# A Short Communication on the Reaction of Some Brinjal (*Solanum melongena* L., Fam. Solanaceae) Varieties to Brinjal Shoot and Fruit Borer Infestation by *Leucinodes orbonalis* Guen. (Lepidoptera: Pyralidae)

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## Abstract

*The morphological characters of 10 different brinjal varieties were evaluated to determine the level of resistance against the brinjal shoot and fruit borer (BSFB),* Leucinodes orbonalis *Guen (Lepidoptera: Pyralidae). The varieties Singnath Dinajpuri, Singnath long, Khatkhatia round, Khatkhatia long and Muktakeshi were fairly resistant to* L. orbonalis *while Jumka showed highly resistant to the pest with lowest infestation (7.71%). The level of infestation was moderate in the varieties Singnath Dinajpuri (20.27%), Singnath long (17.14%), Khatkhatia round (18.64%), Khatkhatia long (17.37%) and Muktakeshi (18.28%). The highest infestation was recorded in the varieties Islampuri (36.44%) and Irri-begoon (36.05%). Some morphological characters of brinjal plants and fruits were found to be associated with the level of infestation. The highly resistant variety Jumka had the largest number of seeds and prickles while Islampuri and Irri-begoon containing less number of seeds and prickles appeared as susceptible varieties to* L. orbonalis.

**Key words:** Resistance, Brinjal, shoot and fruit borer, *Leucinodes orbonalis*.

## Introduction

The brinjal shoot and fruit borer, L*eucinodes orbonalis* Guen., is the key insect pest of brinjal (*Solanum melongena* L.) in Bangladesh (Alam and Sana 1964), India (Tewari and Sardana 1990) and other countries of the world (Dhankar 1988). The fruit infestation by this pest in Bangladesh may be as high as 67% (BARI 1991). The estimated yield loss was 86% in Bangladesh (Ali *et al.* 1996) and 95% in India (Naresh *et al.* 1986). The pest management practices in brinjal crop include mainly spraying of different insecticides which cause several pesticide-related complications such as toxic residues in fruits, lethal effects on the beneficial arthropods and pollution of the environment (Luckmann and

Metcalf 1975). The brinjal growers of Bangladesh spray insecticide almost every day or alternate day in the field with as many as 84 times in a growing season (BARI 1994). It is now urgently required to find out an alternative method for controlling brinjal shoot and fruit borer. The use of host plant resistance against a pest is an important component of Integrated Pest Management (IPM) which is environmentally safe and could be economical also. The relationship between the level of pest infestation and morphological characters of brinjal plants and fruits has not been reported in Bangladesh. The present study aimed at providing information on the relationship between morphological characters of some common brinjal varieties and the level of infestation by brinjal shoot and fruit borer.

## Materials and Methods

The experiment was conducted with 10 brinjal varieties viz., Uttara, Islampuri, Singnath Dinajpuri, Singnath Long, Khatkhatia round, Khatkhatia long, Nayankajal, Muktakeshi, Irribegoon and Jumka in the field of Bangladesh Agricultural University, Mymensingh during September, 1998 to April, 1999. The design was a randomized complete block (RCBD) with three replications. The seedlings of different varieties were raised in seed bed. The land was prepared by ploughing and laddering and fertilized with organic manure such as cow dung @ 10 m ton/ha, 7 days before final land preparation, and chemical fertilizers Urea @ 150 kg/ha, TSP @ 100 kg/ha and MP @ 150 kg/ha. The whole TSP and MP and $^1/_3$ of Urea were applied during the final land preparation. The remaining Urea was applied in two splits- one at 30 days and the other at 50 days after planting. The individual plot size was 3 m × 2.5 m. The seedlings were transplanted in September, 1998 at a spacing of 80 cm between lines and 60 cm between plants. Irrigation and other cultural operations were done as and when necessary.

Percentage of insect infestation by weight is an important criterion for evaluating their performance against *L. orbonalis*. The weight of infested and healthy brinjal fruits per plot were recorded at each harvest. Yield data were taken from all the 30 plots. The percentage of infestation by weight was calculated using the weight of infested and total brinjal fruits.

On the basis of gradation for relative resistance (Lal *et al.* 1976) of different brinjal varieties, the levels of percentage of brinjal shoot and fruit borer infestation were categorized as immune (0%), highly resistant (1-10%), fairly resistant (11-20%), tolerant (21-30%), susceptible (31-40%) and highly susceptible (above 41%).

