ISSN 1810-3030 (Print) 2408-8684 (Online)
Journal of Bangladesh Agricultural University
Journal home page: http://baures.bau.edu.bd/jbau, www.banglajol.info/index.php/JBAU

Appraisal of resistant genotypes against brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis,* Guenee

Hafija Sultana[1], Md. Aabdul Mannan[2], Md. Mostofa Kamal[2], Khan Golam Quddus[2] and Shimul Das[2]

[1]Soil Resource Development Institute, Dhaka, Bangladesh
[2]Agrotechnology Discipline, Khulna University, Khulna-9208, Bangladesh

ARTICLE INFO

Article history:
Received: 04 June 2018
Accepted: 08 August 2018

Keywords:
Solanum melongena, Brinjal Shoot and Fruit Borer, Resistant Genotypes, Bangladesh

Correspondence:
Md. Mostofa Kamal
(mostofaku@gmail.com)

Abstract

The main purpose of this study was to find out the best variety of brinjal having resistance to BSFB. A pot experiment was carried out at the germplasm centre, Agrotechnology Discipline, Khulna University, Khulna during February 2014 to August 2014. The experiment was laid out in CRD using thirteen varieties with five replications. The varieties were V_1=BARI begun-1, V_2=BARI begun-4, V_3=BARI begun-5, V_4=BARI begun-6, V_5=BARI begun-7, V_6=BARI begun-8, V_7=BARI begun-9, V_8=BARI begun-10, V_9=Makra, V_{10}=Muktokashi, V_{11}=Lalita, V_{12}=Hazra, V_{13}=Chaga. Data were collected on total number of shoot, total number of infested shoot, percentage of shoot damage, percentage of shoot infestation reduction, numbers of larvae per infested shoot, total number of fruit, percentage of fruit damage, percentage of fruit infestation reduction, numbers of larvae per infested fruit. Results have shown that the minimum shoot infestation was found in BARI begun-6 (29.60%, 32.40%, 29.86% and 29.38%, respectively at four different stages of eggplant). Percent of fruit infestation was minimum in V_4 (BARI begun-6) (25.16%, 27.42% and 25.40% at three stages respectively).

Introduction

Brinjal (*Solanum melongena L.*) is one of the important vegetables in South and South-East Asia (Thapa, 2010) cultivation of which helps to improve human nutrition and generate income. It is cultivated more than 1.6 million ha of land producing about 50 million MT throughout the globe (FAO, 2012). The higher yield and harvesting period lure the farmer on eggplant production (Ghimire *et al.,* 2007). But in Bangladesh it covers about 15% of the total vegetable area of the country producing 1.6 million MT annually. The production of brinjal is severely affected by the incidence of different insect pests from seedling to fruiting stage (Latif *et al*., 2009) and eight insect species are considered as major pests causing damage to this crop in Bangladesh (Biswas *et al.,* 1992). Among them the brinjal shoot and fruit borer, BSFB (*Leucinodes orbonalis,* Guenee) is the most destructive insect pests (Alam, 1969) which caused 31-86% fruit damage in Bangladesh (Alam *et al*., 2003) reaching up to 90% (Rahman, 1997). The situation of brinjal production is in threat in the recent years due to increased cost of production for the management of insect pest. Farmers of Bangladesh in most cases solely depend on insecticides for the management of this pest. Such dependence on insecticides has created many problems such as excessive residues on marketed vegetables that concerns general consumer's health and the environment, pesticide resistance, trade implications, poisoning, hazards to non-target organisms, increased production costs etc. (Alam *et al*., 2003; Pedigo, 2002). Now-a-days, importance is given on the use of resistant genotype against BSFB. Because the use of resistant variety is non-toxic and safe alternatives to the conventional chemical control (Anil and Pandey, 2001; Dolui and Debnath, 2010). There was no naturally selected brinjal varieties available having resistance to BSFB except transgenic Bt brinjal varieties. So, for the production of brinjal fruit with minimum environmental hazards, the present study was undertaken to evaluate some genotype from Bangladesh for their resistance properties against BSFB.

