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MANAGEMENT OF FRUIT BORER OF TOMATO USING CYPERMETHRIN

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ABSTRACT

Cypermethrin 10 EC was applied in the tomato field following different doses and spray schedule to know the infestation of tomato by fruit borer *Helicoverpa armigera* Hübner (Lepidoptera: Noctuidae). The study also investigated the yield of tomato and benefit cost ratio of cypermethrin applied to control fruit borer. Results showed that the tested doses of Cypermethrin significantly reduced the infestation level of tomato and exerted higher yield. The lowest rate of fruit infestation (2.50% number and 1.92% weight) and the highest marketable yield (32.7 t ha^{-1}) were obtained with Cypermethrin 10 EC @ 1 ml/L water sprayed at 45 days after transplanting and repetition of the same at 7 days interval. The highest marginal benefit cost ratio (6.6) was found with Cypermethrin 10 EC @ 1 ml l^{-1} of water sprayed after initiation of 5% level of fruit infestation and repetition of the same at 15 days interval.

Keywords: Insect, insecticide doses, *Solanum lycopersicum*, *Helicoverpa armigera*

Introduction

The important nutritious vegetable, tomato *Solanum lycopersicum* L. production in Bangladesh is about 22.5 thousand tons per year (BBS 2013) but yield is very low compared to other countries in the world. One of the major constrains for tomato production in Bangladesh is the attack of insect pests.

The tomato plant is attacked by different species of insect pests such as fruit borer, white fly, aphid and leaf miner in Bangladesh. Among them tomato fruit borer, *Helicoverpa armigera* Hübner is one of the serious pest which caused damage 50-60 % fruits (Singh and Singh 1977). Due to severe infestation, fruit as well as seed maturation hampered greatly and the viability of the seeds reduced (Tewari 1985).

Current management practices of insect pests are mostly based on chemical insecticides as they give quick result. Mazed *et al.* (2017) reported that the cypermethrin had very effective result against the okra shoot and fruit borer which showed 10.3 t yield ha^{-1} with benefit cost ratio 6.7. Hossain *et al.* (2013) and Paul *et al.* (2016) found that the cypermethrin exerted as the most effective against pod borer of yard long bean and summer country bean, respectively. Rahman *et al.* 2014 found that the cypermethrin showed effective result against brinjal shoot and fruit borer. Cypermethrin showed effectiveness at low concentration had has low environmental persistence (Rahman *et al.* 2014). But, the dose and spray schedule of this insecticide is not yet study to control fruit borer of tomato. So, the present study was undertaken to find out an effective spray schedule of cypermethrin for managing fruit borer of tomato in field condition.

Materials and Methods

The study was carried out in the field laboratory of the Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during July 2015 to June 2016. The experiment was laid out in a randomized complete block design with 3 replications. The unit plot size was 3 m × 3 m and separated by 1 m and block to block distance was 2 m. Seeds of BARI tomato 3 were collected from Bangladesh Agricultural Research Institute, Gazipur. Seedlings were raised in polythene bags and 30 days old seedlings were transplanted in the field according to assigned plot of each treatment. A total 315 seedlings were transplanted in 21 plots at the rate of 15 seedlings per plot with the distance of 1 m between lines and 60 cm between plants. Manures and fertilizers were applied according to the fertilizer recommendation guide and intercultural operations were done whenever necessary. Experimental plots were monitored weekly to know the incidence and infestation of fruit and starting

of spray schedule. Six treatments including control were practiced for collection of data. The experimental treatments were T_1 = Cypermethrin 10 EC @ 1 ml l^{-1} of water sprayed at 45 DAT and repetition of the same at 7 days interval up to last harvest, T_2 = Cypermethrin 10 EC @ 1 ml l^{-1} of water sprayed after initiation of 2% level of fruit infestation and repetition of the same at 15 days interval up to last harvest, T_3 = Cypermethrin 10 EC @ 2 ml l^{-1} of water sprayed after initiation of 2% level of fruit infestation and repetition of the same at 15 days interval up to last harvest, T_4 = Cypermethrin 10 EC @ 1 ml l^{-1} of water sprayed after observing 5% level of fruit infestation and repetition of the same at 15 days interval up to last harvest, T_5 = Cypermethrin 10 EC @ 2 ml l^{-1} of water sprayed after observing 5% level of fruit infestation and repetition of the same at 15 days interval up to last harvest and T_6 = Untreated control.

