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Leaf characters of brinjal influencing the infestation rate of brinjal shoot and fruit borer

M.N. Ahmed, K.S. Ahmed, T. Akter[1], I.J. Khan[2] and M. Mone[3]
Department of Entomology, [2]Department of Agronomy, [3]Department of Plant pathology, Bangladesh Agricultural University, Mymensingh-2202, [1]Department of Zoology, Jahangirnagar University, Saver, Dhaka, Bangladesh

Abstract: A field experiment was conducted with sixteen brinjal varieties/lines at the Plant Pathology Farm, Bangladesh Agricultural University (BAU), during the period from October 2008 to May 2009 to identify their characteristics for susceptibility/resistance against brinjal shoot and fruit borer infestation. Different leaf characters of plants showed significant relation among the tested varieties/lines. Correlation value indicated that the shoot infestation increased with the increase of number of leaves plant^{-1} and third leaf length; while shoot infestation decreased with the increase of third leaf width. Fruit infestation also increased with the increase of number of leaves plant^{-1}. The fruit infestation rate decreased with the increase of both length and width of third leaf.
Key words: leaf length, width, leaf number, shoot infestation, fruit infestation.

Introduction

All over Bangladesh, brinjal is cultivated in the kitchen garden and also in large farms throughout the year. Various insects cause enormous losses to brinjal in every season and every year in Bangladesh (Alam, 1969). The brinjal is attacked by 53 species of insect pests (Nayar *et al*. 1995). Among them the most serious and destructive one is the brinjal shoot and fruit borer, *Leucinodes orbonalis* Guence, in Bangladesh (Alam and Sana, 1964; Alam, 1969) and India (Tewari and Sandana, 1990) and also a major pest in other countries of the world (Dhankar, 1988).

Brinjal is locally known as 'Begon' and its early European name is 'eggplant' and also known as Guinea squash, garden egg and aubergine. It is normally a self pollinated annual crop. In Bangladesh, brinjal is the second most important vegetable crop after potato in relation to its total production (Anonymous, 1996).

Brinjal shoot and fruit borer is a polyphagous insect and belongs to the order Lepidoptera and family Pyralidae. The genus *Leucinodes* includes three species *Leucinodes orbonalis* Guenee, *Leucinodes diaphana* Hampsen and *Leucinodes apicalis* Hampson (Alam *et al*. 1964). The pest is active throughout the year at place having moderate climate but its activity is adversely affected by severe cold. This pest is not common in temperate region. This pest can also infest potato and other solanaceous crops and wild species of Solanum (Karim, 1994). Only the larvae of this pest cause damage to shoots from 12 to 16% and fruits from 20 to 60% (Alam, 1970; Maureal *et al*. 1982). It is very active during the rainy and summer seasons and often causes more than 90% damage (Ali *et al*. 1980; Kalloo, 1988). The yield loss has been estimated upto 86% (Ali *et al*. 1980) and 67% (Islam and Karim, 1991) in Bangladesh and upto 95% (Naresh *et al*. 1986) and 63% (Dhankar *et al*. 1977) in India.

In Bangladesh very few research findings have so far been reported on the host plant resistant of brinjal shoot and fruit borer, although use of resistant variety in vegetable pest management program is considered as economic and safe in comparison to chemical control. To minimize the use of synthetic insecticides and problems arising due to their frequent use, it is very much essential to identify the plant morphological characters of different varieties influencing the infestation rate of brinjal shoot and fruit borer.

Materials and Methods

Sixteen brinjal varieties/lines viz. Singnath, Borka, Kaikka-G, Dohazari-G, Chega, Menter, Bholanath, Jessore-L, Ishurdi WS, Laffa-BAU, Thamba, Marichbegun-S, Katabegun-WS, ISD-006, China oblong and Wild were screened for brinjal shoot and fruit borer resistance in the Plant Pathology Farm of BAU during October 2008 to May 2009.

The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications for each (Gomez and Gomez, 1984). The experimental field was divided into three blocks and each block consisted of sixteen lines. The treatments were randomly assigned to the block.

