impose a ban on many insecticides which ignited the use of newer insecticides with a diversified mode of action. There fore an effort has been made in the present investigation to evaluate the new insecticide molecule such as Spinetoram 0.8% GR at different doses against rice yellow stem borer.

Materials and Methods

An experiment was carried out at Agricultural Research Station, Gangavathi, Karnataka for two seasons during *kharif* 2017 and *kharif* 2018 to evaluate the bioefficacy of spinetoram 0.8% GR against yellow stem borer of paddy in a randomized block design with six treatments and four replications. Treatment details are given in table 1.

Insecticides application as soil and sprays were taken up based on seasonal occurrence and Economic Threshold Level (ETL) of stem borer and leaf folder. Two sprays were taken at an interval of 10 days.

Observation

Observations were made for the stem borer counts were taken on the number of dead hearts from 10 randomly selected hills before one day and 3, 7 and 10 days after each spray. While data on white ear head was taken at 15 days before harvesting. Data collected during two years of cropping period (2017 & 2018) were pooled into single and were subjected to ANOVA after transforming them into arcsine value, then the per cent reduction over control (ROC) was calculated after each spray by a standard formula. The data on grain yield at maturity were recorded from each plot, converted to a hectare basis and subjected to ANOVA.

Impact on yield

The yield in each treatment was recorded separately and subjected to statistical analysis to test the significance of mean yield variation in different treatments.

Results and Discussions

Data obtained from two seasons were pooled and subjected for statistical analysis, the results were mentioned in the below table 2. The values transformed into arcsine transformation, then per cent reduction over control was calculated after each spray. The details of the experimental results were given below.

Stem borer, *Scirpophaga incertulas* (Walker)

From pooled data of 2017 and 2018, it was clear that the dead heart was uniform over all the treatments before the application of insecticides (5.32-5.42 % dead heart/hill) (Table 2). After the imposition of the treatments, there was a reduction in the dead heart symptom was noticed in all the treatments except the untreated control. Observation recorded during 10 days after spray (DAS) indicates that the dead heart symptom was lower (1.61 % dead heart/hill) in the plot treated with Spinetoram 0.8% GR @ 70 *g a.i/ha*, which is at par with its second lower dose Spinetoram 0.8% GR @ 65 *g a.i/ha.* which recorded a 2.33 % dead heart per hill (Table 2). Which is followed by Spinetoram 0.8% GR @ 60 *g a.i/ha* 3.05% dead heart/hill. The same trend was followed even after 20 days after spraying, after 20 days of spraying dead hear symptom was lower (1.69 % dead heart/hill) in the plot treated with Spinetoram 0.8% GR @ 70 *g a.i/ha* with 86.52 per cent reduction over control. The highest (12.54 % dead heart/hill) dead heart symptom was recorded in the untreated plot.

Regarding white ear head lowest (1.63 %) was recorded in the plot treated with Spinetoram 0.8% GR @ 70 *g a.i/ha.* with 88.43 per cent reduction over control and it was on par with Spinetoram 0.8% GR @ 65 *g a.i/ha* with 2.15 % white ear head and 84.25 per cent reduction over control. Among three dose of spinetoram 0.8% GR @ 60, 65 and 70 *g a.i/ha*., 65 *g a.i/ha* is on par with spinetroam 0.8% GR 70 *g.a.i/ha*. Hence spinetoram 0.8 % GR @ 65 *g a.i.ha* is considered as the best treatment over the rest of the other treatment. The lower dose of spinetoram 0.8% GR @ 60 g a.i/ha is on par with chlorantriniliprole 0.4% GR @ 40 *g a.i.ha.*

Impact on natural enemies

From pooled data of 2017 and 2018, it was found that the natural enemy population was decreased after the chemical spray in all the plots except the untreated plot where the population of natural enemies was increased throughout the cropping period (Table 3). But the present tested chemical does not found to be hazardous on the plant, only the population of natural enemies was reduced due to the spray of insecticides. The results were corroborated with earlier findings Suri and Makkar (2017) who reported that there is a less population of natural enemies in insecticide-treated plot compared to an untreated plot. Karthikeyan *et al.,* (2008) also reported that insecticides treatment caused a significant decrease in natural enemy population this was in line with earlier findings Murray and Lloyd (1997), he reported the population of natural enemies was less in insecticides treated plot.

Impact on yield

The yield obtained from two seasons was pooled and from pooled data, it was confirmed that the yield was higher in all the treatments over the untreated plot (Table 3). The highest yield was noticed in spinetoram 0.8 % GR @ 70 *g a.i.ha* (74.68 q/ha), it was followed by the same chemical of its lower dose @ 65 *g a.i.ha* (73.03 q/ha), it was followed by lower dose @ 60 *g a.i.ha* (68.59 q/ha) and lowest yield was recorded in the controlled plot (42.18 q/ha).

