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Review Articles

Research Articles

Research Article

EFFICACY OF COMMERCIAL INSECTICIDE FOR THE MANAGEMENT OF TOMATO FRUIT BORER, *Helicoverpa armigera* HUBNER, ON TOMATO IN CHITWAN, NEPAL

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ABSTRACT

A field experiment was conducted to understand the peak season of tomato fruit borer, and to evaluate the efficacy of commercial available pesticides for management of tomato fruit borer. Tomato fruit borer was monitored using Heli-lure trap. A total of seven treatments; (i. Emamectin benzoate 5SG@ 0.625g/L, ii. Fubendiamide 48SC@ 0.21mL/L; iii. *Metarihizium anisopilae@ 3g/*L, iv. *Bacillus thuringiensis@ 3g/*L, v. Chlorpyrifos 50%+Cypermethrin 5%@ 2mL/L, vi. Derrisom@ 3mL/L, and vii. Control) were tested using Randomized Complete Block design (RCBD) with three replication for each treatment. The highest number of tomato fruit borer male moth was trapped during mid-April. The results showed that the damage percentage of fruit by tomato fruit borer was recorded the highest with control plot (42.24) which was statistically similar to *Bacillus thuriengiensis* (39.44), *Metarihizium anisopliae* (35.32) and Derrisom (31.31) treated plots. Whereas the lowest fruit damage percent was recorded with Flubendiamide (8.41) followed by Chlorpyrifos+Cypermethrin (19.98) and Emamectin benzoate (20.82). Among the treatments, the highest yield was obtained with Flubendiamide (68.68t/ha) followed by Chlorpyrifos+cypermethrin (67.53t/ha), Derisom (64.45t/ha) and Emamectin benzoate (63.32t/ha). Whereas the lowest yield was obtained with control plot followed by *Metarihizium anisopliae* (57.24t/ha) and *Bacillus thuriengiensis* (58.37t/ha) treated plots. The Flubendiamide resulted the lowest fruit damage and highest yield, thus could be the best insecticide to manage tomato fruit borer.

Key words: Monitoring, tomato fruit borer, bio-pesticide, flubendiamide

INTRODUCTION

Tomato is an important vegetable crop with high economic return which is cultivated in 17,273 ha area with production of 2,32,897 metric ton and productivity of 13.5 metric ton/ha in Nepal (MoAD, 2014). Sirjana is important hybrid varieties grown in Nepal with productivity 105-110 metric ton/ha (AICC, 2017).

Tomato fruit borer is a polyphagous pest. It attacks more than 100 plants of economic importance and causes great damage on tomato both in terms of quality and quantity throughout the Asia (Qayyum, Wakil, & Ghazanfar, 2012; Muthukumaran & Selvanarayanan, 2016) including Nepal. This insect is widespread across the country and is considered as the national priority pest in Nepal (Manandhar, 1997). This pest is becoming a major threat of winter season tomato for the last few years in Nepal.

Tomato fruit borer, *Helicoverpa armigera* is polyphagous pest feeding more than 15 crops throughout world (Vinutha, Bhagat, & Bakthavatsalam, 2013). Farmers are using chemical pesticides frequently to manage this insect. But, the awareness level regarding pesticide use and safety among the farmers was very low and some fruits and vegetable samples were contaminated even with banned pesticide in Nepal (Giri, 2010). The use of chemical pesticides degrade soil health, water condition and affects human health (Vinutha et al., 2013). So, this study was conducted to evaluate efficacy of bio-pesticides and novel insecticide against tomato fruit borer for identification of effective safe insecticide against tomato fruit borer.

MATERIALS AND METHODS

Monitoring of tomato fruit borer

One heli-lure trap was installed in research field and number of Tomato fruit borer (*Helicoverpa armigera)* trapped was recorded in weekly interval throughout the research period to monitor population dynamics of tomato fruit borer. Heli-lure was replaced in every 4 weeks interval.

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Field experiment

The nursery of Sirjana variety was prepared on 19 October 2016. The tomato seedlings were transplanted on 16 November 2016 in main field. The staking was done on 23 December 2016. FYM was applied at the rate of 1500 Kg/ropani and fertilizer at the rate of 10:9:4Kg NPK/ropani.