All agronomic practices and recommended fertilizers were used. No insecticidal control measure was taken. Five plants from each plot were selected at random. The number of leaves plant^{-1} was counted at 40, 70, 100 and 120 DAT. The third leaf length and width were recorded by meter scale.

Statistical analysis was done by using MSTAT Package Computer Program and mean differences were adjusted with DMRT (Duncan, 1955). To determine the extent of interaction between brinjal shoot and fruit borer infestation and brinjal plant characters, correlation matrix for all possible data combinations was worked out by the method described by Hayes *et al*. (1955). Correlation coefficient was further partitioned into characters of direct and indirect effects by path coefficient analysis originally developed by Wright (1923) and later described by Dewey and Lu (1959) taking all the characters into consideration. Brinjal shoot and fruit borer infestation was considered resultant variable.

Results and Discussion

Number of leaves plant^{-1} of sixteen selected brinjal varieties/lines at different days after transplantation (DAT)

Number leaves plant^{-1} varied significantly among the varieties/lines at different DAT which was shown in Table 1. Number of leaves plant^{-1} of different brinjal varieties/lines at different days after transplantation ranged from 7.5 to 166.00. The highest number of leaves plant^{-1} was found in the variety Singnath (47.75), begun S (90.75), Marich begun S (132.50) and Marich begun S (166.00) at 40, 70, 100 and 120 DAT respectively. The lowest number of leaves plant^{-1} was found in the variety

Thamba (7.50), Thamba (14.50), Thamba (32.50) and Thamba (35.00) at 40, 70, 100 and 120 DAT respectively.
The average highest number of leaves was recorded in the variety Marich begun S (108.94) which was significantly different from that of other varieties/lines that was top position in the ranked order. But the lowest number of leaves was recorded in the variety Thamba (22.37) which was significantly identical with that of varieties/lines ISD 006 and Laffa-BAU and occupied the last position in the ranked order.

Table 1. Number of leaves plant^{-1} of sixteen selected brinjal varieties/lines at different days after transplantation (DAT)

Varieties/ Lines	Number of leaves plant^{-1}					Rank order
	40 DAT	70DAT	100 DAT	120 DAT	Mean	
ISD-006	11.25i	21.25j	40.50l	48.50ij	30.38k	14
Laffa-BAU	11.50i	20.00j	36.50m	42.50jk	27.63l	15
Bholanath	14.00h	32.00i	48.00k	52.25i	36.56i	12
Thamba	7.5j	14.50k	32.50n	35.00k	22.38m	16
Dohazari-G	20.50g	40.50h	60.50j	65.50h	46.75h	11
Borka	23.50ef	46.50g	65.50i	73.00gh	52.13g	10
Kaikka-G	29.25d	50.50f	74.00gh	78.50fg	58.06e	8
Jessore-L	29.75d	53.50e	74.75g	81.50f	59.88e	7
Singnath	47.75a	85.75b	122.50b	142.50b	99.63b	2
Marich begun S	46.50a	90.75a	132.50a	166.00a	108.94a	1
Kata begun-WS	30.50cd	52.75ef	92.50d	107.50d	70.81c	4
China oblong	11.00i	30.50i	41.25l	51.00i	33.44j	13
Wild	24.50e	57.50d	112.50c	122.50c	79.25c	3
Ishurdi WS	21.50fg	53.25ef	71.50h	81.50f	56.94f	9
Menter	32.50c	54.50e	81.50f	93.50e	65.50d	6
Chega	37.00b	61.50c	85.50e	97.50e	70.38c	5
Coefficient of variation	6.35	4.66	2.93	6.25	4.66	
Standard error	0.79	1.12	1.07	2.61	1.22	

Within column means followed by same letter(s) did not differ at p<0.05 by DMRT

Table 2. Third leaf length (cm) of sixteen selected brinjal varieties/lines at different days after transplantation (DAT)

