J. Sher. Agric. Univ., 1(1): 14-22, July 2007

USING SOME IPM PACKAGES FOR SUPPRESSING BRINJAL SHOOT AND FRUIT BORER (*Leucinodes orbonalis* Guenee) IN KHARIF SEASON

A. Akter[1], J. Begum[2], M. Ali[3] & M. M. Rahman[4]

ABSTRACT

A study was conducted at the experimental farm of Sher-e-Bangla Agricultural University (SAU), Dhaka during January to July, 2005 to evaluate the effect of six IPM Packages in suppressing brinjal shoot and fruit borer. IPM packages were: 1. Mechanical + cultural control, 2. Mechanical + cultural control + Sumi-alpha 5EC @ 1ml/l of water at 7 days interval, 3. Furadan 5G applied at vegetative stage+ Sumi-alpha 5EC applied at 7 days interval, 4. Mechanical + cultural control, Suntap 50 WP at 7 days interval, 5. Suntap 50 WP at 7 days interval, 6. Mechanical and cultural control + Suntap 50WP + Sumi-alpha 5EC at 5% infestation level, 7. An untreated control is needed in this study for comparison. These packages were tested on a local brinjal variety, "Khatkhatia'. Highest infestation of shoot (17%) & fruit (63% by wt. & 75% by no.) was observed in the control plot, which was significantly highest from all other treatments. The lowest shoot infestation (6.0%) and fruit infestation (36.11%) was obtained from the plots of Mechanical and cultural control + Suntap50WP@1g/l & Sumi-alpha5EC @ 1ml/l of water, which was differed significantly from other treatments. The rate of fruit infestation due to BSFB was higher at later stages of crop growth for all the treatments.

Key words: Intensity infestation, brinjal shoot and fruit borer

INTRODUCTION

Brinjal, *Solanum melongena* L. also known as eggplant and aubergine, is one of the most popular and principal vegetable crops grown in Bangladesh. Brinjal is a warm season crop requires continuous long warm weather during growth and fruit maturation. The optimum growing temperature is 22-30^0 C and growth stops at temperatures below 17^0 C (Yamaguchi, 1983)

Brinjal is extensively grown in kitchen and commercial gardens in both Rabi and Kharif season in Bangladesh and acceptable to the people of all social status. It is the second most important vegetable crop after potato in Bangladesh in relation to its production and consumption. Brinjal covers an area of 29,960 hectares, which is about 14.92% of total vegetable area of the country, and its production is about 382000 tons during the year 2000 (Anon, 2003).

Brinjal is attacked by 53 species of insect pests among which the most obnoxious and detrimental one is the brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guenee (Alam and Sana, 1962, Butani and Jotwani, 1984; Nair, 1986; Chattopadhyay, 1987, Tewari and Sandana, 1990). The incidence of the pest occurs either sporadically or in outbreak every year throughout subcontinent affecting the quality and yield of the crop adversely (Alam, 1969; Dhankar, 1988).

Incidence of BSFB in brinjal could cause damage as high as 12-16% on shoots and 20-63% on fruits depending on different brinjal varieties, growing area, and seasons (Alam, 1969). The colossal yield loss caused by this pest has been estimated up to 67% in Haryana, India (Dhankar, 1988). Considering the seriousness of the pest a wide range of organphosphorus, carbamates and synthetic pyrethroids with various spray formulations have been advocated from time to time against this pest (Yein, 1985; Parkash, 1988).

[1]M.S Student, [2] Prof. ,[3] Prof. , [4]Asstt.Prof., Department of Entomology, Sher-e-Bangla Agricultural University, Dhaka-1207.

Thus, the use of chemical means still vital and provide a rapid, cost-competitive and typically effective tool to combat this pest although in many instances the insecticides do not provide good control.

It is, therefore, a national demand to find out the best-suited control measures including chemicals for managing this pest at desirable level. The possibility of suppression of this pest by cultural method, clipping of infested shoots, use of kerosene, neem oil and botanicals, grafting seedling on wild Solanum and use of selective chemicals are some of the new and unexploited approaches. July-2007]

As no other suitable non-chemical control measures against this pest are available, the best IPM package develop through this study is expected to be an economically sound to combat this pest with maximum return. Moreover, escape from such undesirable adverse effect of pesticides, judicious use of chemical insecticides may still be considered as a prime weapon.

