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Management of Rice Stem Borers and Leaf Folder in Punjab

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Abstract

Chlorantraniliprole (Coragen 18.5 SC) was evaluated against stem borers and leaf folder infesting rice in Multi-location Research Trials conducted at Ludhiana, Kapurthala, Jalandhar, Amritsar and Rupnagar (Ropar) during Kharif 2020 crop season and compared with the check, Flubendiamide (Fame 480 SC). An untreated control was also kept for comparison. The experiments were laid out in randomized block design with three replications at each location. Stem borers damage was significantly lower in the insecticide treated plots than the untreated control plots, at all the test locations. Coragen 18.5 SC @ 150 ml/ha (1.31 per cent dead hearts) was statistically at par with the check, Fame 480 SC recording 1.39 per cent dead hearts. Also, Coragen 18.5 SC @ 150 ml/ha with an overall mean of 2.34 per cent white ears, was statistically at par with the check, Fame 480 SC (2.42% white ears). Coragen 18.5 SC @ 150 ml/ha recorded 1.58 per cent leaf folder damaged leaves (overall pooled mean), after 5 days of insecticide application, which were statistically at par with the check, Fame 480 SC recording 1.62 per cent damaged leaves. Coragen 18.5 SC @ 150 ml/ha recorded paddy yields at par with the check insecticide, Fame 480 SC at all the test locations. Hence, the new insecticide, a green toxicity compound, is effective against stemborers and leaf folder infesting rice and will help in better management of these insect pests. It will also enhance the choice of farmers in selecting insecticides from different groups.

Key words : *Coragen 18.5 SC, fame 480 SC, rice stem borer, leaf folder, management.*

Introduction

Rice, *Oryza sativa* L. is one of the important staple food of more than half of the world population. Rice is produced and consumed mainly in Asian countries. In Punjab, it was grown on an area of 31.42 lakh hectares with the production of 188.63 lakh ton during 2019-20 (1). A critical analysis of the gap between the potential and actual rice yield across the nation reveals several factors as yield constraints (2, 3). One of the main causes of low yields of rice in the tropical Asian countries is the damage caused by the insect pests (4). In India, approximately 100 insect species feed on rice, but 20 of these are considered as major pests (5). A few acts as vectors of virus diseases also (6). On the basis of the extent and severity of the damage, stem borers are considered as major pests of rice. Major species of stem borers infesting rice in India are; Yellow stem borer, *Scirpophaga incertulas* (Walker); White stem borer, *S. innotata* (Walker); Striped stem borer, *Chilo suppressalis* (Walker); Gold-fringed stem borer, *C. auricilius* Dudgeon; Dark-headed stem borer, *C. polychrysus* (Meyrick) and Pink stem borer, *Sesamia inferens* (Walker). Yellow stem borer (YSB) is the monophagous pest of paddy causing yield loss of about 10-60 per cent (7). The extent of rice yield losses due to YSB has been estimated as 20–70% (8). It has assumed the number one pest status and attacks the rice crop at all growth stages (9). The insect causes “Dead hearts” at tillering stage and “White ear heads” at reproductive stage. Leaf folder scrap the chlorophyll content of the leaf which may restrict the photosynthesis process hence cause economic loss to rice (10). The farmers highly rely on synthetic insecticides as a tool of choice in the battle against these noxious pests because of broad spectrum activity, relatively low cost and rapid killing attributes. However, like all tools, insecticides have limitations. The excessive and indiscriminate use of insecticides resulted in severe adverse effect on agro-ecosystem and human health. To overcome this crisis, emphasis has been given on use of less disruptive control measures with pesticides as a last resort. Hence, an attempt has been made to manage stem borers and leaf folder using a green toxicity labelled material, Coragen 18.5 SC having selective toxicity and different mode of action as compared to commonly used neurotoxic insecticides as use of insecticides has shown a positive impact on rice production (11). Coragen is a member of the anthranilic diamide class of insecticides with a novel mode of action acting on insect ryanodine receptors. Although Coragen 18.5 SC has contact activity, it is most effective thorugh ingestion of treated plant material. When anthranilamide bind to ryanodine receptors of insect muscles, the muscles contract leading to paralysis and death (12). It controls pests resistant to other insecticides while its

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Table-1 : Efficacy of Coragen 18.5 SC (chlorantraniliprole) against stemborers infesting rice at different locations in the Punjab during Kharif 2020.

