



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(6): 218-221
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www.thepharmajournal.com

Received: 07-04-2021

Accepted: 09-05-2021

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Field evaluation of bio-effectiveness of acephate 95% SP against insect pests of rice crop

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Abstract

A field experiment was conducted in the year 2018 at University Experimental Farm, 'C' Unit, BCKV, Kalyani, Nadia, West Bengal to evaluate insecticide molecules against yellow stem borer, Leaf folder and hopper pest in rice variety "Satabdi/Minikate" comprising seven treatments including control and three replication in randomized block design during summer 2018. The experimental data revealed that the least leaf folder population i.e. 0.00 and 0.33 was recorded in the treatments Acephate 95% SG@ 562.5 g a.i./ha followed by Acephate 95% SG@ 500 g a.i./ha. (100 and 95.87% reduction over control) and were on par with other, least percentage of dead hearts 0.55% and 0.91% was recorded in the treatments Acephate 95% SG @ 562.5 g a.i./ha followed by Acephate 95% SG @ 500 g a.i./ha. (94.78% and 91.30% reduction over control). The yield data of Grain Rice was highest 33.50 and 32.50 q/ha Acephate 95% SG@ 562.5 g a.i./ha and Acephate 95% SG @ 500 g a.i./ha.

Keywords: stem borer, leaf folder, Acephate, bio-efficacy, insecticide trials

Introduction

Rice (*Oryza sativa* L.) is the most important cereal food crop of the world providing major source of the food energy for more than half of the human population. In world the total production of rice is 463.3 million tonnes (Thawait *et al.*, 2014) [1]. India is world's second largest rice producer and consumer next to China. Total area under rice in India is 45.4 million hectare with annual production of 99.2 million tonnes and productivity is 2.18 tonnes/ha. (Anonymous, 2011) [2]. There are more than seventy pest infesting rice crop in India and twenty are of regular occurrence (Pathak, 1975) [3]. The stem borer and leaf folder are the worst pests which can cause severe damage and yield loss to the rice crop in the later stage. 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 (Samanta *et al.*, 2019) [4]. Out of this, 20 to 30 per cent damage is alone done by yellow stem borer, *Scirpophaga incertulas* (Walker) (Lal, 1996) [5]. 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.) [6]. It causes dead hearts at active tillering stage and white ears at harvest stage, which can lead to complete failure of the crop (Karthikeyan and Purushothaman, 2000) [7].

The rice leaf folder (RLF), *Cnaphalocrocis medinalis* (Guenee) (Lepidoptera: Pyralidae), is a predominant foliage feeder and one of the most destructive pests, affecting in all the rice ecosystems in Asia (Luo, 2010) [8]. Rice leaf folder was considered as pests of minor importance have increased in abundance in late 1980's and have become major pests in many parts of India. The yield loss is from 30 to 80 per cent due to leaf folder epidemic situation (Nanda and Bisoi, 1990; Shah *et al.*, 2008) [9, 10]. The rice leaf folder was considered as minor or sporadic pest in the past in many Asian countries. However, now it has been assumed as one of important insect pests and become a major threat to rice production in tropical and subtropical Asia. (Kushwaha and Singh, 1984; Shrivastava, 1989) [11, 12]

Among the various strategies adopted to combat the pest of rice, insecticides are the first line of defence. Most of the insecticides used on agricultural crops are based on quit limited number of chemically different classes out of them the most important inorganic insecticides that are used against the pest on rice belongs to synthetic pyrethroids. Therefore an effort has been made in present investigation to evaluate the new molecules of chemical insecticides such as Acephate 95% SG at different doze rates supplied M/s Krishi Rasayan Exports Pvt. Ltd., Fipronil 5% EC and Chlorpyrifos 20% EC against rice yellow stem borer and leaf folder.

