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EFFECTIVENESS OF SOME INSECTICIDES ON INFESTATION AND YIELD AGAINST BRINJAL SHOOT AND FRUIT BORER

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ABSTRACT

An experiment was conducted at the Sher-e-Bangla Agricultural University, Bangladesh during December 2005 to May 2006 to evaluate one organophosphate, one carbamate and two synthetic pyrethroid insecticides for their effectiveness to control brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee). The study comprising five treatments including a control and laid out in a Randomized Complete Block Design (RCBD). Among the treatments, T_3 (marshal 20EC applied at 28 days after transplanting and applied at 7 days interval) performed best in terms of reduction of shoot and fruit infestation, on the other hand it increased fruit yield. It gave 65.18% reduction in shoot infestation and 95.38% reduction in fruit infestation over control with the highest yield of 24.55 t/ha.

Key words: brinjal shoot and fruit borer, infestation, intensity, yield

INTRODUCTION

Brinjal (*Solanum melongena* Linnaeus) is one of the most popular and principal vegetable crops grown in Bangladesh. Brinjal is also known as eggplant or aubergine or melanzane which belongs to the family Solanaceae. In Bangladesh a total of 3, 34,000 metric tons brinjal was produced during the year of 2006 (Anon., 2006). More than 70% of the total vegetables are produced in Rabi season and less than 30% of it is grown in Kharif season(Anon., 1995). Brinjal is attacked by 53 species of insect pests of which eight insect species are considered as major pests causing damage to the crop and the remaining ones including a mite are considered as minor pests (Biswas *et al.*, 1992). The losses caused by these pests vary from season to season depending upon environmental factors (Patel *et al.*, 1988). Among them, Brinjal shoot and fruit borer (BSFB) *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae) is the most obnoxious and detrimental pest of brinjal in Bangladesh (Alam, 1969; Butani and Jotwani, 1984; Nair, 1986; Chattopadhyay, 1987). The pest is very active in summer, especially in the rainy season and less active during February to April. The yield loss has been estimated up to 86% (Ali *et al.*, 1980) and 67% (Islam and Karim, 1991) in Bangladesh. The infestation ranged from 12 to 16% for shoot (Alam *et al* ., 1964) and 20 to 86% for fruit in Bangladesh (Ali *et al.,* 1980), and the percent of fruit infestation and crop loss caused by this pest ranged from 37 to 63% in different states of India. Considering the importance of this pest a wide range of organophosphorus, carbamates and synthetic pyrethroids with various spray formulations have been suggested from time to time against this pest in india (Yein, 1985). The suppression of this pest by other alternative non-chemical approaches like cultural, mechanical, biological, host plant resistance, grafting techniques etc. in Bangladesh and some other parts of the world are limited.

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To feed the ever increasing world population demand the intensified drive for food production call for the use of safer and environment friendly agro chemicals. The use of such insecticides has become indispensable in increasing vegetable crop production. The review reveals that among the available pest control techniques, safer and friendly chemical means are still encouraging for their rapid, cost-competitive, effective uses. At present, many such safer organophosphates, carbamates and synthetic pyrethroids are being used to control brinjal shoot and fruit borer. But the actual efficacy of such type of insecticides is lacking. These insecticides and doses were selected because most of the brinjal growers used these insecticides and doses for the control of brinjal shoot and fruit borer in the field. Therefore, the present study was undertaken to evaluate the effectiveness of one organophosphate, one carbamates and two synthetic pyrethroid insecticides against the brinjal shoot and fruit borer.

MATERIALS AND METHODS

The experiment was carried out at the Horticulture Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during the period from December 2005 to June 2006. The experimental field was a medium high land and p^H of the soil was 5.6 under the Agroecological Zone 28. The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications. The land was well prepared by harrowing followed by ploughing, cross- ploughing and leveling. Cow-dung and other chemical fertilizers were applied as recommended by Rashid (1993) for eggplant. The whole field was divided into four equal size blocks having 1 m space between the block and each block was again sub-divided into 5 plots (3m x 3m each) with 1 m space between the plots. Eighteen pits were made in each plot at a distance of 100 cm between rows and 50 cm between pits on a row. Brinjal seeds (variety: Singnath) were used and fourty days-old healthy seedlings were transplanted on 31 January, 2006 in the field. A total of 360 seedlings were transplanted in 20 plots at the rate of 18 seedlings per plot. Effectiveness of four treatments to reduce shoot and fruit borer infestation in brinjal was evaluated in relation to control having no insecticide. The treatments included in the study were as follows: T_1= Application of cymbush 10EC @ 500 ml/ha after 28 days of transplanting and repeated at 7days interval, T_2 = Application of ripcord 10EC @ 500 ml/ha after 28 days of transplanting and repeated at 7days interval, T_3 = Application of marshal 20EC @ 1500 ml/ha at 28 days after transplanting and repeated at 7days interval, T_4 = Application of chlorpyrifos 20EC @ 1000 ml/ha after 28 days of transplanting and applied at 7days interval, T_5 = Untreated control. For the purpose of determining the incidence of adults and the level of infestation after insecticide application, a close monitoring of egg deposition, shoot infestation and fruit infestation till final harvest has been carried out at every alternate days from randomly selected 9 plants per plot. For convenience of expression of infestation intensity per fruit, four scales corresponding to the number of bores per fruit have been used as follows:- Scale 1 (Low intensity) : 1-2 bores per fruit; Scale 2 (Moderate intensity) : 3-4 bores per fruit; Scale 3 (High intensity): 5-6 bores per fruit; Scale 4 (Very high intensity): > 7 bores per fruit. The infestation data so collected have been transformed into percent each time so that the application of insecticide can be made whenever it reaches the pre-set level. The following parameters were considered for evaluating the effectiveness of each treatment in controlling brinjal shoot and fruit borer infestation: shoot infestation, fruit infestation, infestation intensity per fruit, extent of damage and yield. Fruit length, girth of fruit, fruit weight, damage length, damage weight and fresh weight of fruit also recorded. All the data collected were processed and analyzed statistically after appropriate transformations. The analysis of variance (ANOVA) of different parameters was done and the means were separated by Duncan's Multiple Range Test (DMRT). Graphs have been prepared wherever needed for presenting the results.

