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Original Research Article

Screening of Local and Exotic Eggplant Genotypes for Tolerance to Shoot and Fruit Borer

Nisha Rani[1*], Shirin Akhtar[1], Preeti Kumari[1] and Rahul K. Verma[2]

[1]Department of Horticulture (Vegetable & Floriculture), Bihar Agricultural College, Bihar Agricultural University, Sabour- 813210, Bihar, India
[2]SMS, Department of Horticulture, Krishi Vigyan Kendra, Lakhisarai, Bihar, India
**Corresponding author*

Keywords

Brinjal, Fruit and shoot borer, Summer season, Tolerance

A B S T R A C T

An experiment was carried out with thirty six brinjal genotypes at Bihar Agricultural University, Sabour, Bhagalpur to screen the suitable tolerant brinjal genotypes against brinjal fruit and shoot borer in Bihar for hot summer-rainy when its incidence is at the peak. The life cycle and fecundity of *Leucinodes orbonalis* greatly varies with the climate dynamics. It was observed that in the summer season the fruit borer infestation was in the range of 29.63 % to 52.04 % and 28.4 % to 53.67 % on number and weight basis respectively, while the shoot borer incidence ranged from 10.43 to 32.46%. Among them none was found to be immune to the pest.The results showed that genotype BRBL -01, having oblong stripe green fruits, was least infested by fruit borer on number and weight basis with maximum marketable yield (208.11 q/ha).

Introduction

Eggplant is an annual plant, grown year-round in the subtropics and tropics. The crop is mainly cultivated on small family farms and is an important source of nutrition and cash income for many resource-poor farmers of Bihar, especially during hot wet summer when other vegetables are in short supply. *Leucinodes orbonalis*, is the most destructive pest for eggplant during this period. The larvae bore inside an eggplant fruit and feed until they pupate. Fruit feeding is the major cause of damage. The larvae may also bore into tender shoots causing wilting and death of the branch terminals. This reduces the fruit-bearing capacity of plant. The pest incidence is likely to be influenced by the prevalence of maximum temperature. It is very active during the summer and rainy season and often causes more than 90% damage (Kalloo, 1988). The pest is likely to complete the life cycle comparatively at a shorter duration at elevated temperatures and increase their population, thereby the incidence. The percent fruit borer incidence on brinjal had a positive association with maximum and minimum temperatures and also sunshine (Rao *et al.*, 2010). At elevated temperatures, due to climatic change (hot-humid), the borer incidence rise slightly. During the past two decades this crop has been increasingly wasted by eggplant fruit and shoot borer. Farmers have resorted to frequent sprays of pesticides to kill the larva

before it enters the fruit. Such extensive use of pesticides cuts into profitability of eggplant production, makes eggplant more expensive to consumers, poses health hazards, and causes environmental pollution and resource degradation. Accordingly, host plant resistance would be convenient either as a wide-ranging control measure or as a part of the integrated pest management plan with limited dependency on pesticides. Hence, the present study was started to find out resistant or tolerant brinjal genotypes against fruit and shoot borer in hot summer under field conditions.

Materials and Methods

The experiment was conducted at Vegetable Research Plot, Bihar Agricultural College Farm, Bihar Agricultural College, BAU, Sabour, Bhagalpur located at 25^0 15' 40'' North latitude and 80^0 2' 42'' East longitude with an altitude of 46 m above the mean sea level in the South Bihar alluvial plain zone.

Thirty six genotypes were planted in a randomized block design replicated thrice, the plants being spaced at 60cm. The observations for the incidence of shoot borer were recorded at an interval of 30 days, *i.e.*, 60, 90, 120 and 150 DAT and pooled. In case of fruit, the borer incidence was recorded at each harvest on percent infestation both on affected fruit number and fruit weight basis.

Morphological data like plant height, plant spread, shoot diameter, trichome density, fruit length, fruit girth, average fruit weight, total yield and marketable yield were recorded. Daily weather data, *viz*., maximum and minimum temperature, maximum and minimum humidity, rainfall and sunshine hours, were also collected from the Meteorological Observatory, Department of Agronomy, Bihar Agricultural College, BAU, Sabour. The levels of tolerance were graded on the basis of infestation following the scale of Mannan *et al.,* (2003) as outlined in table 1.

Results and Discussion

Shoot infestation by brinjal shoot and fruit borer

The pooled percent infestation on shoot of various brinjal genotypes at different days after transplanting has been presented in Table 2. Among them the least shoot infestation was found in the cultivar Pusa Purple Cluster (10.43%) followed by BRBR-01(13.67%), IC 545920 (14.32%), BRBL-07 (14.68%), BRBL-04 (14.72%) whereas the highest shoot infestation was found in the genotype EC 382524 (32.46%), BSB-31 (31.42%), EC 384606 (31.30%).

The presence of more number of primary branches, more trichome density and spines and lignified thick cuticle may be the cause for lower infestation. Similar results were found by Ali *et al.,* (1994); Hossain *et al.*, (2002); Ahmad *et al.,* (2008) and Mishra *et al.*, (1988).

