Effect of *Bacillus thuringiensis* Berliner formulation against the rice leaf folder *Cnaphalocrocis medinalis* Guenee (Pyralidae: Lepidoptera)

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ABSTRACT

Two field trials were conducted to evaluate the bioefficacy of *Bacillus thuringiensis* Berliner, water soluble granular formulation against the rice leaffolder, *Cnaphalocrocis medinalis* Guenee. The study revealed that the treatment containing B.t. formulation @ 2.5 kg/ha registered the lowest leaffolder damage of 8.21 per cent that was on par with monocrotophos 36 WSC @ 500 g ai/ha in 7 DAS during the first spraying. On 10 DAS of the first spraying all the treatments recorded more than 13.00 per cent damage, but the low leaffolder damage of 13.65 per cent was recorded in B.t. formulation @ 2.5 kg /ha. The highest leaf folder damage of 18.40 and 17.38 per cent was registered in B.t. formulation @1.0 kg/ha and untreated control, respectively. The B.t. formulation failed to check the leaffolder damage due to the outbreak of the pest induced by high temperature coupled with low relative humidity. The highest grain yield of 28. 58 kg/ plot was registered in B.t. formulation @ 2.5 kg/ha, followed by B.t. formulation @ 2.0 kg/ha.

Keywords: *Bacillus thuringiensis,* granular formulation, rice, leaffolder, crop pest

INTRODUCTION

The rice leaf folder, *Cnaphalocrocis medinalis* Guenee earlier considered as a minor pest of rice in many Asian countries, appears to have become increasingly important with the spread of high yielding rice varieties and accompanying changes in cultural practices. Infestation usually occurs during late growth stages of the rice crop. The larvae fold the leaves and scrape the green tissues of the leaves from within and cause scorching and leaf drying. Each larva is capable of destroying several leaves by its feeding (Upadhyay *et al.,* 1975). Sellamal Murugesan and Chelliah (1983) reported that a 10 per cent increase in flag leaf damage by the leaffolder reduces grain yield by 0.13 g per tiller and the number of fully – filled grains by 4.5 per cent.

The use of organic insecticides developed during the last half of this century may pose risks to human health and can cause environmental problems. Consequently, interest has developed in using alternative strategies for insect pest management. One contemporary approach that has received attention is the development of *Bacillus thuringiensis* (B.t.) toxin as insecticides. *B. thuringiensis,* a gram positive bacteria, produces a proteinaceous parasporal crystalline inclusion during sporualtion. Upon ingestion by insects, this crystalline inclusion is solubilized in the midgut, releasing proteins called delta endotoxin. It causes mortality in the larval stage of insects. (Gill *et al.,*1992; Yadugiri, 2010). Most families of Lepidoptera are susceptible to B.t. var. *kurstaky* (Drummond and Pinnock, 1994). Organic insecticides cause too many ill effects to human beings when they consume insecticides treated products. Therefore, the present investigation was taken up to study the bioefficacy of a new strain of B.t. water soluble granular formulations against rice leaf folder and to get insecticide residues free grains.

MATERIALS AND METHODS

Two field trials were conducted during Kharif 2007 and 2008 with five treatments replicated four times to evaluate the bioefficacy of a new strain of *B. thuringiensis* formulation against the rice leaf folder, *C. medinalis* on a ruling rice variety ADT 43. The size of the experimental plot was 5m x 4m. The spacing adopted in this trial was 20 cm x15 cm. Two rounds of B.t sprays were taken at 56 DAT and 67 DAT. In each plot, ten plants were selected at random and total leaves and leaf folder damaged leaves were recorded one day before and 7 and 10 days after spraying (DAS). The yield of each plot was recorded and expressed in kgs/plot. This new strain of B.t. was isolated and mass cultured by the Directorate of Oil seeds Research (DOR B.t.1), Hyderabad. The structure of the treatments used in this study is given in Table 1 and 2.

Table 1. Bioefficacy of *Bacillus thuringiensis* formulations against rice leaffolder during kharif 2007

Treatments	Pre count (%damage)	I spraying		Pre count (%damage)	II spraying		Yield(kg)/plot
		7 DAS	10 DAS		7 DAS	10 DAS	
B.t formulation @ 1.0 kg/ha	9.36	11.20(19.57)d	17.32(24.59) c	24.12	33.31(35.25)d	82.36(65.16)c	24.40(4.93)b
B.t. formulation @ 1.5 kg/ha	9.31	10.00(18.39)c	16.24(23.76)b	26.42	42.42(40.64)e	81.58(64.58)c	21.60(4.64)c
B.t. formulation @ 2.0 kg/ha	8.15	9.20(17.63)b	16.87(24.25)c	22.34	31.88(34.37)c	79.97(63.41)bc	25.10(5.00)ab
B.t. formulation @ 2.5 kg/ha	12.58	8.00(16.48)a	14.10(22.05)a	21.32	30.89(33.76)b	78.39(62.30)b	26.00(5.09)a
Monocrotophos 36 WSC @ 500 g a.i/ha	10.05	8.08 (16.52)a	14.17(22.11)a	19.48	25.64(30.42)a	65.79(54.20)a	25.70(5.06)a
Untreated control	15.15	11.00(19.36)d	17.24(24.17)c	22.36	42.98(40.96)f	82.48(65.25)c	17.90(4.23)d
Cd (0.05)	0.27	0.23	0.40		0.28	1.80	0.09

