

## Studies on shoot and leaf characters of brinjal plants and their quantitative relationships with brinjal shoot and fruit borer

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### Abstract

The field experiment was conducted with twenty brinjal varieties/lines during October 2007 to May 2008 to identify shoot and leaf characteristics of brinjal plants for their susceptibility/resistance against brinjal shoot and fruit borer infestation. Borer infestation was influenced by different characters of plant shoot and leaf. Various parameters like plant height, stem diameter, number of branches and leaves plant<sup>-1</sup>, third leaf length and width were recorded from different varieties used. The shoot infestation rate was found positively correlated with plant height (0.407), stem diameter (0.520), number of branches plant<sup>-1</sup> (0.255), number of leaves plant<sup>-1</sup> (0.478), third leaf length (0.373) and third leaf width (0.536). Considering all the recorded parameters, the infestation was found minimum on the variety katabegun WS (1.65%) followed by Marich begun S (1.74%).

**Keywords:** Brinjal shoot and fruit borer, Shoot and leaf characters, Quantitative relationship, Infestation

### Introduction

Brinjal is one of the most popular and principal vegetable crops grown in Bangladesh. It is the second most important vegetable crop after potato in relation to its total production (Anonymous, 1996). Various insects cause enormous losses to this vegetable throughout the season in Bangladesh as well as in Indian sub- continent (Alam, 1969 and Dhankar, 1988), among them brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guenee, is the most serious and destructive one. Due to the attack of this pest considerable damage is occurred each year affecting the quality and yield of the crop. Only the larvae of this pest cause 12-16 % damage to shoots and 20-60% to fruits (Alam, 1970; Maureal *et al.*, 1982). The pest is very active during the rainy and summer season and often causes more than 90% damage (Ali *et al.*, 1980; Kalloo, 1988). The yield loss has been estimated up to 86% (Ali *et al.*, 1980) in Bangladesh and up to 95% (Naresh *et al.*, 1986) in India. Indiscriminate use of synthetic chemicals for the controlling insect pest resulted hazardous effects causing serious problems including pest resistance, secondary pest outbreak, pest resurgence and environmental pollution. Considering the above fact, the present study was undertaken to find out whether the shoot and leaf characters influencing the infestation rate of BSFB and also their quantitative relationships with infestation which will help to develop resistant/tolerant varieties against this pest.

### Materials and Methods

For the experiment twenty brinjal varieties/lines, collected from IPM laboratory of Plant Pathology Department, BAU, Mymensingh were used. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and the experimental field was divided into three blocks, each block consisted of twenty lines. The size of the whole field was 40m x 20m. Uniform and healthy seedlings of 45 days old were taken separately from the seedbed, transplanted in the experimental plots maintaining a spacing of 75cm x 60cm between the row to row and plant to plant. Different intercultural operations (weeding, gap filling and irrigation) were accomplished for better growth and development but no insecticide was used. The data on plant height (cm), stem diameter (cm), number of branches and leaves plant<sup>-1</sup>, third leaf length (cm) and width (cm) and infestation were recorded at 60, 80, 100 and 120 days after transplantation. The data were analyzed by using MSTATC Package Computer Program and mean difference were adjusted with DMRT (Duncan, 1955).

## Results and Discussion

The average values of shoot characters and brinjal shoot infestation of twenty selected brinjal varieties/lines at different days after transplantation (DAT) has been presented in Table 1. The average highest plant height was recorded in the variety Eye red (54.18) which was significantly different from that of other varieties/lines, whereas, lowest plant height was recorded in the variety Thamba (19.23) which was significantly different from that of other varieties/lines. On an average, the highest stem diameter was recorded in the variety Irribegun (1.54) which was significantly different from that of other varieties except Islampuri BADC and Kaikka N but the average lowest stem diameter was recorded in the variety Amjuri (0.93) which was significantly different from that of other varieties/lines. The average highest number of branches was recorded in the variety Amjuri (12.79) which was significantly identical with that of the varieties/lines BL-118, Bijoy, Irribegun and Kaikka N, whereas, the average lowest number of branches (6.52) was observed in the variety Thamba which was significantly identical with that of the varieties/lines Dharola, ISD 006 and Khatkhatia BAU. So it was found that the higher plant height and stem diameter increased infestation, on the other hand, more branches plant<sup>-1</sup> reduced infestation because it may be reduced stem diameter which is uncomfortable for infestation.