Therefore, in the present study some IPM package consisting of combinations of various cultural, mechanical and chemical control methods were considered to evaluate some IPM package for reducing the intensity of infestation of Brinjal shoot and fruit borer during Kharif season.

MATERIALS AND METHODS

The present study for suppressing infestation of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) in kharif season by utilizing different IPM packages was carried out at the experimental farm of Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh during April to July, 2005. IPM packages were: 1. Mechanical + cultural control, 2. Mechanical + cultural control + Sumi-alpha 5EC@ 1ml/l of water at 7 days interval, 3. Furadan 5G applied at vegetative stage+ Sumi-alpha 5EC applied at 7 days interval, 4. Mechanical + cultural control, Suntap 50 WP at 7 days interval, 5. Suntap 50 WP at 7 days interval, 6. Mechanical and cultural control + Suntap 50WP + Sumi-alpha 5EC at 5% infestation level, 7. An untreated. The experimental site is situated in the sub-tropical climatic zone characterized by heavy rainfall during the month from April to July during study and scattered rainfall during the rest of the year. Monthly maximum and minimum temperature, relative humidity and total rainfall recorded during the period of present study at the SAU experimental farm.

The experiments consist of six IPM packages and an untreated control was laid out in a `Randomized Complete Block Design (RCBD) having 3 replications. The soil of the experimental field was well prepared by ploughing, harrowing and followed by cross ploughing and leveling. The whole field was divided into 3 blocks of equal size and each block was sub-divided into 7 plots (2m X 1.5m). Nine brinjal (variety: "Khatkhatia") seedlings of 40 days old (3/4 leaf stage) were planted on 10 February, 005 in each plot at a distance of 75 cm between lines and 50cm between plants. A total of 189 seedlings were transplanted in 21 plots. Cowdung and other chemical fertilizers were applied as recommended by Rashid (1999) for brinjal cultivation @ 15 tons of cowdung and 250, 150 and 125 kg of Urea, TSP and MP, respectively per hectare. The half of cowdung and TSP were applied as basal dose during land preparation. The remaining cowdung, TSP and, one-third of MP were applied in the pits at transplantation of brinjal seedlings. The entire dose of urea and the rest of MP were applied as top dressing.

Weeding and mulching were given whenever necessary. The MP and urea were top dressed in 3 splits as described earlier. Insecticides in packages were applied in the manner given below:

Sumi-alpha 5EC was applied by mixing of insecticide @ 1ml per litre of water. Furadan 5G single dose was applied @ 1.5 kg a.i./ ha by mixing the insecticide with soil and light irrigation afterwards during early vegetative stage. Suntap 50WP was applied by mixing 2g of insecticides with one litre of water and sprayed in the similar manner as sumi-alpha. The comparative effectiveness of the IPM packages in suppressing of shoot and fruit borer infestation was

evaluated on the basis of some pre-selected parameters. The following parameters were considered during data collection.

Number of infested shoots: The total number of shoots and the number of shoots infested by the BSFB was recorded at weekly intervals from each plot for each treatment during the period from February to July, 2005 and the weekly percent shoot infestation and its reduction over control were calculated for all the packages. In mechanical control the infested shoots were clipped, removed and destroyed after counting. In cultural control the targeted plots were regularly cleaned and mulched for ensuring good sanitation.

Number of fruits per plot: Data were collected on the basis of the number of harvested fruits per plot at each harvest from each package. The marketable fruits were harvested at 7 days intervals at some early, mid and late fruiting stages.

Number of healthy and infested fruits: In total only 7 harvests were done throughout the fruiting period (April to June 2005). Infestation rate (by number and weight) of brinjal fruits caused by BSFB in plots having different packages and its reduction over control were calculated.

Weight of healthy and infested fruit: The weight of healthy and infested fruits was taken separately per plot for each IPM package.