Treatment	Dose (ml/ha)	Before spray	5 days After spray		10 days After spray		At Harvest	
		Dead hearts (Pooled mean) (%)	Dead hearts (Pooled mean) (%)	Percent reduction over control	Dead hearts (Pooled mean) (%)	Percent reduction over control	White ears (Pooled mean) (%)	Percent reduction over control
Coragen 18.5 SC (chlorantraniliprole)	100	5.19	3.28 (10.37)[c]	38.90	3.18 (10.20)[c]	54.38	5.34 (13.14)[b]	29.55
	125	5.09	2.56 (9.11)[b]	58.84	2.12 (8.28)[b]	69.58	4.44 (11.82)[b]	41.43
	150	5.13	1.31 (6.42)[a]	78.94	0.84 (5.01)[a]	87.95	2.34 (8.04)[a]	69.13
Fame 480 SC	50	5.14	1.39 (6.71)[a]	77.65	0.93 (5.40)[a]	86.66	2.42 (8.39)[a]	68.07
Untreated Control	—	5.16	6.22 (14.42)[d]	—	6.97 (15.29)[d]	—	7.58 (15.95)[c]	—
C.D. (p=0.05)		NS	(1.22)		(1.37)		(2.45)	

Figures in parentheses are arc sine transformed values; DAA = days after insecticide application.

selectivity to non-target arthropods conserves natural parasitoids, predators and pollinators. It has low mammalian toxicity and favourable toxicological profile. Hence, present study was planned to test Coragen 18.5 SC against Stem borers and leaf folder infesting rice keeping in view the severity of these pests and to incorporate green and eco friendly molecules for its management.

Materials and Methods

Chlorantraniliprole (Coragen 18.5 SC) was evaluated against stemborers and leaf folder infesting rice in Multi-location Research Trials conducted at Ludhiana, Kapurthala, Jalandhar, Amritsar and Rupnagar (Ropar) during Kharif 2020 crop season and compared with the check, Flubendiamide (Fame 480 SC). An untreated control was also kept for comparison. Rice variety PR 121 was raised using all the recommended package of practices. The experiments were laid out in randomized block design with three replications at each location. The spraying of insecticides was done when the damage by stem borer and leaf folder exceeded economic threshold level of 5% dead hearts and 10% damaged leaves, respectively. The insecticide was applied by dissolving in 250 litres of water, using manual knapsack sprayer using hollow cone type nozzle. Coragen 18.5 SC was used @ 100, 125 and 150 ml/ha (20, 25 and 30 g a.i. ha^{-1}) while Fame 480 SC (flubendiamide 39.35%) was used @ 50 ml/ha. No chemical was used in case of control field. The plot size was 500 m^2 for each treatment. The observations on dead hearts by stem borer and formation of white streaks by leaf folder were recorded one day before spraying and 5 and 10 days after spraying of insecticides. Dead heart incidence (dead hearts divided by total number of tillers per hill) before insecticide application and 5 and 10 days after application were recorded from 30 randomly selected hills from each treatment. Similarly white ears incidence (white ears over total number of panicle bearing tillers per hill) were recorded from 30 randomly selected hills from each treatment, about a week before harvest. Leaf folder incidence (number of damaged leaves over total leaves per hill) before insecticide application and 5 and 10 days after application was also recorded from 30 randomly selected hills from each treatment. Number of spiders before spray and 5 and 10 days after broadcasting were recorded from 30 randomly selected hills from each treatment.

Phytotoxicity symptoms in terms of epinesty, hyponasty, necrosis and wilting were also recorded after spraying double the doses of test insecticide on the rice crop. The yield of paddy was also recorded at harvest on whole plot basis and and calculated to per hectare basis. The data thus obtained were subjected to statistical analysis and critical difference was calculated at 5% level of significance.

Results and Discussion

Stem borers damage was significantly lower in the insecticide treated plots than the untreated control plots, at all the test locations. The pooled mean of dead hearts formed ranged from 5.09 to 5.19 per cent in different treatments, before application of any insecticide, the differences being non-significant at all the locations. The plots treated with the test insecticide, Coragen 18.5 SC @ 100, 125 and 150 ml/ha recorded 3.28, 2.56 and 1.31 per cent dead hearts after 5 days and 3.18, 2.12 and 0.84 per cent after 10 days of insecticide application, respectively. Hence, Coragen 18.5 SC showed increased efficacy in

Table-2 : Efficacy of Coragen 18.5 SC (chlorantraniliprole) against leaffolder infesting rice and its effect on natural enemies at different locations in the Punjab during *Kharif* 2020.

Treatment	Dose (ml/ha)	Before spray	5 days After spray		10 days After spray			Percent increase over control	Natural Enemies (Spiders/ Hill) (Pooled mean)
		LF Damaged leaves (Pooled mean) (%)	LF Damaged leaves (Pooled mean) (%)	Percent reduction over control	LF Damaged leaves (Pooled mean) (%)	Percent reduction over control	Paddy yield (Pooled mean) (q/ha)		
Coragen 18.5 SC	100	9.08	4.36 (11.96)[b]	59.74	4.63 (12.11)[b]	65.16	66.74[c]	+4.84	0.43
	125	9.12	3.33 (10.38)[b]	69.25	3.05 (9.77)[b]	77.05	69.99[b]	+9.23	0.41
	150	9.17	1.58 (7.00)[a]	85.41	1.03 (5.46)[a]	92.25	72.63[a]	+12.56	0.41
Fame 480 SC	50	9.05	1.62 (7.19)[a]	85.04	1.04 (5.62)[a]	92.17	72.61[a]	+12.53	0.40
Untreated Control	—	9.38	10.83 (19.20)c	—	13.29 (21.35)[c]	—	63.51[d]	—	0.44
C.D. (p=0.05)		NS	(1.72)		(2.40)		2.16		NS