The present study was in line with Snigdha *et al.,* (2020) who reported lower dead heart in the plot treated with spinetoram 0.8% GR @ 65 and 70 *g.a.i./ha.* Earlier workers like Uthamasamy and Kuruppuchamy (1988), Dash *et al.,* (1996) had similar observation like present investigation of effective control of rice pests by application of granular and sprayable insecticidal formulation..

Table.1 Details of the treatments

Tr. No.	Treatments	Dosage (g or ml/ha)
T_1	Spinetoram 0.8% GR	60
T_2	Spinetoram 0.8% GR	65
T_3	Spinetoram 0.8% GR	70
T_4	Chlorantriniliprole0.4%GR	40
T_5	Cartaphydrochloride 4% GR	1000
T_6	Control	-

Table.2 Efficacy of spinetoram against yellow stem borer (YSB) *Scirphophaga incertulas* and yield Pooled data (2017 & 18)

Tr. No.	Treatments	Dosage (g or ml/ha)	% dead heart				% white ear head	% ROC	Yield
			1 DBS	10 DAS	20 DAS	% ROC			
T_1	Spinetoram 0.8% GR	60	5.37 (13.38)	3.05 (10.05)	3.72 (11.11)	70.33	3.35 (10.50)	76.24	68.59
T_2	Spinetoram 0.8% GR	65	5.42 (13.34)	2.33 (8.71)	2.40 (8.72)	80.86	2.15 (8.40)	84.75	73.03
T_3	Spinetoram 0.8% GR	70	5.40 (13.30)	1.61 (7.27)	1.69 (7.43)	86.52	1.63 (7.31)	88.43	74.68
T_4	Chlorantriniliprole0.4%GR	40	5.42 (13.41)	2.73 (9.49)	3.06 (10.06)	75.59	2.76 (9.53)	80.42	72.10
T_5	Cartaphydrochloride 4% GR	1000	5.41 (13.38)	3.44 (10.66)	3.77 (11.18)	69.93	3.91 (11.40)	72.26	66.04
T_6	Control	-	5.32 (13.29)	10.30 (18.68)	12.54 (20.64)	-	14.10 (22.03)	-	42.18
S.Em +			0.43	0.42	0.55		0.43		1.82
CD @ 5%			1.40	1.30	1.70		1.31		5.61

*Values in parenthesis are angular transformed values; DBS-Day Before Spray; DAS- Day After Spray

Table.3 Effect of spinetoram 0.8% GR on natural enemies of rice insect pests Pooled data (2017 & 18)

Tr. No	Treatments	Dosage (a.i/ha)	No.of natural enemies/plant					
			Before application		After first application		After second application	
			Miridbug	Spiders	Miridbug	Spiders	Miridbug	Spiders
1	Spinetoram 0.8%GR	60	1.51 (1.23)	1.69 (1.30)	1.67 (1.29)	2.31 (1.52)	2.89 (1.69)	3.03 (1.74)
2	Spinetoram 0.8%GR	65	1.39 (1.18)	2.01 (1.42)	1.71 (1.30)	2.58 (1.60)	2.90 (1.70)	3.21 (1.79)
3	Spinetoram 0.8%GR	70	1.30 (1.14)	2.19 (1.48)	2.46 (1.57)	2.07 (1.43)	3.28 (1.81)	3.19 (1.78)
4	Chlorantriniliprole 0.4%GR	40	1.67 (1.29)	1.61 (1.29)	1.64 (1.28)	1.93 (1.39)	2.82 (1.68)	2.53 (1.59)
5	Cartap hydrochloride 4%GR	1000	1.22 (1.10)	1.68 (1.29)	1.79 (1.33)	1.79 (1.33)	1.71 (1.30)	1.86 (1.36)
6	Untreated control	-	1.58 (1.25)	1.67 (1.29)	1.61 (1.27)	2.42 (1.55)	3.01 (1.73)	3.37 (1.83)
	S.Em. ±		0.02	0.01	0.01	0.01	0.02	0.02
	CD 0.05%		0.08	0.05	0.03	0.04	0.08	0.08
	CV		3.64	1.86	1.20	1.49	1.98	1.98

Applications of new insecticides for control of rice pest were advocated by Singh (1993) which support the present finding.

From present investigation it was concluded that spinetoram is the best chemical in reducing stem borer population effectively with higher grain yield compared chlorantriniliprole and cartap hydrochloride. So it is suggested to one to go for use of spinetoram to control stem borer effectively

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