The fruit characters studied include the length, diameter, number of seeds/g flesh, shape and colour. The number of prickles on the stem and leaves were counted per twig from the top 20 cm of the twig. Ten plants were randomly selected in each plot for recording data. The length of fruit was measured with a measuring tape from randomly selected marketable fruits in three replications with five fruits in each replication. The same fruits were used to measure the diameter of the fruits. It was recorded by measuring the circumference of the fruits from two points on each side of the middle of the fruit in such a way that $1/4^{th}$ of fruit length was left on each end. Colour of the fruit was observed

visually. All data were analyzed using an Analysis of Variance (ANOVA) and significantly different means were separated by Duncan's Multiple Range Test (DMRT).

## Results and Discussion

*Brinjal shoot and fruit borer infestation*

The ten selected brinjal varieties showed differential response to brinjal shoot and fruit borer infestation. The percentage of infested fruits by weight was significantly different in tested varieties ($P < 0.01$). The percent infested fruits in different varieties ranged from 7.71 to 36.44 (Table 1). The lowest infestation was found in the variety Jumka (7.71%) followed by Singnath Long (17.14%), Khotkhatia long (17.37%), Muktakeshi (18.28%) and Khatkhatia round (18.64%). The highest percentage of fruit infestation was recorded in the Islampuri (36.44%). The variety Jumka was graded as highly resistant and Singnath Dinajpuri, Singnath long, Khatkhatia round, Khotkhatia long and Muktakeshi were fairly resistant to the pest. The varieties Uttara and Nayankajal exhibited some degree of tolerance, while Islampuri and Irri-begoon were graded as susceptible to brinjal shoot and fruit borer.

**Table 1. Percentage of infested fruits by *L. orbonalis* in selected brinjal varieties. Values in a column followed by same letter(s) do not differ significantly at p = 0.05**

| Varieties | Percentage ± SE of infested fruits by weight | Relative resistance/ susceptibility | Yield ± SE (ton/ ha) |
|---|---|---|---|
| Uttara | 24.71±1.12 b | T | 16.54 ±0.83 d |
| Islampuri | 36.44± 0.94 a | S | 19.25±0.82 c |
| Singnath Dinajpuri | 20.27±1.54 c | FR | 19.09±0.86 c |
| Singnath long | 17.14±1.47 e | FR | 21.99 ±1.09 a |
| Khotkhatia round | 18.64±1.28 d | FR | 21.64 ±0.98 ab |
| Khotkhatia long | 17.37 ±1.26 de | FR | 21.56±1.19 ab |
| Nayankajal | 20.87±1.84 c | T | 19.84±1.15 c |
| Muktakeshi | 18.28±1.78 de | FR | 20.28±0.66 bc |
| Irri begoon | 36.05±1.25 a | S | 13.91±0.86 e |
| Jumka | 7.71±1.62 a | HR | 10.50±0.86 0.93 f |
| CV(%) | 2.85 | - | 3.53 |

**T = Tolerant; S = Susceptible ; FR = Fairly resistant ; HR = Highly resistant**

Ahmed *et al.*, (1985) showed that the percentage of fruit borer infestation was 13.47, 23.11, 23.84 and 31.66% in Singhnath long, Khotkhatia round, Khotkhatia long and

Islampuri, respectively. They classified Singnath long as fairly resistant, Khotkhatia round and Khotkhatia long as tolerant and Islampuri as susceptible varieties to *L. orbonalis* according to the gradation for relative resistance (Lal *et al.* 1976). The results of the present trial are in partial concurrence with the findings of Ahmed *et al.,* (1985).

*Yield of brinjal varieties*

The yield of brinjal varieties ranged from 10.5 t/ha in Jumka to 21.99 t/ha in Singnath long (Table 1). Although the lowest infestation was found in variety Jumka, the yield of the variety was not promising, because of its small fruit size and round shape. Sarker and Hoque (1980) while working with some brinjal varieties, obtained highest yield from the variety Japani (29.52 t/ha) followed by Khatkhatia (24.35 t/ha) and Nayankajal (24.34 t/ha). Siddique and Hossain (1971) reported that the variety Singnath produced the highest yield (25.43 t/ha) followed by Khatkhatia (20.17 t/ha). Ahmed *et al.,* (1983) reported highest yield (38.5 t/ha) in the variety Singnath. Some differences in yield of same variety under different studies are evident, probably due to the local variations and different study periods. The other reasons for the yield differences could be due to biotic and abiotic factors of the environment.

The variability in the yield of the ten varieties is likely due to genetic factors. Although in the present study, yield was recorded but it is difficult to make any comparison of the yield performance as the yield was not entirely dependent on insect infestation.