Fruit infestation percent: The infested fruits by number and weight were calculated at each harvest during early, mid and late fruiting stages of the crop the following procedure:

$$\% \text{ Fruit infestation by number} = \frac{\text{Number of infested fruits}}{\text{Total number of fruits}} \times 100$$

$$\% \text{ Fruit infestation by weight} = \frac{\text{Weight of infested fruit}}{\text{Total weight of fruit}} \times 100$$

The data were analyzed statistically for each parameter like mean shoot and fruit infestation (%), Mean (by number and weight) healthy and infested yield etc. The analysis of variance (ANOVA) of different parameters was performed and the means were separated by using Duncan's Multiple Range Test (DMRT). Before statistical analysis, the data were transformed was done where appropriate using square root transformation procedure for the accuracy of results. Data were analyzed by MSTAT-C software.

RESULTS AND DISCUSSION

The results of comparative effectiveness of six IPM packages including an treated control in suppressing the infestation of brinjal shoot and fruit borer (BSFB) was evaluated and their suitability as IPM packages was assessed.

Effect of different packages on shoot infestation of brinjal.

The comparative effectiveness of various IPM packages alongwith untreated control on percent shoot infestation by the BSFB has been evaluated and their efficacy in reducing shoot infestation over control were presented in Table1.

The results revealed that the lowest shoot infestation (6.0%) was obtained from plots having IPM package 6 consisting of Mechanical and cultural control + Suntap 50WP @1g/l & Sumi-alpha 5EC @ 1ml/l of water, which differed significantly from all other packages. The second lowest shoot infestation (8.0%) was obtained from plots utilizing IPM package 5 comprising mechanical and cultural control + Suntap 50WP @ 2g/l of water at 7 days interval. At followed by IPM package 4 (9.0%), and IPM packages 3 (10.0%) and they were not significantly differences from each other (Table 1). The highest shoot infestation (17.0%) was recorded from untreated control

plots, which was significantly higher from all other treatments. The second highest shoot infestation (14.0%) was observed in the plots of IPM packages 1 utilizing mechanical +cultural control followed by IPM packages 2 (12.0%) comprising mechanical and cultural control + Sumi-alpha5EC @ 1ml/l of water but they were significantly different from each other.

The percent shoot infestation reduction over control was highest (64.71%) in plots of IPM package 6 followed by IPM package 5 (52.94%), and IPM package 4 (47.05%). For other treatments, this reduction was 47.06% for IPM package 3, 29.41% for IPM package 2 and 17.65% for IPM package 1.

Table 1. Infestation of brinjal shoots caused by the brinjal shoot and fruit borer

Treatment	*Mean shoot infestation (%)	Reduction of shoot infestation over control (%)
IPM package 1	14.00 b (3.73)**	17.65
IPM package 2	12.00 c (3.46)	29.41
IPM package 3	10.00 d (3.20)	47.06
IPM package 4	9.00 de (3.00)	47.05
IPM package 5	8.00 e (2.80)	52.94
IPM package 6	6.00 f (2.43)	64.71
Untreated control	17.00 a (4.10)	

(BSFB) in plots of different IPM packages and its reduction over control during Kharif 2005.

IPM package 1 = Mechanical control + Cultural control

IPM package 2 = Mechanical and Cultural control + Sumi-alpha 5EC@ 1ml/l of water at 7 days interval

IPM package 3 = Furadan 5G @ 1.5 kg a.i./ha single application at vegetative stage+ Sumi alpha 5EC@ 1 ml/l of water at 7 days interval

IPM package 4 = Suntap 50 WP @ 2 g/l of water at 7 days interval

IPM package 5 = Mechanical and Cultural control + Suntap 50 WP @ 2g/l of water at 7 days interval

IPM package 6 = Mechanical and cultural control + Suntap 50WP @1g/l+ Sumi-alpha 5EC @ 1ml/l of water at 5% infestation level

Untreated control

* Mean of 3 replications; each replication is derived from the mean of 10 observations.

** Figures in parentheses are transformed (square root) values.

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

Results revealed that the mechanical or cultural method supplemented with insecticidal application might increase the percent shoot infestation reduction over the untreated control. Thus

the decreased rate of shoot infestation might be ensured by utilizing IPM package 5 consisting of mechanical +cultural control + Suntap 50WP @ 2g/l. On the other hand IPM package 2 consisting of mechanical +cultural control + Sumi-alpha5EC@ 1 ml/l might be chosen as the second line of defense.