The experiment was laid out in RCBD design with seven treatments (i. Emamectin benzoate 5SG 0.625g/liter, ii. Flubendamide 48SC 0.21ml/liter, iii. *Metarihiziumanisopilae 3g/liter, iv. Bacillus thuringiensis 3g/liter, v.* Chlorpyrifos+Cypermethrin 2ml/liter, vi. Derrisom 3ml/liter vii. Control) and three replication with each plot size of 2.25mx3m. To minimize the boarder effect 1m boarder was left and the space between plot and between the replication was 0.5 m and 1m respectively. All cultivation practices for tomato were conducted as per the recommendation. Different treatments were sprayed using Knapsack sprayer at late afternoon in the experimental plot. Four sample plants from each plot were tagged to study different parameters. Number of total fruit, number of damage fruit, weight of total fruit and weight of damage fruit and percentage of damage were recorded. Spraying in the plant surface was done four times based on the severity of insect pests and data were recorded after 4, 8 and 12 days of spray. Data were tabulated and analyzed using tool like Ms-Excel and R-Studio.

RESULTS AND DISCUSSION

Monitoring of Tomato fruit borer

The number of tomato fruit borer moth trapped in heli-lure is related to weather parameter. No tomato fruit borer moth was trapped during 23rd January and its number increased slowly. The number of tomato fruit borer moth trapped become twelve during 13th March which again increased forward. The highest number of tomato fruit borer moth (29) was trapped on 17thApril, after that its number decreased to zero at 24th April. The study showed that the population of tomato fruit borer moth was the highest during mid April then after it population decreased (Figure 1). Similarly, Pandey et al. (1997) reported March-April was the peak period of moth activities under tropical and subtropical climate. However, Joshi (2016) reported maximum number adult male moths trapped during third to fourth week of March in western part of Nepal.

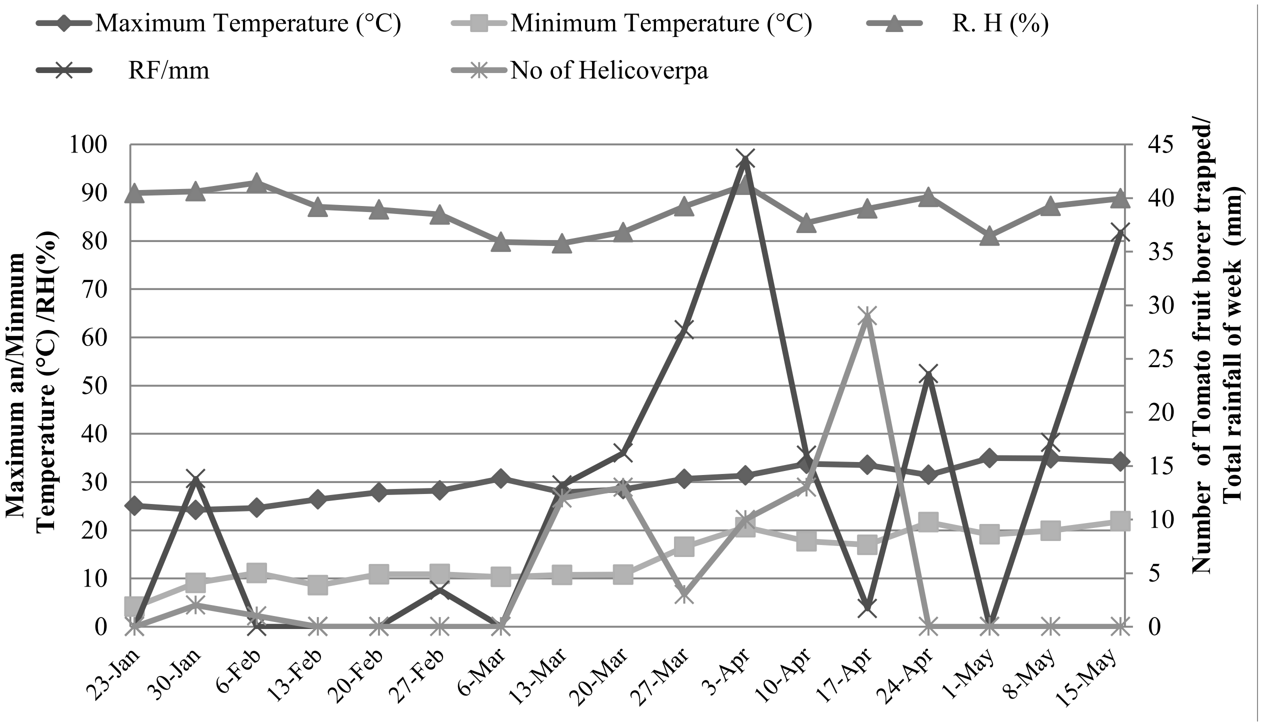

Figure 1. Number of tomato fruit borer moth trapped/week in Heli-lure trap at Bhartpur-18, Chitwan