RESULTS AND DISCUSSION

Effect of different treatments on shoot and fruit infestation

The comparative effectiveness of various treatments on shoot infestation by BSFB has been evaluated in terms of their efficacy in reducing the shoot infestation over control expressed in percent (Table 1). The shoot infestation was the lowest (2.74%) in the plots treated with marshal 20EC after 28 days of transplanting and repeated at 7 days interval (T_3). The second lowest shoot infestation (4.36%) was observed in the plots treated with chlorpyrifos 20EC after 28 days of transplanting at 7 days interval (T_4). The shoot infestation of 5.13% was observed in the plots receiving ripcord 10EC applied after 28 days of transplanting at 7 days interval (T_2). The highest shoot infestation of 6.02% was observed in the plots treated with cymbush 10EC (T_1) which was significantly different from that of control plot (T_5) 7.87%. It is revealed that marshal 20EC gave the significantly highest reduction (Table 1) in shoot infestation (65.18%) over control (T_3). This was followed by a 44.60%, 34.82% and 23.50% reduction in shoot infestation over control achieved by chlorpyrifos 20EC (T_4), Ripcord 10EC (T_2), and cymbush 10EC (T_1), respectively. The comparison of the results of present study with the available findings shows that the level of reduction in shoot infestation was achieved over control, exceed the levels reported by others who found about 80% reduction over control. Kabir *et al.* (1994) observed similar results where the chemical insecticide was not very effective against BSFB.

The comparative effectiveness of various treatments on fruit infestation by the brinjal shoot and fruit borer has been evaluated in terms of per cent fruit infestation by number and weight as well as in per cent reduction in infestation over control is presented in Table 1. The results showed that the lowest fruit infestation of 3.15% by number and 4.28% by weight was observed in the plots of T_3, followed by 8.20%, 21.06% and 24.22% by number and 9.34%, 21.82% and 24.34% by weight in the plots treated with T_4, T_2 and T_1 treatments respectively which were significantly differed from each other including the untreated control.

Table 1. Effect of different treatments on shoot and fruit infestation on brinjal by brinjal shoot and fruit borer

Treatments	Dose (ml/ha)	No. of application	* Shoot infestation (%)	* Fruit infestation (%) over control		* Reduction of fruit infestation (%)		* Reduction of shoot infestation over control
				by no.	by wt.	by no.	by wt.	
T_1	500	12	6.02 b	24.22 b	24.34 b	64.44	44.96	23.50
T_2	500	12	5.13 c	21.06 c	21.82 b	69.08	50.66	34.82
T_3	1500	12	2.74 e	3.15 e	4.28 d	95.38	90.32	65.18
T_4	1000	12	4.36 d	8.20 d	9.34 c	87.96	78.88	44.60
T_5	--	12	7.87 a	68.11 a	44.22 a	--	--	--
$LSD_{(0.005)}$		--	0.578	0.509	3.723	--	--	--
CV (%)		--	7.19	17.11	11.62	--	--	--

T_1=Application of Cymbush 10EC @ 500 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_2 =Application of Ripcord 10 EC @ 500 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_3 =Application of Marshal 20 EC @ 1500 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_4 =Application of Chlorpyrifos 20 EC @ 1000 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_5 =Untreated Control.
* Mean value of 4 replications; each replication is derived from 9 plants per treatment.
In a column, means followed by same letter(s) are statistically identical by DMRT at 5% level of significance.

