

Effectiveness of Some Potential Insecticides for Controlling Eggplant Shoot and Fruit Borer in Bangladesh

ABSTRACT

The experiment was conducted in the central farm of Sher-e-Bangla Agricultural University (SAU), Sher-e-Bangla Nagar, Dhaka, Bangladesh during February to September, 2013 to evaluate some potential insecticides in comparison with conventional insecticides for controlling eggplant shoot and fruit borer (ESFB), *Leucinodes orbonalis*. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and six treatments applied at 7 days interval. The treatments were T₁ [Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) at the rate of 1ml/L of water]; T₂ [Calypso (Thiacloprid) at the rate of 1ml/L of water]; T₃ [Neem oil at the rate of 3ml/L of water]; T₄ [Neem Seed Kernel Extract at the rate of 100g/L of water]; T₅ [Nexaid (Gamma-cyhalothrin) at the rate of 1.5ml/L of water]; T₆ (Untreated Control). The results revealed that amongst newer insecticides Acimix 55 EC at the rate of 1ml/L of water was most effective in reducing shoot infestation (66.72%) and Calypso at the rate of 1ml/L of water was found most effective in reducing fruit infestation by number and weight (68.56 and 61.04%), over control followed (66.56, 53.7% respectively) by Acimix, whereas Neem Seed Kernel Extract @100gm/L of water from the field showed the least performance (19.40 and 9.17%, respectively). [U1] The best treatment, though, T₁ and T₂ reduced the highest level of shoot and fruit infestation respectively, they increased the maximum level of plant and fruit related yield attributes. T₂ increased the maximum height, number of branches per plant, fruit length and girth, number of fruits per plant, and single fruit weight of eggplant over control followed by Acimix whereas Neem Seed Kernel Extract @ 100g/L of water showed the least performance. Calypso also increased the highest fruit yield (15.36 t/ha) over control followed by Acimix (14.86 t/ha). So, Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) and Calypso (Thiacloprid) may be suggested to the farmers for controlling Eggplant shoot and fruit borer (ESFB) at shoot and fruit infestation time respectively.

Keywords: Insecticides, Botanicals, Eggplant, Control, *Leucinodes orbonalis*

1. INTRODUCTION

Eggplant (*Solanum melongena* L.) is one of the popular vegetables and is favored by many people of various countries specially Central, South and South East Asia [1]. It is one of the top ten vegetables grown in the world. Eggplant is the second most important vegetable crop of Bangladesh in respect of total land area (70,750 acre) and production (2,15,490 ton) annually [2]. It is available in the country throughout the year, especially during the lean period when the seasonal vegetables are in scarcity in the market. Eggplant is regarded as a cash crop in Bangladesh [3].

Different order of insect pests attack this crop, out of which [U2] eggplant shoot and fruit borer (*Leucinodes orbonalis*) is most serious [4], which caused up to 86% fruit damage in Bangladesh. To overcome this loss, the eggplant growers spray insecticides almost every day or every alternate day to combat the pest. They also use variety of insecticides belonging to different chemical groups [5]. More than 95% of farmers sprayed 40 different pesticides per cropping season in eggplant field [6]. Majority of the Bangladeshi farmers (98%) of Bangladesh relied exclusively on the use of insecticides and more than 60% of farmers sprayed their crop 140 times or more in the 6-7 months cropping season [7].

Thus, insects become resistant due to indiscriminately and repeatedly used of the same insecticides. So, it must be need to evaluate the effectiveness of new insecticides against the eggplant shoot and fruit borer at field level need to be evaluated.

So, the present study was undertaken to measure the effectiveness of five potential insecticides in Bangladesh to combat eggplant shoot and fruit borer and to determine which one can control the pest effectively find out the best insecticides which control insect pest population up to the mark based on shoot and fruit infestations, and as well as yield attributes.

2. MATERIALS AND METHODS

2.1. Study Site

The experiment was conducted in the central farm (open field condition) of Sher-e-Bangla Agricultural University (SAU), Dhaka from February to September, 2013. Bangladesh Agricultural Research Institute (BARI) released variety BARI Begun-8 was used for this experiment [U3]. The climatic condition of the experimental site was under the sub-tropical monsoon climate [U4], which is characterized by the Rabi season (October to March) and heavy rainfall during kharif season (April to September). There was few or no rainfall during the month of February and March.