The field experiment showed that total fruit number and total fruit weight was similar among different treatment. The damage percentage of fruit by tomato fruit borer on number basis was the highest with control plot (42.24) which was statically similar with *Bacillus thuriengiensis* (39.44)*, Metarihizium anisopliae* (35.32) and Derrisom (31.31) (Table 1). The bio-pesticide like *Bacillus thuriengiensis, Metarihizium* *anisopliae* and Derrisom seems ineffective for managing fruit borer that may be either due to unmanaged storage of pesticides. Katroju et al., (2014) also reported *Bacillus thuriengiensis* based insecticide as least effective against tomato fruit borer among different treatment in his experiment. The lowest fruit damage percent was observed with Flubendiamide (8.41) followed by Chlorpyrifos+Cypermethrin (19.98) and Emamectin benzoate (20.82) (Table 1). The novel insecticide like Flubediamide and Emamectin benzoate were highly effective against Lepidopteran pests (Chatterjee & Mondal, 2012). Similarly, Flubendiamide caused significantly higher reduction in the population of fruit borer larvae, the lowest fruit damage and the highest marketable yield than other treatments (Ameta & Bunker, 2007; Jat & Ameta, 2013; Ambule et al., 2015). The fruit damage percentages on weight basis by tomato fruit borer with different treatments were similar to damage percentage on number basis (Table 1). Similarly, Katroju et al. (2014) and Ambule et al. (2015) reported Emamectin benzoate as intermediate treatment for reducing larval population of tomato fruit borer among different treatment.

Table 1. Effect of treatments on the total number fruit, total fruit weight, percentage of damage fruit on number basis and weight basis in Bharatpur-18, Chitwan, 2017

Treatments	Total fruit number/four plant	Total fruit weight/ four plant(g)	Damage fruit percent	
			number basis	weight basis
Emamectin benzoate (0.625g/liter)	525.33^{abc}	14246.67^{abc}	20.82^{c}	17.05^{a}
Flubendiamide (0.21ml/ liter)	543.66^{ab}	15453.33^{a}	8.41^{d}	7.52^{ab}
Metarihizium anisopliae (3gm/liter)	455.00^{d}	12878.33^{cd}	35.32^{ab}	27.48^{ab}
Bacillus thuriengiensis (3gm/liter)	485.66^{cd}	13133.33^{bcd}	39.44^{a}	32.72^{b}
Chlorpyrifos+cypermethrin (2ml/liter)	572.66^{a}	15193.33^{a}	19.98^{c}	15.70^{c}
Derrisom(3 ml/liter)	516.66^{bc}	14500.00^{ab}	31.31^{b}	24.89^{c}
Control	466.66^{d}	12420.00^{d}	42.24^{a}	30.06^{d}
CV	5.56	5.38	14.56	13.77
LSD 0.05	50.176	1337.74	7.31	5.44
P-value	0.00117	0.00176	$2.91*10^{-6}$	$3*10^{-6}$
SEM	459.29	326,462.86	9.76	5.41

CV: Coefficient of Variation; LSD: Least Significance Difference; Values with the same letter in a column are not significantly different at 5% DMRT; SEM: standard error of means

Among the treatment, the highest yield was obtained with Flubendiamide (68.68mt/ha) which was statically similar with Chlorpyrifos+cypermethrin (67.53mt/ha) treated plot followed by Derisom (64.45mt/ha) and Emamectin benzoate (63.32 mt/ha). Ambule et al. (2015) also reported highest yield of tomato with use of Flubendiamide and intermediate yield with the use of Emamectin benzoate. The lowest yield was obtained with control plot followed by *Metarihizium anisopliae* (57.24mt/ha) and *Bacillus thuriengiensis* (58.37mt/ha).