Varieties/Lines	Third leaf length (cm)					Rank order
	40 DAT	70 DAT	100 DAT	120 DAT	Mean	
ISD-006	15.50ef	18.50e	22.50de	23.00d	19.88de	9
Laffa-BAU	22.50a	26.00a	31.00a	31.25a	27.69a	1
Bholanath	18.50c	20.50c	26.25b	26.75b	23b	2
Thamba	17.50cd	20.25cd	23.50cd	24.50c	21.44d	4
Dohazari-G	16.00def	19.25de	22.25de	23.50cd	20.25d	8
Borka	15.00efg	19.00e	23.75c	23.75cd	20.38d	7
Kaikka-G	14.50fg	16.50g	17.50g	18.50fg	16.75f	11
Jessore-L	17.50cd	19.50cde	22.00ef	24.00cd	20.75d	6
Singnath	20.25b	21.50b	23.50cd	24.50cd	22.44c	3
Marich begun S	16.50de	20.50bc	22.50cde	24.25c	20.94d	5
Kata begun-WS	13.75gh	15.50gh	17.50g	18.50c	16.31f	12
China oblong	12.50h	14.50h	14.50h	16.50fg	14.5g	15
Wild	15.50ef	17.50f	21.00f	21.50e	18.88e	10
Ishurdi WS	13.50gh	15.50gh	17.50g	18.75f	16.31f	13
Menter	12.50h	13.00i	14.50h	15.50i	13.88h	16
Chega	14.50fg	15.50h	16.50g	17.50gh	16f	14
Coefficient of variation	5.95	4.06	3.90	3.52	4.88	
Standard error	0.48	0.37	0.41	0.39	0.59	

Within column means followed by same letter(s) did not differ at p<0.05 by DMRT

Third leaf length (cm) of sixteen brinjal varieties/lines at different days after transplantation (DAT)

Third leaf length of sixteen selected brinjal varieties/lines at different days after transplantation ranged from 12.50 to 31.25 and that has been shown in table 2. The highest third leaf length was found in the variety Laffa-BAU (22.50) and the lowest third leaf length was found in the variety Menter (12.50) at 40 DAT. The highest third leaf length was found in the variety Laffa-BAU (26.00) and the lowest third leaf length was found in the variety Menter (13.00) at 70DAT. The highest third leaf length was found in the variety Laffa-BAU (31.00) and the lowest third leaf length was found in the variety Menter (14.50) at 100 DAT. The highest third leaf length was found in the variety Laffa-BAU (31.25) and the lowest third leaf length was found in the variety Menter (15.50) at 120DAT.

The average highest third leaf length was recorded in the variety Laffa-BAU (27.69) which was significantly identical with that of varieties/lines Bholanath, Singnath and Thamba. The average lowest third leaf length was recorded in the variety Menter (13.87) which was significantly identical with that of the varieties/lines China oblong S, Chega, Ishurdi WS and Katabegun WS.

Third leaf width (cm) of sixteen selected brinjal varieties/lines at different days after transplantation (DAT)

Third leaf width of sixteen brinjal varieties/lines at different days after transplantation ranged from 8.50 to

24.50 and that has been shown in table 3. The highest third leaf width was found in the variety Marich begun S (17.50) and the lowest third leaf width was found in the variety Kaikka-G (8.50) at 40DAT. The highest third leaf width was found in the variety Marich begun S (19.75) and the lowest third leaf width was found in the variety Kaikka-G (9.50) at 70 DAT. The highest third leaf width was found in the variety Marich begun S (22.50) and the lowest third leaf width was found in the variety Kaikka-G (10.50) at 100 DAT. The highest third leaf width was found in the variety Marich begun S (24.50) and the lowest third leaf width was found in the variety Kaikka-G (12.50) at 120 DAT.