Figures in parentheses are arc sin transformed values
DAS day after planting; In a column figures followed by a common alphabets are not significantly different by DMRT (p= 0.05)

RESULTS AND DISCUSSION

The study revealed that the pretreatment counts for first and second sprayings of the first trial ranged from 8.12 to 15.15 and 19.48 to 26.42 per cent, respectively (Table 1). In the second trial the leaf folder damage of 8.34 to 13.12 and 18.40 to 28.00 per cent was recorded in pretreatment counts of first and second sprayings respectively (Table 2). In both the trials the pretreatment count of rice leaf folder damage of first spraying showed more than economic threshold level (13.00 %) on 10 DAS .

The post treatment counts showed that the treatment containing B.t. formulation @ 2.5 kg/ha registered the lowest leaf folder damage of 8.00 and 14.10 per cent that was on par with monocrotophos 36 WSC @ 500 g ai/ha in 7 DAS and 10 DAS respectively, during the first spraying in kharif 2007. The present result is in online with the statement of Halder and Ellar (1989) who stated that the high dose of B.t is effective against lepidopteran insects, since continuous release of delta endotoxin in the midgut of lepidopteran insects will enhance mortality. In kharif 2008 trail the treatment, B.t. formulation @ 2.5 kg/ha recorded the lowest leaf folder damage of 8.42 and 13.21 per cent on 7 DAS and 10 DAS, respectively, followed by monocrotophos 36 WSC @ 500 g a.i /ha. The present result is in view of Singh *et al.* (2000) who elucidated that high concentration of *B. thuringiensis* reduced food consumption by lepidopteran larvae and enhanced significant larval mortality. On 10 DAS of the first spraying all the treatments recorded more than 13.00 per cent damage in both the trials, but the low leaf folder damage of 14.10 and 13.21 per cent was recorded in B.t. formulation @ 2.5 kg /ha. The highest leaf folder damage of 18.40 and 17.38 (over all mean) per cent was registered in B.t. formulation @1.0 kg/ha and untreated check, respectively in both the trial.

In the second spraying of both the first and second trials the standard check treatment, Monocrotophos WSC @ 500 g .a.i/ha recorded the lowest leaf folder damage and all the B.t. formulation treatments recorded more than 25 and 59 per cent damage on 7 and 10 DAS respectively. (Table 1 & 2). Since the crop had high temperature and

Table 2. Bioefficacy of *Bacillus thuringiensis* formulation against rice leaffolder during kharif 2008

Treatments	Pre count (%damage)	I spraying		Pre count (%damage)	II spraying		Yield(kg)/plot
		7 DAS	10 DAS		7 DAS	10 DAS	
B.t. formulation@ 1.0 kg/ha	8.34	12.14(20.39)d	19.48(26.19)e	28.00	36.49(37.16)d	82.48(65.26)cd	22.80(4.77)e
B.t. formulation@ 1.5 kg/ha	9.18	11.35(19.68)d	17.24(24.53)d	25.42	43.44(41.23)e	82.22(65.06)d	23.00(4.80)d
B.t. formulation@ 2.0 kg/ha	8.68	11.02(19.38)c	16.26(23.78)c	23.35	46.22(42.83)f	79.29(62.93)c	30.50(5.52)b
B.t. formulation@ 2.5 kg/ha	12.58	8.42(16.87)a	13.21(21.31)a	20.28	30.22(33.35)b	76.12(60.75)b	31.16(5.58)a
Monocrotophos 36 WSC @ 500 g a.i/ha	11.16	9.44(17.89)b	15.20(22.95)b	18.40	28.12(32.03)a	59.18(50.29)a	28.30(5.32)c
Untreated control	13.12	10.8(19.18)c	17.52(24.75)d	27.46	32.42(34.71)c	82.32(65.14)d	20.40(4.52)f
Cd (0.05)	0.35	0.38			0.92	1.40	0.04

Figures in parentheses are arc sin transformed values
DAS day after planting; In a column figures followed by a common alphabets are not significantly different by DMRT (p= 0.05)

low relative humidity during its flag leaf stage, the leaf folder had devastated the crop completely. The insecticidal treatment as well as microbial treatments were unable to bring the damage of leaf folder below alarming stage. The present statement is in conformity with the statement of Herman and Whiteley (1989) who stated that low persistence of *B. thuringiensis* will give low mortality when it is continuously exposed in ultra violet light of the environment.

The yield data of the trial showed that the highest yield of 28. 58 kg/ plot was registered in B.t. formulation @ 2.5 kg/ ha, followed by B.t. formulation @ 2.0 kg/ha. The study concluded that B.t. formulation @ 2.5 kg/ha was found to be the best treatment, followed by B.t. formulation @ 2.kg/ ha in reducing the damage caused by leaf folder. Since it is a microbial insecticide, it does not have residual effect in grains and stubbles of rice plants and in soil of the field.

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Yadugiri, V. T. 2010. Bt bringal: Good or bad? *Current Science,* **98**(10): 1273-1278

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Received: September 1, 2009; Revised: January 1, 2010; Accepted: February 2, 2010.