2.2 Design of Experimental Design

The field experiment comprising of five treatments with an untreated control was laid out in a Randomized Complete Block Design (RCBD) with simultaneous three replications. The whole field was divided into three blocks of equal size having two meter space between the blocks and each block was again sub-divided into five plots (3m X 3m) with one meter space between the plots. Fifteen pits were made in each plot at a distance of 100 cm between the rows and 60 cm between pits in a row. Fertilizer application was done as recommended dose of this variety and supplementary irrigation; weeding and other intercultural operations were done when necessary. Insecticides were sprayed by knapsack sprayer starting from 14th April 2013 to the last of August 2013. [U5]

The treatments were: T₁ = Spraying of Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) at the rate of 1ml/L of water at 7 days interval, T₂ = Spraying of Calypso (Thiacloprid) at the rate of 1ml/L of water at 7 days interval, T₃ = Spraying of Neem oil at the rate of 3ml/L of water at 7 days interval, T₄ = Spraying of Neem Seed Kernel Extract at the rate of 100g/L of water at 7 days interval, T₅ = Spraying of Nexaid (Gamma-cyhalothrin) at the rate of 1.5ml/L of water at 7 days interval, T₆ = Untreated Control.

2.2.1. Preparation Neem Seed Kernel Extract

One hundred gram fresh neem seed was blended by electric blender then it was mixed with 1 L of water. The solid materials were separated from mixture by sieve.

2.3. Data Recording

The cumulative plot yield of healthy and infested fruits of nine harvests (June 2013 to September 2013) were transformed into healthy, infested and total yield per hectare in tons, respectively and also measure the infested fruit length, girth, number of branch and height of the plant.

Percent Shoot or fruit infestation and reduction of shoot or fruit infestation over control were calculated by using the following formula and insecticides were applied after observing 5% of fruit infestation. [U6]

$$\% \text{ Shoot or Fruit infestation (by number or by weight)} = \frac{\text{Number or Weight of infested shoot or fruit}}{\text{Total number or weight of shoot or fruits}} \times 100$$

$$\% \text{ Reduction of shoot or fruit infestation over control} = \frac{\% \text{ Shoot or Fruit infestation in untreated control} - \% \text{ Shoot or fruit infestation in treated plot}}{\% \text{ Shoot or fruit infestation in untreated control plot}} \times 100$$

2.4. Data Analysis

The data collected on different parameters were statistically analyzed using the MSTAT-C computer package. Mean values were ranked and compared by Duncan's Multiple Range Test (DMRT) at 5% level of significance.

3. RESULTS

3.1. Effectiveness of Five Selected Potential Insecticides on Eggplant Shoot and Fruit Borer (ESFB)

Table 1 revealed that significantly the lowest shoot infestation (6.45%) was observed in T₁ treated plot which was statistically similar but numerically different to T₂ (6.94%) treated plot, whereas the highest value was recorded in T₆ (control). It also revealed that highest shoot infestation reduction over control was recorded in T₁ (66.72%) followed by T₂ (64.19%).

Table 1 also indicated that significantly the lowest fruit infestation by number (14.77%) and weight (18.33%) were observed in T₂, whereas the highest value was recorded in T₆ (control). Reduction of fruit infestation by number and by weight was highest was recorded in T₂ treated plot whereas the lowest was recorded in T₄ treated plot. So, treatments T₁ and T₂ are better than other treatments in respect of reduction-reducing of both shoot and fruit infestation and reduction of fruit infestation both by number and by-weight respectively.

Table 1. Effectiveness of five selected potential insecticides on the infestation of eggplant shoot and fruit caused by eggplant shoot and fruit borer (ESFB)

Treatment	Shoot Infestation (%)	*Reduction of shoot infestation (%) over control	*Reduction of fruit infestation (%) over control			
			*Fruit infestation (%)			
			by number	by weight	by number	by weight
T ₁	6.45 c	66.72	15.64 e	21.78 e	66.56	53.7
T ₂	6.94 c	64.19	14.77 e	18.33 f	68.41	61.04
T ₃	14.03 b	27.68	33.60 c	38.53 c	28.15	18.09
T ₄	15.76 b	18.76	37.70 b	42.73 b	19.40	9.17
T ₅	14.89 b	23.25	21.91 d	31.81 d	53.15	32.38
T ₆	19.40 a	-	46.78 a	47.05 a	0	0
LSD _(0.05)	3.09	-	2.95	3.37	-	-