Effect of different IPM package on fruit infestation of brinjal.

The effect of various IPM packages on the percent fruit infestation at early, mid and late fruiting stages of the crop by number & weight and its infestation reduction over control are presented in Tables 2-4. At early fruiting stage the mean percentages of fruit infestation (by number) among the treatments varied significantly (Table 2). The untreated control plots had the highest fruit infestation (72.22%), which differed significantly from all other IPM packaged plots. The second highest fruit infestation was 61.11% recorded from plots of IPM package 1 consisting of Mechanical + cultural control and this was followed by IPM package 4, plots (50.00%). The lowest fruit infestation (by number) was obtained from the package 6 plots where Mechanical and cultural control +Suntap 50 WP@ 1g/l + Sumi-alpha 5EC @1ml/l of water was used (36.11%). The second lowest fruit infestation was obtained from the Plots with IPM package 3 (44.44%) followed by package 2 (46.66%) and package 5 (46.67). They were statistically similar but numerically different from each other. The highest fruit infestation reduction over control (by number) was recorded from plots having IPM package 6 consisting of mechanical and cultural control + Suntaf 50 WP + Sumi-alpha 5 EC applied at 5% level of infestation (50.00%) followed by package 3 (38.46%), package 2 (35.39%), package 5 (35.38%), package 4 (30.76%), package 1 (15.38%) (Table 2).

Table 2. Infestation of brinjal fruits by BSFB at early fruiting stage in different treatments and its reduction over control during Kharif 2005

Treatment	*Mean fruit infestation (%)		Reduction of fruit infestation over control (%)	
	By weight	By number	By weight	By number
IPM package 1	38.38 b (6.20)**	61.11 b (7.80)	30.31	15.38
IPM package 2	28.13 e (5.23)	46.66 d (6.80)	54.37	35.39
IPM package 3	25.13 f (5.00)	44.44 e (6.67)	37.25	38.46
IPM package 4	34.56 c (5.90)	50.00 c (7.07)	37.25	30.76
IPM package 5	30.98 d (5.57)	46.67 d (6.83)	43.75	35.38
IPM package 6	22.04 g (4.70)	36.11 f (6.03)	59.98	50.00
Untreated control	55.08 a (7.43)	72.22 a (8.50)		

IPM package 1 = Mechanical control + Cultural control

IPM package 2 = Mechanical and Cultural control + Sumi-alpha 5EC@ 1ml/l of water at 7 days interval

IPM package 3 = Furadan 5G @ 1.5 kg a.i./ha single application at vegetative stage+ Sumi alpha 5EC@ 1 ml/l of water at 7 days interval

IPM package 4 = Suntap 50 WP @ 2 g/l of water at 7 days interval

IPM package 5 = Mechanical and Cultural control + Suntap 50 WP @ 2g/l of water at 7 days interval

IPM package 6 = Mechanical and cultural control + Suntap 50WP @1g/l+ Sumi-alpha 5EC @ 1ml/l of water at 5% infestation level

Untreated control

* Mean of 3 replications; each replication is derived from the mean of 10 observations.

**Figures in parentheses are transformed (square root) values.

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

At mid fruiting stage, the percentages of fruit infestation by number and weight varied significantly among plots having various IPM package (Table 3). Plots having IPM package 6 gave the lowest fruit infestation by number (35.55%) and weight (22.04%). Similar to early stage, the highest fruit infestation both by number (76.67%) and by weight (67.70%) was obtained from untreated control followed by 55.57% and 55.00% by number; and 49.83% and 41.37% by weight in plots of IPM package 1 and 4 respectively with no significant difference among them. The highest reduction in fruit infestation by number (53.62%) was in plots of IPM package 6 followed by IPM package 3 (48.76%), IPM 2 (45.63%), IPM package 5 (34.78%) IPM package 4 (28.26%) and package 1 (27.51%).Similarly the highest fruit infestation reduction by weight was obtained in the plots of IPM 6 (68.38%) followed by plots of IPM package 3, (65.62%), 2 (54.90%), 5 (40.65%), 4 (37.03%) and 1 (28.51%) (Table 3).