Data on fruit infestation and fruit yield were recorded. The number of healthy and infested fruits and their weight per plot were recorded at each harvest. The infestation of the pest was expressed in percentage based on number (n/n) and weight (w/w) of pod. The final yield was expressed in t ha^{-1} and benefit cost ratio was calculated. Data were analyzed by analysis of variance (ANOVA) by using MSTAT-C software and the means were separated by Duncan's Multiple Range Test (DMRT).

Results and Discussion

All the treatments of Cypermethrin significantly reduced fruit infestation rate of tomato compared to control (Table 1). The lowest rate of fruit infestation by number was found in plots sprayed with T_1 (2.5%) followed by T_4 (3.0%), T_2 (3.1%) and T_3 (4.7%) and they were statistically similar with each other. The rate of reduction of fruit infestation by number over untreated control was obtained with T_1 (74.6%) followed by T_4 (69.7%), T_2 (68.5%). The lowest fruit infestation by weight was found in plots of T_1 (1.9%) followed by T_2 (2.1%), T_4 (2.3%) and T_3 (3.3%) treated plots and these were statistically similar with each other. Reduction of fruit infestation by number over untreated control ranged from 61.6-80.6%. The increase in weight of healthy fruit over untreated control was 80.6, 78.7 and 76.8% due to spray with T_1, T_2 and T_4, respectively.

Pawar *et al.* (1988) reported that single spray of Endosulfan with concentration 500 g ha^{-1} followed by 3 applications of Cypermethrin or Fenvalerate at 50 g ha^{-1} at an interval of 14 days was the most effective for the control of *E. vitella* infesting okra. Mazed *et al.* (2017) reported that 5.4% fruit infestation by number and 72.4% increase over control, and 4.3% fruit infestation by weight and 78.4% increase over untreated control of okra shoot and fruit borer with Relothrin 10EC (Cypermethrin) @ 1.0 ml l^{-1} of water at 15 days interval.

Table 2 showed that the treatment T_1 produced the highest marketable yield (32.7 t ha^{-1}) of tomato which was statistically similar to that obtained from the treatment T_2 (31.4 t ha^{-1}) and T_4 (30.9 t ha^{-1}). Significantly the lowest yield of marketable fruit was harvested from control plot (14.4 t ha^{-1}) followed by 25.5 t ha^{-1} in T_3 and 25.1 t ha^{-1} in T_5.

Significantly the highest infested fruit yield of tomato (6.8 t ha^{-1}) was found in untreated control. The lowest infested fruit yield was found in T_1 (1.2 t ha^{-1}) followed by in T_4 (1.4 t ha^{-1}), T_2 (1.5 t ha^{-1}), T_3 (1.8 t ha^{-1}) and T_5 (2.0 t ha^{-1}) treated plots and these are statistically similar with each other. The total yield of tomato with different treatments was statistically similar but significantly higher than untreated control plot (Table 2). Patil *et al.* (2002) reported that the combination package neem

Table 1. Effect of foliar spray of cypermethrin on the infestation level of tomato by fruit borer during July 2015 to June 2016

Treatment	Fruit infestation (% number)	Increase over control (%)	Fruit infestation (% weight)	Increase over control (%)
T_1	2.5c	74.6	1.9c	80.6
T_2	3.1c	68.5	2.1c	78.7
T_3	4.7bc	51.9	3.3bc	66.5
T_4	3.0c	69.7	2.3c	76.8
T_5	5.1b	47.8	3.8b	61.6
T_6	9.8a	-	9.9a	-

Means within the same column with a common letter(s) do not differ significantly (P=0.05) according to DMRT.