suppressing the test insect with increase in the concentration of the insecticide and days after application i.e. highest suppression of 78.94 and 87.95 per cent of stem borers infestation was observed at highest dose of 150 ml/ha after 5- and 10-days of spraying the insecticide. Also, Coragen 18.5 SC @ 150 ml/ha was statistically at par with the check, Fame 480 SC recording 1.39 per cent dead hearts. Coragen 18.5 SC @ 125 and 100 ml/ha with 2.56 and 3.28 per cent dead hearts proved inferior to the test insecticide @ 150 ml/ha, after 5 days of insecticide application. The untreated control recorded 6.22 per cent mean dead hearts and proved statistically inferior to all the insecticidal treatments (Table-1). Overall, a reduction of 87.95 per cent of stem borers infestation was recorded over the untreated control in Coragen 18.5 SC @ 150 ml/ha which was comparable to the check, Fame 480 SC with 86.66 per cent reduction of stem borers infestation over the untreated control (Table-1).

Coragen 18.5 SC @ 150 ml/ha with an overall mean of 2.34 per cent white ears, was statistically at par with the check, Fame 480 SC (2.42% white ears) but significantly superior to its lower dosages of 125 and 100 ml/ha (4.44 and 5.34% white ears, respectively), the latter two being at par with each other but superior to the untreated control (7.58% white ears) (Table-1). The results are in agreement with the earlier findings of Suri (2011) where Chlorantraniliprole @ 40 g ai ha^{-1} provided an effective control of stemborers (1.62% dead hearts and 2.00% white-ears) statistically at par with thiocyclam hydrogen oxalate (1.71% dead hearts and 2.07% white-ears) and chlorpyriphos (1.61% dead hearts and 2.00% per cent white-ears) but, significantly better than its lower dosages of 10 and 20 g ai ha^{-1} and the untreated control. (13) found that Chlorantraniliprole reduced the incidence of leaf folder and stem borer.

All the insecticide treated plots recorded significantly lower leaf folder damage than the untreated control. Coragen 18.5 SC @ 150 ml/ha recorded 1.58 per cent leaf folder damaged leaves, after 5 days of insecticide application, which were statistically at par with the check, Fame 480 SC recording 1.62 per cent damaged leaves. Similar observations were recorded after 10 DAA, whereby Coragen 18.5 SC @ 150 ml/ha with overall 1.03 per cent mean damaged leaves was statistically at par with the check, Fame 480 SC (1.04% mean damaged leaves) but superior to its lower dosages (3.05 and 4.63% damaged leaves, respectively in Coragen 18.5 SC @ 125 and 100 ml/ha) and the untreated control (13.29%) (Table-2). (14) also reported that chlorantraniliprole 20 SC, flubendiamide 480 SC, spinosad 45 SC and fipronil 80 WG insecticides significantly reduced the incidence of stem borers and leaf folder and minimized the yield loss in basmati rice.

Coragen 18.5 SC @ 150 ml/ha recorded paddy yields at par with the check insecticide, Fame 480 SC at all the test locations. Based on the pooled analysis, paddy yield of 72.63 q/ha in Coragen 18.5 SC @ 150 ml/ha was on par with Fame 480 SC (72.61 q/ha) but significantly higher than its lower dosages (69.99 and 66.74 q/ha, respectively in Coragen 18.5 SC @ 125 and 100 ml/ha, respectively) and the untreated control (63.51 q/ha). Overall, there was 12.56 and 12.53 per cent increase in paddy yield over the untreated control, in the plots treated with Coragen 18.5 SC @ 150 ml/ha and Fame 480 SC, respectively (Table-3).

The spider population recorded in various treatments ranged from 0.40 to 0.43 spiders/hill at 10 days after insecticide application, however the differences among them were non-significant based on the pooled mean of 5 test locations at each of the location (Table-2).

No phytotoxicity symptoms in terms of epinesty (downward bending of a leaf resulting from greater growth of the upper side than of the lower side), hyponasty (the upward bending of a leaf), necrosis (premature death of cells in living tissues) and wilting were observed when Coragen 18.5 SC was used at double the dose (300 ml/ha) on rice crop.

Conclusions

The new insecticide Coragen 18.5 SC, a green toxicity compound, is effective against stemborers and leaf folder infesting rice and will help in better management of these insect pests. It will also enhance the choice of farmers in selecting insecticides from different groups.

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