*Infestation in relation to fruit characters*

Different morphological characters were obtained for *L. orbonalis* infestation are shown in Table 2. The mean length of fruits of different varieties ranged from 6.65 to 24.88 cm. The variety Jumka had very short fruits (6.65 cm) and Singhnath long had long fruits (24.88 cm). Correlation co-efficient between the length of fruits and the degree of fruit infestation was found insignificant ($r = 0.30$). Grewal and Dilbagh, (1995) reported similar results.

The fruit diameter of the varieties ranged from 7.3 to 33.4 cm. The varieties Khotkhotia round, Khotkhatia long and Jumka had shorter diameter ranging from 7.33 to 9.21 cm, while Singnath Dinajpuri, Singnath long, Uttara and Nayankajol had medium diameter (11.4 to 14.2 cm) and Islampuri, Muktakeshi and Irribegoon had large fruit diameter (20.1 to 33.4 cm). Fruit diameter was negatively correlated to fruit length ($r = -0.51$, $y = -0.51x + 18.47$). However, there was a positive linear correlation ($r = 0.75$, $y = 0.85X + 9.03$) between the diameter of fruits and the level of fruit infestation (Fig. 1). Malik *et al.,* (1986) also showed negative correlation between fruit diameter and fruit length. Daodu, (1986) highlighted that fruit diameter may not always have positive correlation to fruit infestation.

It was observed that the oval/round and small shaped brinjal fruits (Jumka) had significantly less infestation (7.71%) followed by long and narrow shaped ones (Singnath Dinajpuri, Singnath long, Khatkhatia round and Khatkhatia long). Ali, (1994) and Mishra *et al.,* (1988) reported that oval, thin and elongated fruits are resistant to the brinjal shoot and fruit borer. The results of the present study are thus similar to reports of above

authors. The low infestation in small and round fruit might be due to less preference for the larvae, as the fruit could be insufficient for supporting its growth and development.

The number of seeds/g flesh varied from 6.21 to 46.31. The varieties Irrigegoon, Islampuri, Uttara and Nayankajal had minimum number (6.21 to 9.3) of seeds and Jumka had maximum (46.31). The number of seeds/g flesh were negatively correlated to the percentage fruit infestation ($r = -0.79$, $y = -0.58X + 31.58$) (Fig. 2). The results showed that the variety Jumka with highest number of seeds (46.31) had the lowest percentage of infested fruits (7.71) and Irribegoon with largest number of seeds (6.21) had the highest (35.05%) infestation. The percentage of fruit infestation decreased with increase in number of seeds/g flesh. Grewal and Dilbagh, (1995) opined that the seeds of brinjal fruit acted as a mechanical barrier to the entry of the fruit borer.

**Table 2. Fruits characters of brinjal in relation to infestation by *L. orbonalis*. Values in a column followed by same letter(s) do not differ significantly at p = 0.05**

| Variety | Fruit length ± SE (cm) | Fruit diameter ± SE (cm) | No. of seeds/g flesh ± SE | No. of prickles/ twig ± SE | Shape | Colour | Percentage ± SE of infested fruits |
|---|---|---|---|---|---|---|---|
| Uttara | 13.8±0.81 g | 11.4±0.41 f | 9.3±1.20 f | 8.9±1.24 d | Long, fleshy | Pink | 24.71±1.12 b |
| Islampuri | 12.14±1.13 h | 33.4±0.51 a | 7.4±1.10 f | 1.19±0.37 e | Oval, fleshy | Purple green | 36.44± 0.94 a |
| Singnath Dinajpuri | 21.00±0.68 c | 14.2±0.60 c | 19.98±1.23 c | 11.30±1.03 c | Long, narrow | Blackish purple | 20.27±1.54 c |
| Singnath long | 24.88±0.98 a | 12.1± 0.61e | 24.10±1.25 b | 30.11±1.33 b | Long, very narrow | Blackish purple | 17.14±1.47 e |
| Khotkhatia round | 18.23±0.67 e | 8.8±0.58 h | 14.4±1.08 d | 9.99±1.18 d | Medium long, narrow | Purple | 18.64±1.28 d |
| Khatkhatia long | 20.0±0.83 d | 7.3±0.91 I | 20.1±1.57 c | 11.9±1.56 c | Long, narrow | Purple | 17.37 ±1.26 de |
| Nayankajal | 16.6±0.83 f | 13.4±0.68 d | 8.23±0.99 g | 2.58±0.57 e | Oblong-oval, fleshy | Purple | 20.87±1.84 c |
| Muktakeshi | 22.0±0.92 b | 20.3±0.56 b | 13.25±0.83 e | 9.18±1.25 d | Oblong, fleshy | Greenish purple | 18.28±1.78 de |
| Irri-begoon | 18.8±0.98 e | 20.1±0.84 b | 6.21±0.71 h | 1.18±0.05 e | Oblong, fleshy | Greenish purple | 36.05±1.25 a |
| Jumka | 6.65±0.75 I | 9.21±0.60 g | 46.31±1.44 a | 70.36±1.56 a | Oval/roundsmall | Green | 7.71±1.62 f |
| CV(%) | 1.35 | 1.84 | 3.53 | - | - | - | 2.85 |