Materials and Methods

Experimental site

The experiment was conducted at the germplasm centre, Agrotechnology Discipline, Khulna University, Khulna during February 2014 to August 2014. The soil used in bags was collected from the garden of germplasm centre of Agrotechnology Discipline, Khulna University, Khulna. The average character of the soil was clay loam to clay. After collecting the soil it was sun dried and ground well. Then the soil debris was removed by sieving and the soil was put into bags after mixing with manure and fertilizer.

Plant material used and raising of seedlings

Seeds were collected from local market of Khulna and Bangladesh Agricultural Research Institute (BARI) and raised as seedling in germplasm centre of Khulna University, used in the experiment. Brinjal seedling was

raised in seedbed of 3m × 1m size. The soil was well prepared and converted into loose friable and dried mass by spading. All weeds and stubbles were removed. Weeding, mulching and irrigation were done when required.

Design and layout of the experiment, **Preparation of bags and Transplanting of brinjal seedlings**

The experiment was laid out in CRD using thirteen varieties with five replications. In this experiment medium size bazaar bags were selected as growing container. Each bag was filled-up with sun dried soil and kept under natural light. Cowdung was uniformly incorporated to the soil before filling bags. The rest half dose of cowdung, full TSP, one-third Urea and one-third MoP were mixed during pit preparation in the bag. Rest of the Urea and MoP were applied 21 DAT, 35 DAT and 50 DAT. The bags were pre-labeled for each variety. Healthy seedlings were uprooted from the seedbed and were transplanted in the experimental bags during late afternoon on February, 2014.

Treatments of the experiment

Eight improved varieties released by BARI and 5 local cultivar were used as treatment. The brinjal varieties were

V_1=BARI begun-1
V_2=BARI begun-4
V_3=BARI begun-5
V_4=BARI begun-6
V_5=BARI begun-7
V_6=BARI begun-8
V_7=BARI begun-9
V_8=BARI begun-10
V_9=Makra
V_{10}=Muktokashi
V_{11}=Lalita
V_{12}=Hazra
V_{13}=Chaga.

Intercultural operations

After transplanting of seedlings, various intercultural operations were accomplished for better growth and development of the plants. When the brinjal seedlings were well established, the soil around the base of each seedling was pulverized. A few gaps filling was done by healthy seedlings of the same stock where initially planted seedlings failed to survive. Weeding and mulching were accomplished as and whenever necessary to keep the crop free from weeds, for better soil aeration and to break the crust. It also helped in soil moisture conservation. Irrigations were given throughout the growing period at 10-15 days interval. The irrigations were given to increase the yield.

Harvesting and Data collection

Harvesting of fruits was started at 60 days after transplanting and continued up to 150 days after transplanting with an interval of 7 days. Harvesting was usually done manually. In order to know the effects of the treatments of controlling BSFB, data in respect of the following parameters were collected from vegetative to late fruiting stage. Data were collected on total number of shoot, total number of infested shoot, percentage of shoot damage, percentage of shoot infestation reduction, numbers of larvae per infested shoot, total number of fruit, percentage of fruit damage, percentage of fruit infestation reduction, numbers of larvae per infested fruit.

Percentage of infested shoots was calculated using the following formula:

$$\text{Percentage of shoots damage} = \frac{\text{Numbers of infested shoot/plant}}{\text{Total number of shoot/plant}} \times 100$$

Percentage of fruits damage was calculated using the following formula:

$$\text{Percentage of fruits damage} = \frac{\text{Numbers of infested fruit/plant}}{\text{Total number of fruit/plant}} \times 100$$

Data analysis

Data were analyzed by using MSTAT-C software for analysis of variance after square root transformation for per stage data. ANOVA was made by F variance test and the pair comparisons were performed by Duncan's Multiple Range Test (DMRT) (Gomez & Gomez, 1984).

Results and Discussion

Shoot infestation at different stages of brinjal

The percent shoot infestation by brinjal shoot and fruit borer (BSFB) at different varieties of eggplant at different stages was statistically significant (Table 1). Among thirteen varieties the highest percent shoot infestation was recorded in chaga at Vegetative stage and Late fruiting stage and at Early fruiting stage and Mid fruiting stage, the highest percent shoot infestation by brinjal shoot and fruit borer (BSFB) was observed in Makra varieties and the minimum shoot infestation was found in BARI Begun-6 at all stages among the varieties (29.60%, 32.40%, 29.86% and 29.38% respectively at all four stages).