In terms of reduction in fruit infestation, over control, marshal 20EC (T_3) sprayed at 7 days intervals @ 1.5 ml/l of water provided the highest reduction in fruit infestation (95.38% by number and 90.32% by weight) over untreated over control (T_5). This was followed by fruits harvested from T_4 (87.96%), T_2 (69.08%) and T_1 (64.44%) treated plots in respect of reduction of fruit infestation by number, and T_4 (78.88%), T_2 (50.66%) and T_1 (44.96%) in respect of fruit infestation by weight. Only the treatment T_3 was able to exceed the standard level of 80% reduction in fruit infestation over control by both number and weight. The results thus obtained in the present study when compared to the findings reported by other workers suggest that all the treatments including the one which achieved the highest reduction of 95.38% by number and 90.32% by weight were less effective in reducing the fruit infestation as compared to those reported by them. Arrivo and Bestox achieved 56.94% and 51.33% reduction of fruit infestation respectively over control, respectively (Anonymous, 1995). Kabir *et al.* (1994) reported similar results and apprehended the development of resistance as a cause for poor performance of insecticides in reducing the brinjal shoot and fruit borer infestation. Prakash (1988) also reported that insecticides were unable to suppress this borer pest below the Economic Injury Level (EIL).

Effect of different treatments on the yield of brinjal

Effect of different treatments on yield has been evaluated in terms of total fruit yield, healthy fruit yield and infested fruit yield obtained in each treatment during the entire period of the crop (Table 2). The total fruit yield was maximum (24.55 t/ha) in the plots of marshal 20EC applied after 28 days of transplanting and repeated at 7 days intervals (T_3) followed by significantly lower yield (21.95 t/ha) in the plot of T_4 with minimum yield of infestation fruit (1.05 t/ha-2.05 t/ha).Table 2 indicated that application of cymbush 10EC (T_1) was not enough to protect the fruit yield from the pest attack and provided only 14.72 t/ha healthy yield and this was followed by those of ripcord (T_2) treated plots with no significant difference between these. Control had only 8.91 t/ha healthy fruit yield.

Table 2. Effect of different treatments on the yield of healthy fruits, infested fruits and total fruits of brinjal

Treatments	Yield(t/ha)		
	*Healthy	*Infested	*Total
T_1	14.72c	4.72b	19.44c
T_2	16.61c	4.64b	21.25bc
T_3	23.50a	1.05d	24.55a
T_4	19.90b	2.05c	21.95b
T_5	8.91d	6.97a	15.88d
$LSD_{(0.005)}$	1.917	0.441	2.083
CV (%)	7.44	7.39	

T_1= Application of Cymbush 10EC @ 500 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_2 =Application of Ripcord 10 EC @ 500 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_3 =Application of Marshal 20 EC @ 1500 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_4 =Application of Chlorpyrifos 20 EC @ 1000 ml/ha at 28 dayas after transplanting and repeated at 7days interval.
T_5 =Untreated Control.

* Mean value of 4 replications; each replication is derived from 9 plants per treatment.

In a column, means followed by same letter(s) are statistically identical by DMRT at 5% level of significance.

Infestation Intensity and Yield Reduction

The yield of edible fruits, non-edible fruits and total yield in relation to different scales of infestation intensity as shown in Figure 1 displayed that the total weight of the non-edible fruits decreased very sharply with the increase of infestation intensity. Thus the infestation intensity has got significant impact on the yield reduction. It is revealed from the Figure that total weight (yield) has drastically decreased, the proportion of non-edible fruit (yield) has sharply increased with the decrease in the healthy portion of fruit in case of higher Scales of infestation intensity.

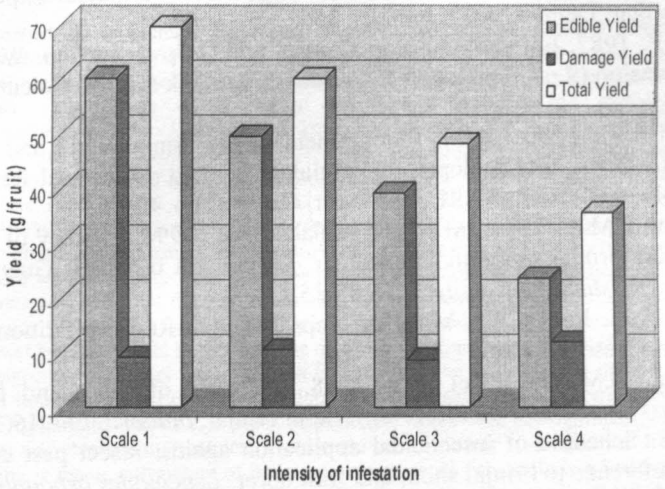

Figure 1. Relationship of intensity of infestation with edible, damage and total yield per fruit

Thus from the above analysis it may be inferred that for proper evaluation of the effect of insecticide would be logical to consider infestation intensity as a measure of comparison. The fruits under different treatments, therefore, should be sorted out into groups corresponding to different scales based on the number of bores per fruit. Otherwise, the results relating to efficacy of the insecticides in reducing the fruit infestation by brinjal shoot and fruit borer would be misleading failing to reflect the actual effect. Although not exactly the same but similar approach had been followed in an experiment conducted by Biswas *et al.*(1998).

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