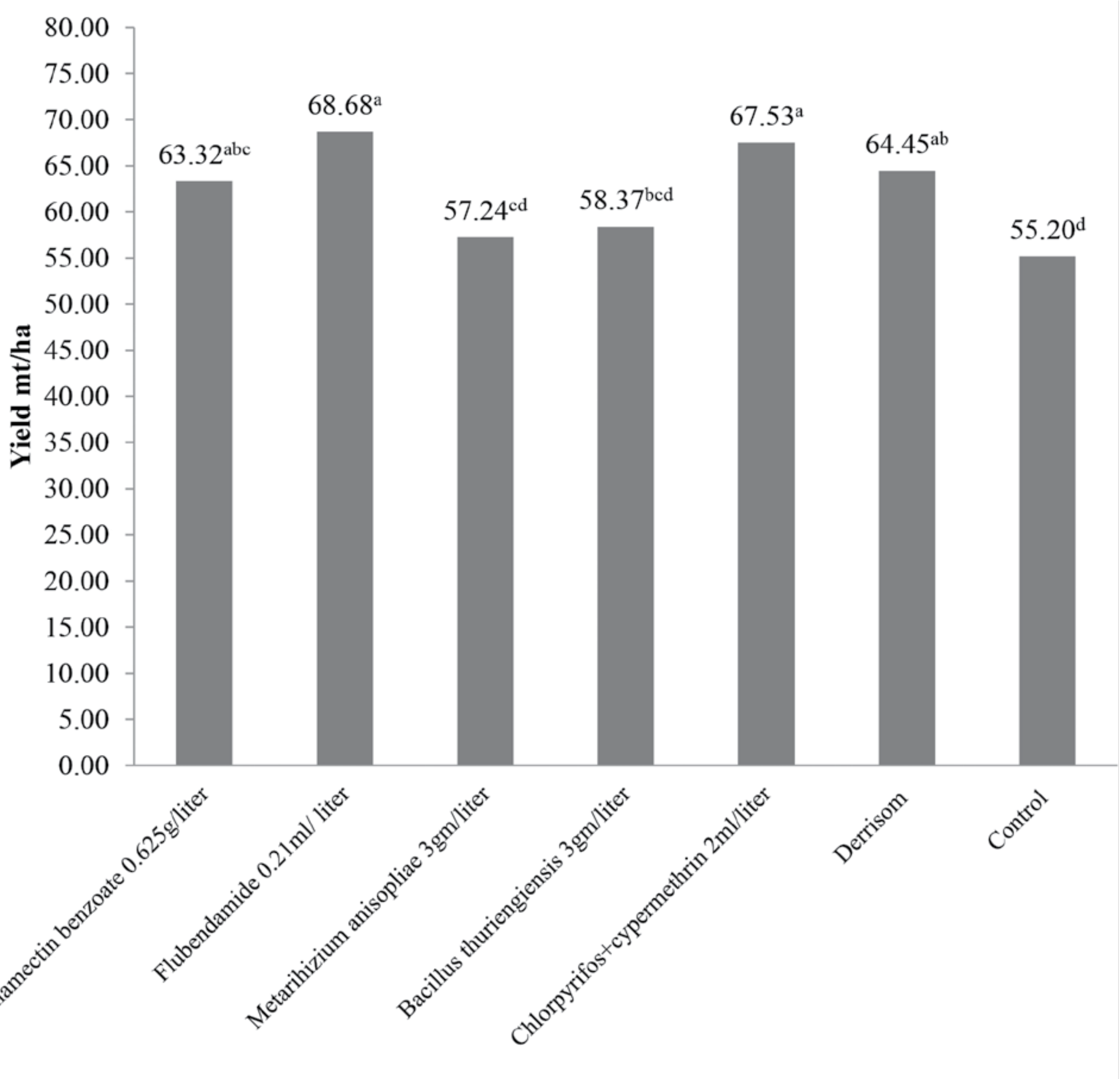

Figure 2. Tomato Yield under different insecticide against tomato fruit borer, Bhartpur-18, Chitwan, 2017

CONCLUSION

The population of tomato fruit borer adult moth was highest during mid-April then after its population decreased,so effective management option must be applied before April to reduce damage caused by this pest in tomato. The Flubendiamide being novel insecticide and very effective against tomato fruit borer, thus can be the best option for pest management over conventional insecticide.

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