Table 3. Infestation of brinjal fruits by BSFB at mid fruiting stage in different treatments and its reduction over control during khaif 2005

Treatment	*Mean fruit infestation (%)		Reduction of fruit infestation over control (%)	
	By weight	**By number**	**By weight**	**By number**
IPM package 1	49.83 b	55.57 b	28.51	27.51
	(7.03)**	(7.47)		
IPM package 2	31.43 e	41.67 d	54.90	45.63
	(5.60)	(7.47)		
IPM package 3	23.96 f	39.28 e	65.62	48.76
	(4.90)	(6.07)		
IPM package 4	43.89 c	55.00 b	37.03	28.26
	(6.60)	(7.47)		
IPM package 5	41.37 d	50.00 c	40.65	34.78
	(6.43)	(7.47)		
IPM package 6	22.04 g	35.55 f	68.38	53.62
	(6.70)	(5.800		
Untreated control	69.707 a	76.67 a		
	(8.33)	(8.77)		

IPM package 1 = Mechanical control + Cultural control

IPM package 2 = Mechanical and Cultural control + Sumi-alpha 5EC@ 1ml/l of water at 7 days interval

IPM package 3 = Furadan 5G @ 1.5 kg a.i./ha single application at vegetative stage+ Sumi alpha 5EC@ 1 ml/l of water at 7 days interval

IPM package 4 = Suntap 50 WP @ 2 g/l of water at 7 days interval
IPM package 5 = Mechanical and Cultural control + Suntap 50 WP @ 2g/l of water at 7 days interval
IPM package 6 = Mechanical and cultural control + Suntap 50WP @1g/l+ Sumi-alpha 5EC @ 1ml/l of water at 5% infestation level
Untreated control

* Mean of 3 replications; each replication is derived from the mean of 10 observations.
**Figures in parentheses are transformed (square root) values.
In column, values followed by same letter(s) are statistically identical by DMRT at 5% level of significance.

At late fruiting stage (Table 4), significantly the highest fruit infestation by number was observed in untreated control plot (76.66%), which was statistically different from other IPM packages. The lowest fruit infestation was recorded in the plots of IPM package 6 (33.33%) followed by plots of IPM package 3 (36.66%). In case of weight, the highest fruit infestation was observed in untreated control plot (64 .64%), which was significantly different from other plots utilizing IPM packages. varied with others. The lowest fruit infestation was recorded in the plots having IPM package 6 (30.48%) followed by plots with IPM package 3 (30.85%) with no significant difference among them.

The highest fruit infestation reduction over control by number was recorded in the plots of IPM package 6 (56.52%) at late fruiting stage. It was similar to those obtained for shoot infestation and infestation at early and mid fruiting stages. When the percent fruit infestation reduction by weight was considered, the descending order of percent fruit infestation reduction over control was IPM package 6< IPM package 3 < IPM package 2 < IPM package 5 < IPM package 4 < IPM package 1. Percent results revealed the lower infestation in late fruiting stage than early and mid fruiting stages. Alam *et al.*(2002) also observed lower fruit infestation in late fruiting stage than early and mid fruiting stages during Kharif season.

Table 4. Infestation of brinjal fruits by BSFB at late fruiting stage in different treatments and its reduction over control during Kharif 2005

Treatment	*Mean fruit infestation (%)		Reduction of fruit infestation over control (%)	
	By weight	By number	By weight	By number
IPM package 1	51.07 b **(7.13)	55.55 b (7.47)	20.99	27.53
IPM package 2	40.92 e (6.40)	55.55 b (7.47)	36.68	27.53
IPM package 3	30.85 f (5.57)	36.66 c (6.06)	52.27	52.18
IPM package 4	47.03 c (6.87)	55.55 b (7.47)	27.24	27.54
IPM package 5	43.35 d (6.60)	55.55 b (7.47)	32.93	27.53
IPM package 6	30.48 f (5.50)	33.33 d (5.80)	52.84	56.52
Untreated control	64.64 a (8.03)	76.66 a (8.77)		