CV(%)	13.19	-	5.71	5.57	-	-
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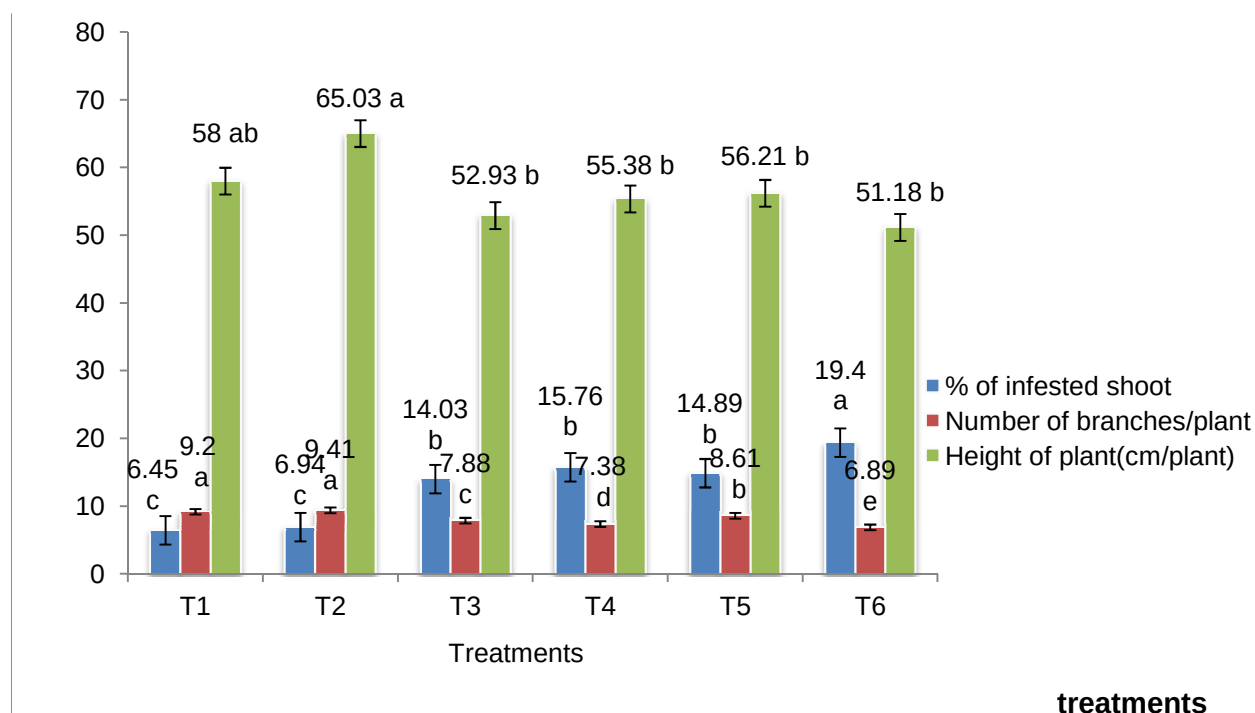
In a column, means followed by same letter(s) are not statistically different by DMRT at 5% level of significance.

[T₁ = Spraying of Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) at the rate of 1ml/L of water at 7 days interval; T₂ = Spraying of Calypso (Thiacloprid) at the rate of 1ml/L of water at 7 days interval; T₃ = Spraying of Neem oil at the rate of 3ml/L of water at 7 days interval; T₄ = Spraying of Neem Seed Kernel Extract at the rate of 100g/L of water at 7 days interval; T₅ = Spraying of Nexaid (Gamma-cyhalothrin) at the rate of 1.5ml/L of water at 7 days interval; T₆ = Untreated Control]

*Mean of 3 replications; each replication is derived from mean of 9 recordings; each recording is made from 5 plants per treatment.

3.2. Statistical Data between Shoot Infestation and Yield Attributes of Eggplant

Figure 1 represented that among the different treatments, Percent shoot infestation was lowest found in T₁ and T₂ treated plot which was not statistically different and percent shoot infestation was highest in untreated control plot (T₆) and other treatments showed the intermediate results. Number of the branch per plant and height of the plant was highest was recorded in Acimix 55 EC and Calypso [P10] treated plot which was significantly different from other treatments.[U11]