Fruit infestation in different stages of brinjal

The percent fruit infestation by brinjal shoot and fruit borer (BSFB) in different varieties of eggplant at different stages was statistically significant (Table 2). Among thirteen varieties the highest percent fruit infestation by brinjal shoot and fruit borer (BSFB) at three different stages was recorded in chaga (75.28%, 74.40% and 73.90%) at early, mid and late fruiting stage respectively and the minimum in BARI Begun-6 (25.16%, 27.42% and 25.40%) at early, mid and late fruiting stage respectively.

Table 1. Shoot infestation (in percentage) by brinjal shoot and fruit borer (BSFB) at different stages

Varieties	Vegetative stage (30–60 DAT) (%)	Early fruiting stage (60–90 DAT) (%)	Mid fruiting stage (90–120 DAT) (%)	Late fruiting stage (120–150 DAT) (%)
BARI begun-1	43.47abcde	50.19bc	51.06cd	48.70de
BARI begun-4	41.79bcde	43.83d	35.87f	41.99f
BARI begun-5	34.17def	35.54e	34.56f	34.06g
BARI begun-6	29.60f	32.40e	29.86f	29.38g
BARI begun-7	41.90bcde	43.75d	44.20e	43.07f
BARI begun-8	33.33ef	32.82e	32.92f	31.47g
BARI begun-9	52.14ab	52.58bc	54.44bc	50.56cd
BARI begun-10	43.33abcde	42.82d	44.90de	44.05ef
Makra	40.00cdef	60.36a	62.03a	60.02a
Muktokashi	46.00abcd	47.46cd	51.43cd	48.16de
Lalita	51.43abc	54.25ab	56.36abc	55.07bc
Hazra	50.00abc	55.40ab	56.75abc	56.07ab
Chaga	54.00a	59.210a	59.62ab	60.94a
LS	**	**	**	**
CV (%)	14.60	7.42	7.95	6.00

LS= Level of Significance, **= Significant at 1% level
Means followed by common letter(s) in a column do not differ significantly by DMRT
CV= Coefficient of Variation

Table 2. Fruit infestation (in percentage) by brinjal shoot and fruit borer (BSFB) at different stages

Varieties	Early fruiting stage (60–90 DAT) (%)	Mid fruiting stage (90–120 DAT) (%)	Late fruiting stage (120–150 DAT) (%)
BARI begun-1	37.68fg	37.04hi	38.60g
BARI begun-4	40.18f	40.24gh	40.14fg
BARI begun-5	44.24f	44.88fg	44.88f
BARI begun-6	25.16h	27.42j	25.40h
BARI begun-7	29.22h	30.38j	30.38h
BARI begun-8	51.86e	50.14ef	50.88e
BARI begun-9	31.82gh	32.40ij	31.06h
BARI begun-10	55.44de	55.48de	54.82de
Makra	69.98ab	69.28ab	68.76ab
Muktokashi	72.82a	72.08ab	70.76a
Lalita	59.52cd	60.06cd	59.30cd
Hazra	64.90bc	65.96bc	64.30bc
Chaga	75.28a	74.40a	73.90a
LS	**	**	**
CV (%)	8.55	7.05	7.01

LS= Level of Significance, **= Significant at 1% level
Means followed by common letter(s) in a column do not differ significantly by DMRT
CV= Coefficient of Variation

Larvae in infested shoot and fruit at different stages

Number of Larvae in infested shoot and fruit in different varieties was statistically significant (Table 3). The maximum mean number of larvae per infested shoot was recorded in chaga at vegetative, early, mid and late fruiting stage respectively and the minimum in BARI Begun-8 at vegetative stage early, mid and late fruiting stage respectively . The maximum mean number of larvae per infested fruits was recorded in chaga at early, mid and late fruiting stage respectively and the minimum larvae per infested fruits was recorded in BARI Begun-8 at early, mid and late fruiting stage respectively.