**Table 1. Average values of shoot characters and percent infestation of twenty selected brinjal varieties/lines at different days after transplantation (DAT)**

Varieties/Lines	Plant height (cm)	Stem diameter (cm)	No. of branches plant <sup>-1</sup>	% Shoot infestation caused by BSFB
Amjuri	41.50 <sup>fg</sup>	0.93 <sup>i</sup>	12.79 <sup>a</sup>	2.03 <sup>l</sup>
BL-118	51.61 <sup>b</sup>	1.07 <sup>gh</sup>	11.91 <sup>a-c</sup>	3.32 <sup>de</sup>
Bijoy	45.52 <sup>d</sup>	1.38 <sup>bc</sup>	11.83 <sup>a-c</sup>	5.04 <sup>a</sup>
Borka	30.20 <sup>k</sup>	1.15 <sup>e-h</sup>	11.21 <sup>b-d</sup>	2.81 <sup>g-i</sup>
Dharola	38.38 <sup>hi</sup>	1.047 <sup>h</sup>	6.80 <sup>h</sup>	2.74 <sup>h-j</sup>
Deem begun	43.22 <sup>ef</sup>	1.12 <sup>f-h</sup>	9.74 <sup>d-f</sup>	2.49 <sup>jk</sup>
Eye red	54.18 <sup>a</sup>	1.27 <sup>de</sup>	10.76 <sup>c-f</sup>	4.27 <sup>b</sup>
ISD 006	31.89 <sup>k</sup>	1.12 <sup>f-h</sup>	6.92 <sup>h</sup>	2.64 <sup>i-k</sup>
Islampuri BADC	39.09 <sup>hi</sup>	1.48 <sup>ab</sup>	9.19 <sup>fg</sup>	3.90 <sup>c</sup>
Irribegun	38.82 <sup>hi</sup>	1.54 <sup>a</sup>	12.02 <sup>a-c</sup>	3.19 <sup>ef</sup>
Kaikka N	44.88 <sup>de</sup>	1.49 <sup>ab</sup>	12.50 <sup>ab</sup>	5.14 <sup>a</sup>
Kajla	46.63 <sup>cd</sup>	1.14 <sup>f-h</sup>	9.50 <sup>ef</sup>	3.09 <sup>ef</sup>
Katabegun WS	34.44 <sup>j</sup>	1.15 <sup>e-h</sup>	10.58 <sup>c-f</sup>	1.65 <sup>m</sup>
Khatkhatia BAU	34.11 <sup>j</sup>	1.22 <sup>d-f</sup>	7.96 <sup>gh</sup>	2.43 <sup>k</sup>
Laffa S	39.94 <sup>gh</sup>	1.40 <sup>bc</sup>	10.52 <sup>c-f</sup>	2.64 <sup>i-k</sup>
Marich begun S	35.12 <sup>j</sup>	1.22 <sup>d-f</sup>	9.86 <sup>d-f</sup>	1.74 <sup>m</sup>
Nayantara	38.39 <sup>hi</sup>	1.30 <sup>cd</sup>	9.35 <sup>e-g</sup>	3.50 <sup>d</sup>
Singnath	47.99 <sup>c</sup>	1.40 <sup>bc</sup>	10.87 <sup>c-e</sup>	2.76 <sup>hi</sup>
Thamba	19.23 <sup>l</sup>	1.18 <sup>e-g</sup>	6.52 <sup>h</sup>	3.04 <sup>fg</sup>
Uttara	37.76 <sup>i</sup>	1.15 <sup>f-h</sup>	9.98 <sup>d-f</sup>	2.99 <sup>f-h</sup>
S.E	0.93	0.051	0.68	0.022
CV (%)	2.90	4.80	8.24	4.83

Within column means followed by same letter(s) did not differ significantly at P<0.05 by DMRT  
BSFB = Brinjal shoot and fruit borer

The average values of leaf characters and brinjal shoot infestation of twenty selected brinjal varieties/lines at different days after transplantation (DAT) has been presented in Table 2. The average highest number of leaves was recorded in the variety Kaikka N (53.13) which was significantly different from that of other varieties/lines except Irribegun. But the lowest number of leaves was recorded in the variety Thamba (35.11) which was significantly identical with that of varieties/lines ISD 006 and Dharola. The average highest third leaf length was recorded in the variety

Singnath (22.71) which was significantly identical with that of varieties/lines Kaikka N, BL-118, Eye red, Khatkhatia BAU, Laffa S, Bijoy, Irribegun, Marich begun S and Uttara, but The average lowest third leaf length was recorded in the variety ISD 006 (16.23) which was significantly identical with that of the varieties/lines Borka, Amjuri, Deembegun, Thamba, Nayantara, Katabegun WS and Islampuri BADC. The average highest third leaf width was recorded in the variety Bijoy (12.21) which was significantly identical with that of varieties/lines Kaikka N, Khatkhatia BAU and Uttara, whereas, the lowest third leaf width was recorded in the variety Dharola (8.37) which was significantly identical with that of the varieties/lines Borka, ISD 006, Nayantara, Katabegun WS, Laffa S, Kajla, BL-118, Amjuri and Uttara. So it can be suggested that more leaf numbers and higher third leaf width might increase infestation because the more leaves and higher third leaf width may be favorable for egg lying of BSFB.