IPM package 1 = Mechanical control + Cultural control
IPM package 2 = Mechanical and Cultural control + Sumi-alpha 5EC@ 1ml/l of water at 7 days interval
IPM package 3 = Furadan 5G @ 1.5 kg a.i./ha single application at vegetative stage+ Sumi alpha 5EC@ 1 ml/l of water at 7 days interval
IPM package 4 = Suntap 50 WP @ 2 g/l of water at 7 days interval
IPM package 5 = Mechanical and Cultural control + Suntap 50 WP @ 2g/l of water at 7 days interval
IPM package 6 = Mechanical and cultural control + Suntap 50WP @1g/l+ Sumi-alpha 5EC @ 1ml/l of water at 5% infestation level

Untreated control

* Mean of 3 replications; each replication is derived from the mean of 10 observations.

**Figures in parentheses are transformed (square root) values.
In column, values followed by same letter(s) are statistically identical by DMRT at 5% level of significance

Considering shoot and fruit infestation, IPM package 6 and IPM package 3 provided better results than other packages. Present results clearly revealed that chemical measures incorporated with non-chemical tools (i.e. cultural or mechanical method) might provide better performance to reduce the fruit infestation in brinjal.

REFERENCES

Alam, M. S., Islam, M. N., Kabir, K. H., Alam, M. Z. and Hossain, M. M. 2002. Evaluation of against the brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee and on natural enemy conservation. An M.S. thesis submitted to the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Salna, Gazipur, Bangladesh.

Alam, M. Z.and Sana, . L. 1962. Biology of the brinjal shoot and fruit borer, *Leucinodes orbonalis* G. (Pyralidae: Lepidoptera) in East Pakistan. The Scientist. 5 (1-4): 13-24.

Alam, M. Z. 1969. Insect pest of vegetables and their control in East Pakistan. The Agricultural Information Services, Department of Agriculture, 3, R.K.Mission Road, Dacca-3, East Pakistan. 14p.

Anonymous, 2003. Year Book of Agricultural Statistics of Bangladesh, 2000.Bangladesh Bureau of statistics, Planning Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.350p.

Butani, D. K. and Jotwan, M. G. 1984. *Insects in Vegetables*. Periodical Expert Book Agency. D-42, Vivek Vihar, Delhi-110032, India, 356p.

Chattopadhyay, P. 1987. Entomology, *Pest Control and Crop Protection* (in Bangla). West Bengal State Book Board, Arjo Mansion (9th floor), 6A, Raja Subodh Mollick Square, Calcutta-700013, India, 356p.

Dhankar, B. S., 1988. Progress in resistance studies in the eggplant (*Solanum melongena* L.) against shoot and fruit borer (*Leucinodes orbonalis* Guenee) infestation. Tropical Pest Management. 34: 343-345.

Islam, M. N. and Karim, M. A. 1994. Integrated management of the brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae) at Joydebpur. Annual Research Report, 1993-94. Entomology Division, BARI, Joydebpur, Gazipur.pp.41-44.

Nair, M. R. G. K. 1986. *Insects and Mites of crops in India.* Revised Edition. Indian Council of Agricultural Research, New Delhi. 408p.

Parkash., O. 1988. Schedule of insecticidal application against insect pest complex of brinjal with special reference to brinjal shoot and fruit borer, *Leucinodes orbonalis. Indian J.Ento.* 50(1): 16-19.

Rashid, M. M. 1999. Begun Paribarer Shabji. In: *Shabji Biggan* (in Bangla). 2nd Edn. Rashid Publishing House, 94 old DOHS, Dhaka-1206, Bangladesh. 526p.

Tewari, G. C. and Sandana, H. R.1990. An unusual heavy parasitization of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee, by a new braconid parasite. *Indian J.Entomol.* 52(2): 338-341.

Yamaguchi, M. 1. 983.Solanaceous fruits. In: World Vegetables Principles, Production and Nutritive Values. AVI Publishing Company, INC. Westport, Connecticut.pp. 298-304.

Yein, B. R. 1985. Field efficacy of some insecticides against shoot and fruit borer of brinjal, *Leucinodes orbonalis . J. Res. Assam Agril. Univ.* 6(1): 31-34.