Table 3. Mean number of larvae per infested shoot and per infested fruit at different stages

Varieties	Mean number of larvae per infested shoot				Mean number of larvae per infested fruit		
	Vegetative stage (30–60DAT)	Early fruiting stage (60–90 DAT)	Mid fruiting stage (90–120 DAT)	Late fruiting stage (120–150 DAT)	Early fruiting stage (60–90 DAT)	Mid fruiting stage (90–120 DAT)	Late fruiting stage (120–150 DAT)
BARI begun-1	2.00e	2.15f	1.73e	1.64fg	2.03gh	1.93fg	1.84fg
BARI begun-4	2.15de	2.22f	1.96de	1.86ef	2.47fg	2.36ef	2.25ef
BARI begun-5	2.40d	2.38f	2.04de	1.91ef	2.56f	2.42e	2.32e
BARI begun-6	1.70f	1.40g	1.71e	1.34gh	1.89hi	1.76gh	1.66gh
BARI begun-7	2.75c	2.74ef	2.23d	2.15de	2.70ef	2.58de	2.44de
BARI begun-8	1.16g	1.25g	1.19f	1.07h	1.52i	1.44h	1.32h
BARI begun-9	2.89c	2.74ef	2.68c	2.50cd	3.10e	2.96d	2.84d
BARI begun-10	3.20b	3.40cd	2.92bc	2.79bc	4.25bc	4.06b	3.94b
Makra	4.47a	4.12 ab	4.34a	4.11a	4.37b	4.17b	4.04b
Muktokashi	4.39a	4.22ab	4.26a	4.06a	3.70d	3.54c	3.36c
Lalita	3.26b	3.02de	3.26b	2.88bc	3.87cd	3.72bc	3.60bc
Hazra	3.24b	3.72bc	3.30b	3.06b	3.88cd	3.74bc	3.62bc
Chaga	4.53a	4.48a	4.30a	4.08a	4.96a	4.76a	4.56a
LS	**	**	**	**	**	**	**
CV (%)	5.04	11.58	9.04	9.60	8.49	8.53	9.16

LS= Level of Significance, **= Significant at 1% level
Means followed by common letter(s) in a column do not differ significantly by DMRT
CV= Coefficient of Variation

Yield performance of different brinjal varieties

Significant difference ($p \leq 0.01$) was found in different varieties in terms of yield performance (Table 4). The highest Number of fruits per plant was found in BARI begun-1 (60.00) and in BARI begun-4 (60.00) and the lowest in muktokashi (14.04). The maximum Weight of fruits per plant was recorded in BARI begun-10 (4.70) and the minimum in lalita (2.13). The BARI begun-6 showed moderate yield.

Table 4. Yield Performance of different varieties

Varieties	Number of fruits per plant	Weight of fruits per plant (Kg)
BARI begun-1	60.00a	3.77bc
BARI begun-4	60.00a	3.35cd
BARI begun-5	42.00b	4.20ab
BARI begun-6	30.00cd	3.15cde
BARI begun-7	26.00de	2.85def
BARI begun-8	33.60c	3.23bcd
BARI begun-9	27.20de	2.99cde
BARI begun-10	44.80b	4.704a
Makra	15.60gh	3.12cde
Muktokashi	14.40h	2.45ef
Lalita	16.40fgh	2.13f
Hazra	22.40ef	3.14cde
Chaga.	21.60efg	3.20cde
Level of significance	**	**
CV (%)	11.26	13.23

**= Significant at 1% level
Means followed by common letter(s) in a column do not differ significantly by DMRT
CV= Coefficient of Variation

Resistance of different brinjal varieties against brinjal shoot and fruit borer (BSFB) infestation

Resistance of different brinjal varieties against brinjal shoot and fruit borer (BSFB) infestation was varied significantly at 1% level. The maximum Number of fruits per plant was found in BARI begun-1 (60.00) and in BARI begun-4 (60.00) respectively and the minimum was recorded in muktokashi (14.40). The highest Number of infested fruits per plant was found in BARI begun-1 (17.40) and the lowest in BARI begun-6 (5.80). The maximum Percent of fruit infestation was observed in muktokashi (59.05) and the minimum in BARI begun-6 (19.28) (Table 5). Yadav and Sharma (2005) was conducted a field experiment to observe the infestation by shoot and fruit borer in aubergine cultivars. Three out of twelve cultivars of aubergine were found to be less susceptible to *L. orbonalis* with infestation less than 25%.