The number of prickles was minimal (1.18 to 1.19) on the stem and leaves of varieties Islampuri and Irribegoon while the highest number of prickles (70.36) was recorded for Jumka. The number of prickles was negatively correlated ($r = -0.73$, $y = -0.30X + 26.51$) to infestation level (Fig. 3). The level of infestation increased with a decrease in number of prickles. The role of prickles of brinjal plants in imparting resistance to borer attack

has earlier been reported by several authors (Chelliah and Srinivasan 1983; Malik *et al.*, 1986; Mishra *et al.* 1988; Ali 1994). Prickles on the stem and leaves of the brinjal plant can play an important role as physical barrier against the fruit borer.

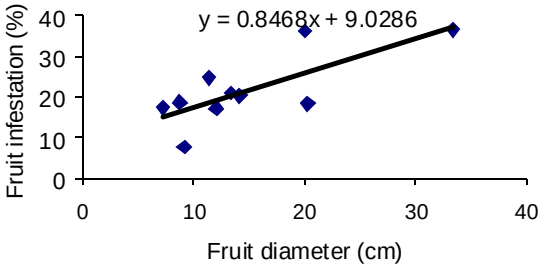


Figure 1. Fruit infestation in relation to fruit diameter of brinjal

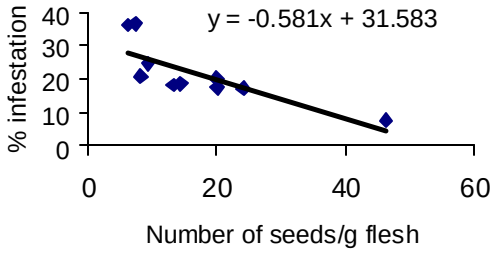


Figure 2. Infestation in relation to number of seeds/g flesh

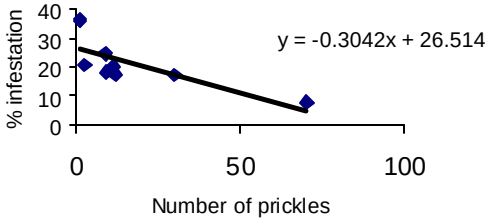


Figure 3. Infestation in relation to number of prickles/twig

The colours of the fruits were green, purple, greenish purple, blackish purple and pink. It was observed that the variety Jumka with green coloured fruits were significantly less susceptible and those with greenish purple (Irribegoon), purple green (Islampuri) and purple (Nayankajal) colours were more susceptible. Regarding the colour of fruits in relation to fruit infestation level, Lal *et al.,* (1976) reported that fruit colour had no impact on the degree of fruit infestation. However, Grewal and Dilbagh, (1995) observed that green coloured fruits were less susceptible while the varieties with dark purple or white coloured fruits were more susceptible. Rout and Souone, (1980) and Mote, (1981) also reported that green fruit varieties were less susceptible to brinjal shoot and fruit borer. In the present study, it was also noted that the variety Jumka with green fruit had less infestation. The reason for low infestation in green coloured fruits might be due to the similarity of colour of brinjal shoot and fruits. On the contrary different colour of fruits from shoot may have some advantages for the moth to mark the fruit easily.

The present one season study in the location of major brinjal growing area in Bangladesh provides some findings towards the IPM for brinjal shoot and fruit borer. However, it needs trials in other areas for location specific variation if any occur.

The results and observations from the present trial showed that the high-yielding varieties were relatively more susceptible to brinjal shoot and fruit borer than the low-yielding varieties. It could also be mentioned that the resistance in brinjal is collectively controlled by a number of factors and not a single factor. Thus, the genetic basis of resistance from a wide gene of cultivated brinjal varieties as well as non-cultivated BSFB-resistant wild varieties of brinjal should be utilized to develop brinjal varieties with desirable resistance, yield potential and consumable qualities.

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