Materials and Method

A field experiment was conducted in the year 2018 at University Experimental Farm, 'C' Unit, BCKV, Kalyani, Nadia, West Bengal to evaluate insecticide molecules against yellow stem borer, Leaf folder and hopper pest in rice variety "Satabdi/Minikate" comprising seven treatments including control and three replication in randomized block design during summer 2018. Two rounds of applications were given one at active tillering upon the appearance of leaf folder when the pest status reached beyond ETL (one damaged leaf per hill) and second at panicle initiation stage. Spraying was conducted by high volume Knapsack sprayer fitted with hollow cone nozzle using water @ 500 l/ha with T1- Acephate 95% SG @ 450 g. a.i./ha, T2- Acephate 95% SG @ 500 g. a.i./ha, T3- Acephate 95% SG @ 562.5 g. a.i./ha, T4- Acephate 95% SG @ 562.5 g. a.i./ha, T5- Fipronil 5% EC @ 75 ml. a.i./ha and T6- Chlorpyrifos 20% EC @ 375 ml. a.i./ha.

To record the incidence of pests, Two rows were discarded on all sides as border rows. Ten hills diagonally cross were examined to count the no. of leaf folder per hill, percentage of dead hearts and percentage of white ear heads. The observations on pests were taken on before spray and 1st, 5th and 10th days after each spray. The data on the pest incidence and yield were subjected to analysis of variance after making necessary transformation wherever needed.

The data thus collected were converted into percent damage index. The data on pest incidence and yield were subjected to analysis of variance after making necessary transformations wherever needed.

Results and Discussion

Before the imposition of the treatments the leaf folder infestation ranged from 7.67 to 9.67 larvae per plant. After the imposition of treatments the population of leaf folder decreased gradually till ten days and all the treatments were significantly superior to the untreated control. At ten days after the spray the least leaf folder population i.e. 0.00 and 0.33 was recorded in the treatments Acephate 95% SG@ 562.5 g a.i./ha followed by Acephate 95% SG@ 500 g a.i./ha. (100 and 95.87% reduction over control) and were on par with other. These were followed by 0.67, 0.67, 1.00 and 1.00 (92.81, 92.81, 88.46 and 87.99% reduction over control) in Acephate 95% SG@ 450 g a.i./ha, Acephate 95% SG@ 562.5 g a.i./ha, Chlorpyrifos 20% EC @ 375 g a.i./ha and Fipronil 5% EC@ 75 g a.i./ha. In untreated control the maximum number of larval population per hill was recorded to be 11.00 (Table 1). There was no significant leaf folder population during the second spray.

Before the imposition of the treatments the stem borer

infestation the percentage of dead hearts ranged from 10.21% to 10.74% per plot. After the imposition of treatment the percentage of dead hearts decreased gradually till ten days and all the treatments were significantly superior than the untreated control. At ten days after the spray the least percentage of dead hearts 0.55% and 0.91% was recorded in the treatments Acephate 95% SG @ 562.5 g a.i./ha followed by Acephate 95% SG @ 500 g a.i./ha. (94.78% and 91.30% reduction over control) and were on par with other. These were followed by 1.42%, 1.70%, 1.83% and 3.05% in Acephate 95% SG@ 450 g a.i./ha, Acephate 95% SG@ 562.5 g a.i./ha, Fipronil 5% EC@ 75 g a.i./ha and Chlorpyrifos 20% EC @ 375 g a.i./ha. In untreated control the most percentage of dead hearts 11.00% was recorded (Table 1).

Similar trend was observed after the second spray imposition. Before the imposition of treatments the stem borer population i.e. the percentage of white earheads ranged from 4.94% to 5.35% per plant. At ten days after the second spray the least percentage of white earheads ranged 0.00% and 0.71% was recorded in the treatments Acephate 95% SG@ 562.5 g a.i./ha and Acephate 95% SG@ 450 g a.i./ha. (100% and 86.23% reduction over control) and were on par with each other. These were followed by 0.93%, 0.98%, 1.28% and 1.49% in Acephate 95% SG@ 562.5 g a.i./ha, Acephate 95% SG@ 500 g a.i./ha, Fipronil 5% EC@ 75 g a.i./ha and Chlorpyrifos 20% EC@ 375 g a.i./ha. In untreated control the maximum percentage of white earheads ranged 4.97 was recorded.