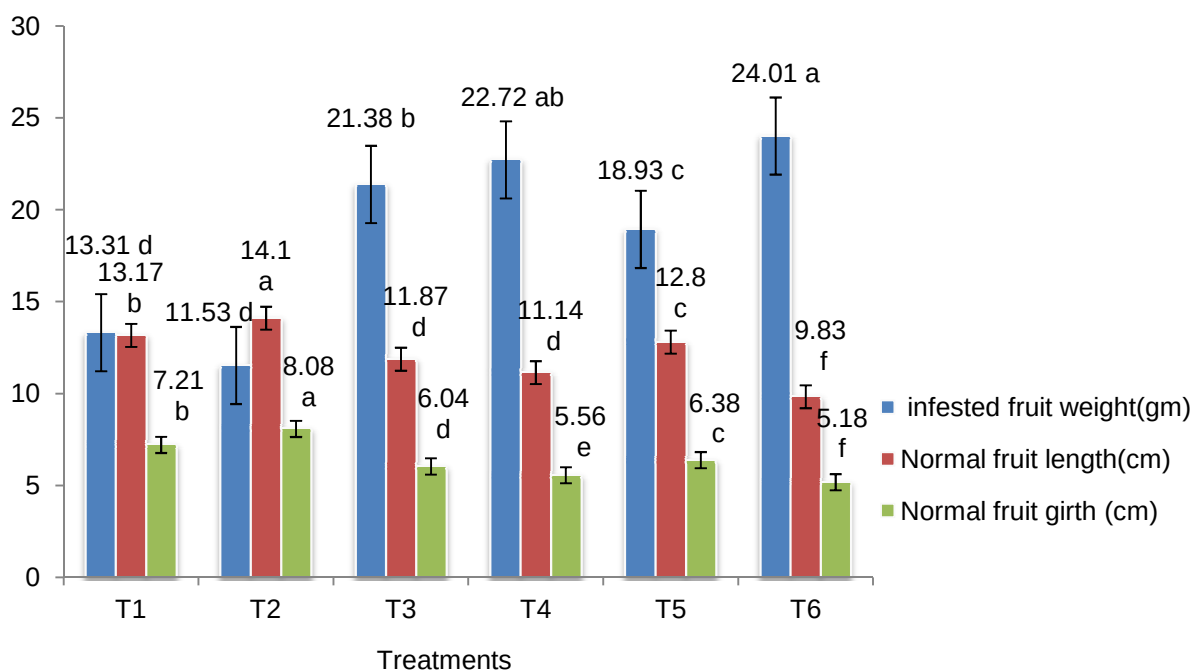


[U12]

[T₁ = Spraying of Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) at the rate of 1ml/L of water at 7 days interval; T₂ = Spraying of Calypso (Thiacloprid) at the rate of 1ml/L of water at 7 days interval; T₃ = Spraying of Neem oil at the rate of 3ml/L of water at 7 days interval; T₄ = Spraying of Neem Seed Kernel Extract at the rate of 100g/L of water at 7 days interval; T₅ = Spraying of Nexaid (Gamma-cyhalothrin) at the rate of 1.5ml/L of water at 7 days interval; T₆ = Untreated Control]

3.3. Statistical Data between Infested Fruit Weight and Fruit Related Yield Attributes in Different Treatments

Statistical data between infested fruit weight and yield attributes of eggplant is presented in the Figure 2. It was revealed that normal length and girth of single fruit were found in the treatments where the fruit infestations by weight were found lower and vice versa. These variations were found due to efficiency variations of different chemical control practices against eggplant shoot and fruit borer. That is the best treatment (T_2) increased the maximum length and girth of single fruit by reducing the fruit infestation at minimum level. [U13]



[T₁ = Spraying of Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) at the rate of 1ml/L of water at 7 days interval; T₂ = Spraying of Calypso (Thiacloprid) at the rate of 1ml/L of water at 7 days interval; T₃ = Spraying of Neem oil at the rate of 3ml/L of water at 7 days interval; T₄ = Spraying of Neem Seed Kernel Extract at the rate of 100g/L of water at 7 days interval; T₅ = Spraying of Nexaid (Gamma-cyhalothrin) at the rate of 1.5ml/L of water at 7 days interval; T₆ = Untreated Control]

3.4. Effectiveness of Some Potential Insecticides on the Yield of Eggplant Fruit

The significant variations were found among different treatments [U15] in terms of fresh fruit yield of eggplant due to application of different chemical practices against ESFB (Table 2). The highest yield was recorded in calypso (Thiacloprid) treated plot followed by Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) treated plot in terms of yield/kg/plot and yield/ton/ha. Significantly the lowest yield was found in control plot. The highest percent yield increase over control was observed in T₂ treated plot followed by T₁ treated plot and the lowest yield increase was found in T₄ treated plot.