Table 3. Third leaf width (cm) of sixteen selected brinjal varieties/lines at different days after transplantation (DAT)

Varieties/Lines	Third leaf width (cm)					Rank order
	40 DAT	70 DAT	100 DAT	120 DAT	Mean	
ISD-006	10.00f	10.75i	12.50gh	13.50g	11.69g	14
Laffa-BAU	12.50d	13.50g	14.25ef	15.50e	13.94e	8
Bholanath	10.00f	10.50i	11.75h	14.00fg	11.56g	15
Thamba	15.50b	17.50c	19.50b	20.50c	18.25c	4
Dohazari-G	10.75ef	12.50h	13.25fg	15.00ef	12.88f	11
Borka	10.50ef	11.50hi	14.50de	15.50e	13e	10
Kaikka-G	8.50g	9.50j	10.50i	12.50h	10.25h	16
Jessore-L	10.50ef	11.5hi	12.50gh	14.25fg	12.19f	13
Singnath	15.50b	18.50b	21.50a	24.00a	19.88b	2
Marich begun S	17.50a	19.75a	22.50a	24.50a	21.06a	1
Kata begun-WS	14.50b	16.50d	17.50c	19.00d	16.88d	5
China oblong	10.50f	11.50i	12.50gh	14.50efg	12.25f	12
Wild	15.50b	17.50c	19.50b	22.50b	18.75c	3
Ishurdi WS	13.50c	15.50e	18.50bc	19.50d	16.75d	6
Menter	11.50e	12.50h	13.00g	15.50e	13.13e	9
Chega	12.50d	14.50f	15.50d	18.50d	15.25de	7
Coefficient of variation	5.15	4.56	5.10	4.04	6.78	
Standard error	0.32	0.32	0.40	0.35	0.81	

Within column means followed by same letter(s) did not differ at p<0.05 by DMRT

Table 4. Correlation between plant leaf characters and shoot infestation by brinjal shoot and fruit borer

Character	Number of leaves plant-1	Third leaf length (cm)	Third leaf width (cm)	Shoot infestation
Number of leaves plant-1	1	-0.174	0.628**	0.291
Third leaf length (cm)		1	0.126	0.011
Third leaf width (cm)			1	-0.106
Shoot infestation				1

** indicate level of significant at 0.01 respectively.

Table 5. Correlation between plant leaf characters and fruit infestation by brinjal shoot and fruit borer

Character	Number of leaves plant-1	Third leaf length (cm)	Third leaf width (cm)	Fruit infestation
Number of leaves plant-1	1	-0.174	0.628**	0.319
Third leaf length (cm)		1	0.126	-0.128
Third leaf width (cm)			1	-0.008
Fruit infestation				1

** indicate level of significant at 0.01 respectively

The average highest third leaf width was recorded in the variety Marich begun S (21.06) which was significantly identical with that of varieties/lines Singnath, Wild and Thamba that occupied in the first position in the ranked order. The lowest third leaf width was recorded in the variety Kaikka-G (10.25) which was significantly identical with that of the varieties/lines Bholanath, ISD-006, Jessore-L and China oblong and hold the last position in the ranked order.

Correlation between plant leaf characters and shoot infestation by brinjal shoot and fruit borer

Experimental information on correlation is particularly useful for measuring the relationship among the variables. In case of shoot, infestation rate was found to be positively correlated with number of leaves plant^{-1} (0.291) and third leaf length (0.011) that was presented in table 4. The shoot infestation rate was recorded negatively correlated with third leaf width (-0.106) that was presented in table 4. The results indicated that the shoot infestation increased with the increased of number of leaves plant^{-1} and third leaf length and shoot infestation decrease with the increase of third leaf width.

Correlation between plant leaf characters and fruit infestation by brinjal shoot and fruit borer

Experimental information on correlation is particularly useful for measuring the relationship among the variables. In case of fruit, infestation rate was positively correlated with number of leaves plant^{-1} (0.319) that was presented in table 5. The fruit infestation rate was negatively correlated with third leaf length (-0.128) that was shown in table 5.

Fruit infestation increase with the increase of number of leaves plant^{-1}. The fruit infestation rate decreased with the increase of third leaf length and third leaf width.

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