All the treatments were superior over the untreated check. The yield data of Grain Rice was highest 33.50 and 32.50 q/ha Acephate 95% SG@ 562.5 g a.i./ha and Acephate 95% SG@ 500 g a.i./ha. Both the treatments were on par with each other and were significantly superior to the standard checks. These were followed by 30.00 q/ha in Acephate 95% SG@ 562.5 g a.i./ha, 28.75 q/ha in Acephate 95% SG@ 450 g a.i./ha, 28.50q/ha in, Fipronil 5% EC@ 75 g a.i./ha, and 27.20 q/ha in Chlorpyrifos 20% EC@ 375g a.i./ha. In untreated check the lowest yield 24.05 q/ha was recorded.

It is evident from the studies undertaken during August - November 2018 that Acephate 95% SG supplied by M/s Krishi Rasayan Exports Pvt. Ltd. provided excellent control of important insect pests of Rice viz. Leaf folder and stem borer along with significant yield increase. Thus Acephate 95% SG can be recommended for the management of rice stem borer and leaf folder. The results of the experiment agreed with the findings of Jeer *et al.*, 2017 ^[13]; Seni and Naik, 2017 ^[14]; Kumari *et al.*, 2019 ^[15]; Patidar *et al.*, 2018 ^[16]; Badariprasad *et al.*, 2020 ^[17] who also reported that Acephate is very effective in the management of insect pests of rice in singly or in combination with other insecticides.

Table 1: Effect of Acephate 95% SG against Leaf folder and Stem borer of rice during September, 2018 at University Experimental

Sr. No.	Treatment	Dosage g a.i./ha	Percentage of leaves damaged by leaf folder larvae / 10 hills.				% reduction after 10 days of spray	Percentage of Dead Heart (%)				% reduction after 10 days of spray	Percentage of White Heads (%)				% reduction after 10 days of spray
			PT [^]	1	5	10		PT [^]	1	5	10		PT [^]	1	5	10	
T1	Acephate 95% SG	450	9.00 (3.07)	7.33 (2.78)	3.67 (2.02)	0.67 (1.05)	92.56	10.42 (19.28)	7.33 (15.84)	6.27 (15.08)	1.42 (7.96)	90	4.94 (13.48)	1.14 (7.32)	0.76 (6.41)	0.71 (6.29)	86.23
T2	Acephate 95% SG	500	8.00 (2.90)	6.00 (2.53)	3.33 (1.95)	0.33 (0.88)	95.87	10.46 (19.33)	6.00 (14.80)	5.43 (14.05)	0.91 (6.80)	91.3	5.10 (13.68)	0.80 (6.53)	0.53 (5.80)	0.98 (5.31)	91.3
T3	Acephate 95% SG	562.5	7.67 (2.85)	5.00 (2.34)	2.67 (1.77)	0.00 (0.71)	100	10.52 (19.34)	5.00 (13.09)	4.10 (12.38)	0.55 (5.87)	94.78	5.35 (14.00)	0.16 (4.66)	0.13 (4.56)	0.00 (4.05)	100
T4	Acephate 95% SG	562.5	9.33 (3.12)	8.00 (2.90)	3.67 (2.03)	0.67 (1.05)	92.81	10.55 (19.42)	6.33 (15.82)	6.37 (15.18)	1.70 (8.52)	81.77	5.05 (13.63)	1.25 (7.59)	1.17 (7.43)	0.93 (6.85)	81.59

T5	Fipronil 5% EC	75	8.33 (2.95)	6.33 (2.61)	4.00 (2.11)	1.00 (1.17)	87.99	10.57 (19.53)	6.33 (16.32)	6.60 (15.45)	1.83 (8.77)	80.38	5.15 (13.75)	1.55 (8.23)	1.33 (7.75)	1.28 (7.66)	82.69
T6	Chlorpyrifos 20% EC	375	8.67 (3.02)	6.33 (2.61)	3.67 (2.02)	1.00 (1.22)	88.46	10.21 (19.05)	8.00 (19.81)	6.27 (15.07)	3.05 (10.75)	70.12	5.25 (13.88)	2.05 (9.18)	1.54 (8.18)	1.49 (8.08)	75.14
T7	Untreated control	-	9.67 (3.18)	11.00 (3.39)	11.00 (3.39)	10.33 (3.29)		10.74 (19.56)	11.00 (19.81)	11.00 (19.81)	9.33 (18.26)		4.97 (13.51)	4.92 (13.45)	4.04 (12.29)	3.97 (12.19)	
Sem			0.16	0.15	0.12	0.12		0.67	0.35	0.36	0.53		0.2	0.32	0.32	0.41	
CD (p=0.05)			0.49	0.45	0.38	0.38		2.03	1.05	1.08	1.61		0.61	0.98	0.98	1.26	
CV %			9.28	9.38	9.83	16.11		5.99	3.78	4.02	9.65		2.54	6.84	7.49	9.95	