**Table 2. Average values of leaf character and percent infestation of twenty selected brinjal varieties/lines at different days after sowing (DAT)**

Varieties/Lines	No. of leaves plant <sup>-1</sup>	Third leaf length (cm)	Third leaf width (cm)	% Shoot infestation caused by BSFB
Amjuri	45.74cd	17.41gh	8.66gh	2.03 l
BL-118	45.38cd	22.40ab	8.76gh	3.32de
Bijoy	46.44c	20.86a-f	12.21a	5.04a
Borka	42.19ef	16.32h	9.47d-h	2.81g-i
Dharola	36.44h	19.14c-h	8.365h	2.74h-j
Deem begun	42.76ef	17.95f-h	9.74c-g	2.49jk
Eye red	46.88c	22.16a-c	10.27b-f	4.27b
ISD 006	35.36h	16.23h	9.37d-h	2.64i-k
Islampuri BADC	46.36c	18.89d-h	10.56b-e	3.90c
Irribegun	51.99a	20.39a-g	10.61b-d	3.19ef
Kaikka N	53.13a	22.59ab	11.43ab	5.14a
Kajla	49.55b	19.53b-g	8.93gh	3.09ef
Katabegun WS	42.13ef	18.14e-h	9.06f-h	1.65m
Khatkhatia BAU	44.07de	21.77a-d	11.10ab	2.43k
Laffa S	46.32c	21.23a-e	9.05f-h	2.64i-k
Marich begun S	39.82g	19.82a-g	9.86c-g	1.74m
Nayantara	41.83f	18.06f-h	9.331e-h	3.50d
Singnath	45.26cd	22.71a	10.78bc	2.76hi
Thamba	35.11h	17.99f-h	10.36b-e	3.04fg
Uttara	41.95f	19.75a-g	9.54d-h	2.99f-h
S.E	1.32	1.32	1.58	0.022
CV (%)	8.23	8.23	6.55	4.83

Within column means followed by same letter(s) did not differ significantly at  $P < 0.05$  by DMRT  
BSFB = Brinjal shoot and fruit borer

Experimental information on correlation coefficient is particularly useful for measuring the relationship among the variables. The shoot infestation rate was found to be positively correlated with plant height (0.407), stem diameter (0.520), number of branches plant<sup>-1</sup> (0.255), number of leaves plant<sup>-1</sup> (0.478), third leaf length (0.373) and width (0.536) which was presented in Table 3. The estimated correlation coefficients among shoot infestation caused by BSFB and tested leaf and shoot characters were partitioned into direct and indirect effects and have been presented by path coefficient analysis in Table 4. The direct effect of plant height and stem diameter, number of leaves plant<sup>-1</sup> and third leaf width against shoot infestation caused by BSFB were positive (0.396, 0.248, 0.059 and 0.393 respectively) and higher in magnitude at 1% level of significance. The direct effect of number of branches plant<sup>-1</sup> and third leaf length against shoot infestation were negative (-0.082 and -0.067 respectively) and lower in magnitude at 5% level of significance.

**Table 3. Correlation matrix between plant characters and shoot infestation rate caused by brinjal shoot and fruit borer (BSFB)**

Characters	Stem diameter (cm)	Number of branches plant <sup>-1</sup>	Number of leaves plant <sup>-1</sup>	Third leaf length (cm)	Third leaf width (cm)	Shoot infestation caused by BSFB
Plant height (cm)	0.149	0.540**	0.626**	0.517	0.042	0.407**
Stem diameter (cm)		0.281	0.516**	0.379**	0.576**	0.520**
Number of branches plant <sup>-1</sup>			0.690**	0.378**	0.138	0.255*
Number of leaves plant <sup>-1</sup>				0.473**	0.336**	0.478**
Third leaf length (cm)					0.368**	0.373*
Third leaf width (cm)						0.536**

\*\* = Significant at P<0.01; \*Significant at P<0.05

**Table 4. Path coefficient analysis of brinjal plant characters influencing shoot infestation caused by brinjal shoot and fruit borer (BSFB)**

Characters	Indirect effect						Total correlation with shoot infestation caused by BSFB
	Plant height (cm)	Stem diameter (cm)	Number of branches plant <sup>-1</sup>	Number of leaves plant <sup>-1</sup>	Third leaf length (cm)	Third leaf width (cm)	
Plant height (cm)	<b><u>0.396</u></b>	0.037	-0.044	0.037	-0.035	0.017	0.407
Stem diameter (cm)	0.059	<b><u>0.248</u></b>	-0.018	0.030	-0.025	0.226	0.520
Number of branches plant <sup>-1</sup>	0.214	0.054	<b><u>-0.082</u></b>	0.041	-0.025	0.054	0.255
Number of leaves plant <sup>-1</sup>	0.248	0.128	-0.057	<b><u>0.059</u></b>	-0.032	0.132	0.478
Third leaf length (cm)	0.205	0.094	-0.031	0.028	<b><u>-0.067</u></b>	0.145	0.373
Third leaf width (cm)	0.017	0.143	-0.011	0.020	-0.025	<b><u>0.393</u></b>	0.536

N.B: Bold and underline figures are the direct effects, Residual effect is the square root of = 0.517

It was observed that the higher plant height, stem diameter, third leaf width and more number of leaves increased infestation of BSFB, because more leaves and higher third leaf width may be suitable for oviposition and thick stem associated with succulent, thin cuticle and soft parenchymatous cells may be suitable to bore easily by young larvae. On the other hand, higher number of branches plant<sup>-1</sup> reduced infestation because it may be reduced stem diameter. Malik *et. al.* (1986) reported that thin shoots of brinjal found tolerant to *leucinodes orbonalis*.

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