Table 2. Effect of foliar spray of cypermethrin on the yield of tomato during July 2015 to June 2016 by controlling fruit borer

Treatments	Yield (t ha^{-1})		
	Marketable	Infested	Total
T_1	32.7a	1.2b	33.9a
T_2	31.4a	1.5b	32.9a
T_3	25.5b	1.8b	27.3ab
T_4	30.9a	1.4b	32.3a
T_5	25.1b	2.1b	27.1ab
T_6	14.4c	6.8a	21.2b

Means within the same column with a common letter(s) do not differ significantly (P=0.05) according to DMRT.

Table 3. Benefit cost ratio of cypermethrin applied during July 2015 to June 2016 to control tomato fruit borer

Treatment	Management cost (Tk ha^{-1})	Gross return (Tk ha^{-1})	Net return (Tk ha^{-1})	Adjusted net return (Tk ha^{-1})	Benefit cost ratio
T_1	50490.00	326700.00	276210.00	142110.00	2.81
T_2	27540.00	313800.00	286260.00	152160.00	5.53
T_3	49140.00	255000.00	205860.00	71760.00	1.46
T_4	22950.00	309000.00	286050.00	151950.00	6.62
T_5	40950.00	250500.00	209550.00	75450.00	1.84
T_6	-	134100.00	134100.00	0	-

T_1 consisted 11 sprays, T_2 and T_3 consisted 6 sprays and T_4 and T_5 consisted 5 sprays. Market value of tomato was 10 taka/kg, Ripcord (cypermethrin) 10 EC @ Tk 120/100 ml. Insecticide preparation and application @ 3 labor/ha, Labor wage @ Tk. 300/day, Sprayer rent @ Tk. 30/day.

seed kernel extract + cypermethrin controlled okra fruit borers effectively and reduced fruit damage by 14.5% and highest yield of 6.7 t ha^{-1}. Similar findings was reported by Mazed *et al.* (2017) and they found 10.5 t ha^{-1} marketable yield (59.2% increase over control) with application of Relothrin 10EC (Cypermethrin) @ 1.0 ml l^{-1} of water at 15 days interval in okra.

The management cost of different treatments used tomato fruit borer was calculated and presented in Table 3. The highest management cost was (50490.00 Tk) in T_1 followed by T_3 (49140.00 Tk) and T_5 (40950.00 Tk) and the lowest (22950.00 Tk) in T_4 followed by T_2 (27540.00 Tk). The gross return was the highest Tk. 326700.00 ha^{-1} in T_1 followed by Tk. 313800.00 ha^{-1} in T_2, Tk. 309000.00 ha^{-1} in T_4 and the lowest was Tk. 134100.00 ha^{-1} in untreated control plot followed by Tk. 250500.00 ha^{-1} in T_5, and Tk. 255000.00 ha^{-1} in T_3 treated plots. The highest net return (Tk. 286260.00 ha^{-1}) was recorded in T_2 followed by Tk. 286050.00 in T_4 and the lowest net return (Tk. 134100.00 ha^{-1}) in untreated control plot followed by Tk. 205860.00 ha^{-1} in T_3, Tk. 209550.00 ha^{-1} in T_5 and Tk. 276210.00 ha^{-1} in T_1 treatments. The highest adjusted net return (Tk. 152160.00 ha^{-1}) was recorded in T_2 followed by Tk. 151950.00 ha^{-1} in T_4 and the lowest (Tk. 71760.00 ha^{-1}) in T_3 followed by Tk. 75450.00 ha^{-1}in T_5 and Tk. 142110.00 ha^{-1} in T_1 treatments (Table 3).

The highest marginal benefit cost ratio (6.62) was obtained with T_4 followed by T_2 (5.53), T_1 (2.81), T_5 (1.84) and T_3 (1.46). The causes of lower of these treatments were due to comparatively lower yield and higher cost of management against tomato fruit borer (Table 3). Similar findings was reported by Mazed *et al.* (2017) and they found benefit cost ratio 6.7 with application of Relothrin 10EC (Cypermethrin) @ 1.0 ml L^{-1} of water at 15 days interval against okra shoot and fruit borer. The results of this study reveal that higher frequency as well as higher dose of Cypermethrin is not cost effective although provide higher yield.

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