Table 5. Resistance of different brinjal varieties against brinjal shoot and fruit borer (BSFB) infestation

Varieties	Number of fruits per plant	Number of infested fruits per plant	Percent of fruit infestation
BARI begun-1	60.00a	17.40a	29.09cdef
BARI begun-4	60.00a	16.60ab	27.52def
BARI begun-5	42.00b	14.40b	34.30cd
BARI begun-6	30.00cd	5.80e	19.28g
BARI begun-7	26.00de	6.00e	23.09fg
BARI begun-8	33.60c	10.00c	30.00cde
BARI begun-9	27.20de	7.20de	26.60ef
BARI begun-10	44.80b	15.60ab	34.86c
Makra	15.60gh	8.40cde	53.93a
Muktokashi	14.40h	8.40cde	59.05a
Lalita	16.40fgh	8.80cd	57.33a
Hazra	22.40ef	9.80cd	43.67b
Chaga.	21.60efg	9.40cd	43.42b
Level of significance	**	**	**
CV (%)	11.26	13.70	10.16

**= Significant at 1% level
Means followed by common letter(s) in a column do not differ significantly by DMRT
CV= Coefficient of Variation

Conclusion

Our results have showed that BARI begun-6 have minimum shoot and fruit infestation percentage caused by brinjal shoot and fruit borer (BSFB). Although, it has medium yield performance. The growers could be motivated to cultivate BARI begun-6 for efficient management of brinjal shoot and fruit borer (BSFB).

References

Alam, M. Z. 1969. Insect pest of vegetables and their control in East Pakistan. The Agriculture Information service, Dept. Agric.; East Pakistan, p. 146.

Alam, S. N., Rashid, M. A., Rouf, F. M. A., Jhala, R. C., Patel, J. R., Satpathy, S., Shivalingaswamy, T.M., Wahundeniya, S.Rai, I., Ammaranan, A., Cork, C. and Talekar, N. S. 2003. Development of an integrated pest management strategy for eggplant fruit and shoot borer in South Asia. Shanhua, Taiwan: AVRDC—the World Vegetable Center. Technical Bulletin No. 28. AVRDC Publication No. 03-548. p. 56.

Anil, K. and Pandey, M. C. 2001. Role of Biopesticides in plant protection system. Biopest Conf. BET., Chandigarh, India. p.113.

Biswas, G. C., Sattar, M. A. and Saba, M. C. 1992. Survey and monitoring of insect pests of brinjal at Khagrachari Hilly Region. Annual Report, 199l-92, Entom. Div., BARI, Joydebpur, Gazipur. pp. 44–42.

Dolui, A. K. and Debnath, M. 2010. Antifeedant activity of plant extracts to an insect *Helopeltis theivora*. *J. Environ. Biology*. 31(5): 557–559.

Food and Agricultural Organization (FAO) 2012. FAOSTAT data 2012 (Avalilable at: http://www.fao.org Retrived on 25 February, 2014).

Ghimire, S. N., Upreti, G., Thapa, R. B. and Manandhar, D. N. 2007. Ecofriendly management of brinjal fruit and shoot borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae). *IAAS Res. Advances*. **2**: 127–131.

Gomez, K. A. and Gomez, A. A. 1984. Statistical procedures for agricultural research. 2nd edition. International Rice Research Institute, John Willey and Sons, Singapore. p. 490

Latif, M. A., Rahman, M. M., Alam, M. Z. and Hossain, M. M. 2009. Evaluation of Flubendiamide as an IPM Component for the Management of brinjal shoot and fruit borer, *Leucinodes Orbonalis* Guenee. *Mun. Entom. Zool.* 4 (1): 257–267.

Pedigo, L. P. 2002. Entomology and Pest Management. 4th Edition. Prentice Hall, Upper Saddle River, New Jersey, USA. p. 633.

Rahman, A. K. M. Z. 1997. Screening of 28 brinjal line for resistance/tolerance against the brinjal shoot and fruit borer. Annual Report. Entom. Div., Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, Bangladesh. pp. 32–35.

Thapa, R. B. 2010. Integrated management of brinjal fruit and shoot borer, *Leucinodes orbonalis* Guenee: An overview. *J. Inst. Agric. Anim. Sci.* 30 & 32: 1–16.

Yadav, D. S. and Sharma, M. M. 2005. Evaluation of brinjal varieties for their resistance against fruit and shoot borer, *Leucinodes orbonalis* Guenee. *Indian J. Entom*. 67(2): 129–132.