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*Mean of four replications: PT^ Pretreatment; Values in parenthesis are ArcSine and angular transformed.

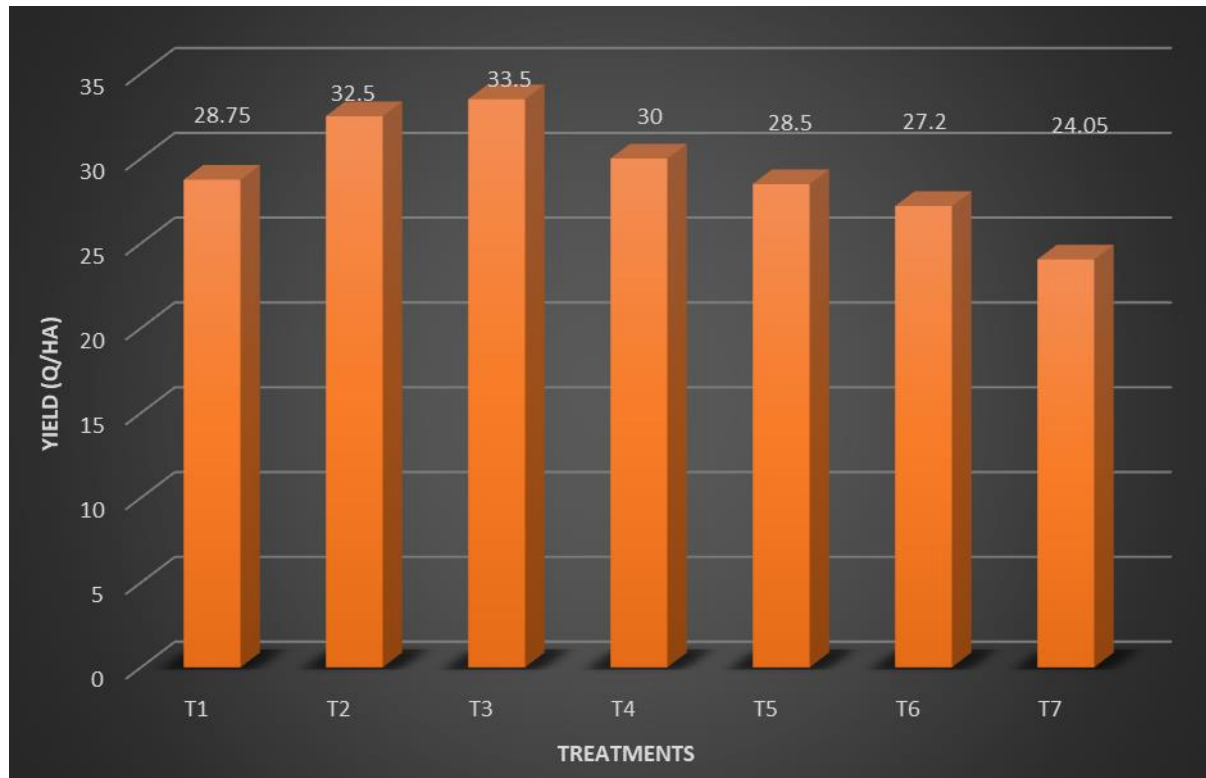


Fig. 1: Yield data of rice in various treatments of Acephate 95% SG for the management of various insect pests of Rice.

Acknowledgement

We are very much indebted to M/s Krishi Rasayan Exports Pvt. Ltd for providing the required insecticides for conducting the trials.

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