Table 2. Effectiveness of five selected potential insecticides on the yield of eggplant fruit during the total cropping season

Treatment	Yield of Fresh Fruits		
	*(kg/plot)	*(Ton/ha)	% Increased over control
T ₁	8.91 ab	14.86 ab	40.98
T ₂	9.21 a	15.36 a	45.73
T ₃	8.41 c	14.02 c	33.01
T ₄	7.58 d	12.63 d	19.89
T ₅	8.61 bc	14.35 bc	36.17
T ₆	6.32 e	10.54 e	-
LSD _(0.05)	0.45	0.76	-
CV(%)	3.08	3.08	-

In a column, means followed by same letter(s) are not statistically different by DMRT at 5% level of significance.

[T₁ = Spraying of Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) at the rate of 1ml/L of water at 7 days interval; T₂ = Spraying of Calypso (Thiacloprid) at the rate of 1ml/L of water at 7 days interval; T₃ = Spraying of Neem oil at the rate of 3ml/L of water at 7 days interval; T₄ = Spraying of Neem Seed Kernel Extract at the rate of 100g/L of water at 7 days interval; T₅ = Spraying of Nexaid (Gamma-cyhalothrin) at the rate of 1.5ml/L of water at 7 days interval; T₆ = Untreated Control]

**Mean of 3 replications; each replication is derived from mean of 9 recordings; each recording is made from 5 plants per treatment.*

4. DISCUSSION

Chlorpyrifos 50% + Cypermethrin 5% EC Mainly used for controlling bollworm, thrips, shoot & fruit borer, beetle in various agriculture crop like cotton, okra, brinjal etc [8]. It has no phytotoxic effect if used as recommended dose. It acts as strong contact, stomach and respiratory action [9]. *So, in this study we found plant height and number of branches grows well that enhance the fruit length and girth of the fruit and finally influence the yield of the eggplant, it's may be because it has no phytotoxic effect.*[P16]

Similar findings were reported by some researchers supporting the results of the present study. Only cypermethrin 10 EC at 1 ml/l of water sprayed after observing 5% level of fruit infestation can control ESFB effectively and economically [10]. *Why???* The combination of Chlorpyrifos 50% EC + Cypermethrin 5% EC, being the most effective and economically viable insecticide to manage *L. orbonalis* in eggplant crop [11]. Nimbecidene was the least effective in controlling the BSFB and resulted lowest yield [12], but another researchers reported that Nimbecidene provided higher yield (13.02 t/ha) than Endosulfan [13]. Several researchers reported the best performance of Cypermethrin in producing highest yield of eggplant [14]. Efficacy of cypermethrin and abamectin was moderate in winter but low in summer [15]. So, in our study Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) supports the previous results. It is noticeable that, due to used of synthetic pyrethroids for the control of eggplant shoot and fruit

borer, leading to whitefly, aphid and mite resurgence [16]. For considering eco-friendly plant health management, and retain natural enemy in field level Neem extract is very effective for controlling ESFB [17].

Calypso is a broad spectrum thiacloprid group of insecticide that is feasible for chewing/sucking type insect including Apple maggot, Second generation codling moth, Oriental fruit moth, First generation spotted tentiform leafminer, Leafhoppers, Aphids, Japanese beetle, Mullein bug, Second and third generation spotted tentiform leafminer and so on [18]. But, in this experiment we found that this insecticide is very much effective against lepidopteran insect mainly Eggplant Shoot and Fruit Borer (ESFB). It is more effective in fruit infestation time rather than shoot infestation time in eggplant agroecosystem. This is first time reported in Bangladesh that, this insecticide is effective for controlling ESFB.

You must give reasons for statements that you gave. Discussion should be elaborated, not just simply compared with other published works. Thus, you need to redo the discussion.

5. CONCLUSION

In this study, amongst the five potential insecticides, Acimix 55 EC (Chlorpyrifos 50% + 5% Cypermethrin) and Calypso (Thiacloprid) perform better than other insecticides for controlling ESFB effectively based on shoot and fruit infestation, fruit length, plant height, branches of the plant, girth of the fruit and finally fresh yield of the eggplant. [P17] Between these two insecticides Acimix 55 EC is most effective in shoot infestation time and Calypso is most effective in fruit infestation time though they are statistically similar (but numerically different). So, we suggest the farmers use the Acimix 55 EC when ESFB attacks on shoot and in fruit infestation time (after observing 5% of fruit infestation) Calypso may be used for controlling ESFB as per recommended dose. It might be a suggestion to the farmers not to use insecticide indiscriminately but also used as a rational manner to get better yield as well to keep the environment sound from toxic materials.

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