Fruit infestation by brinjal shoot and fruit borer

The pooled percent fruit borer infestation varied significantly both on number and weight basis (Table 2). The data indicated the infestation in the range of 29.63 % to 52.04 % and 28.4 % to 53.67 % on number and weight basis respectively. The average lowest fruit infestation was found in the genotype BRBL-01 (29.63%), IC 545920 (30.90%), Pusa Purple Cluster (31.58%), Muktakeshi (32.97%), BRBL-07 (34.97%), BRBL-04 (34.39%), BRBL-02 (37.94%). The highest fruit infestation was found in IC 107769 (52.04%).

Table.1 Grade index of Mannan *et al.*, (2003)

Grade	Percent fruit infestation
Highly Resistant	1-10
Fairly resistant	10-20
Tolerant	21-30
Susceptible	31-40
Highly susceptible	>40

Table.2 Fruit and shoot borer infestation and yield potential of eggplant genotypes in summer season 2015

Genotypes	SBI (%)	FBIN (%)	FBIW (%)	TP (q/ha)	MY (q/ha)
BRBL-05	17.03	49.46	49.03	190.25	96.97
Arka Neelkanth	19.74	45.74	44.29	58.76	32.74
BRBR-01	13.67	44.5	42.54	102.35	58.81
BSB-31	31.42	45.42	42.44	132.78	76.43
BRBL-06	23.46	36.79	41.35	75.87	44.50
DRNKV-03-26	18.18	46.85	44.26	47.66	26.57
EC 169084	19.86	46.09	44.82	135.22	74.61
EC 382524	32.46	34.49	36.20	72.47	46.24
EC 384606	31.3	42.95	49.08	48.88	24.89
BRBL-08	25.74	51.13	53.67	177.87	82.41
IC 107769	22.31	52.04	45.30	22.34	12.22
IC 215020	23.97	40.49	49.32	75.59	38.31
IC 261802	20.47	48.13	43.61	87.66	49.43
IC 545920	14.32	30.9	33.35	63.19	42.12
IC 89837	15.71	40.51	35.83	111.76	71.72
IC 89933	15.62	37.45	37.88	105.62	65.61
IC 90087	23.48	47.84	48.73	93.18	47.77
IC 90121	26.67	38.18	41.49	136.56	79.90
IC 90148	21.28	38.14	43.47	57.76	32.65
IIHR 562	22.91	36.95	38.12	125.45	77.63
IIHR 563	21.67	37.41	39.30	175.65	106.62
IIHR 586	22.77	40.48	43.61	231.65	130.63
BRBL-02	25.49	37.94	38.84	280.66	171.65
Muktakeshi	23.67	32.97	29.69	152.33	107.10
Pant Rituraj	18.52	40.07	38.61	106.55	65.41
BRBL-07	14.68	34.97	37.93	64.33	39.93
Punjab Brinjal 67	18.39	36.52	33.45	48.97	32.59
Pusa Purple Cluster	10.43	31.58	32.71	188.75	127.01
Pusa Purple Long	20.44	38.19	39.21	305.56	185.75
BRBL-04	14.72	34.39	35.55	182.45	117.59
RCMBL-04	20.82	35.56	36.87	122.13	77.10
BRBL-01	22.95	29.63	28.40	290.66	208.11
Swarna Mani	15.31	48.09	43.88	127.64	71.63
Swarna Manjari	24.33	38.79	37.88	87.49	54.35
Swarna Shree	20.63	49.15	49.72	166.55	83.74
Swarna Shyamli	22.16	41.9	40.07	107.75	64.57
Mean	21.02	40.6	40.85	126.68	74.93
S.E. (±)	0.67	0.62	0.62	13.32	17.94
C.D. 5%	1.90	1.76	1.75	37.56	50.59

SBI – Percent shoot borer infestation, FBIN - Percent fruit borer infestation by number, TFBIW – Total fruit borer infestation by weight, TP – Total production in quintal per hectare, MY (q/ha) – Marketable yield in quintal per hectare.

Table.3 Morphological characters of the 36 brinjal genotypes in summer season 2015

Genotypes	Characters							
	PH	PB	SD	TD	FrL	FrD	FrW	FrP
BRBL-05	80.67	3.11	4.73	104.36	8.84	4.28	68.61	9.98
Arka Neelkanth	107.11	5.33	4.95	75.09	9.31	6.06	63.81	3.32
BRBR-01	131.11	5.78	5.08	95.98	8.18	5.33	77.82	4.75
BSB-31	87.00	3.22	4.42	98.95	8.75	5.34	76.92	6.21
BRBL-06	87.78	3.11	4.36	90.36	8.47	4.56	65.81	4.15
DRNKV-03-26	88.33	3.44	4.47	78.27	9.31	5.17	72.08	2.38
EC 169084	92.22	4.22	4.78	90.05	10.16	5.17	76.00	6.41
EC 382524	98.33	3.44	4.73	83.12	9.60	5.05	59.92	4.36
EC 384606	109.67	3.55	4.47	80.18	8.89	5.72	43.22	4.08
BRBL-08	67.67	3.00	4.46	86.43	7.73	5.06	70.10	9.14
IC 107769	107.45	3.78	4.91	92.27	9.17	4.94	51.23	1.57
IC 215020	72.33	3.44	4.92	85.27	8.38	4.36	80.19	3.39
IC 261802	83.33	4.22	5.30	98.64	10.23	4.73	70.99	4.45
IC 545920	97.44	4.22	5.02	96.49	9.88	4.78	83.40	2.73
IC 89837	136.00	5.11	5.20	94.32	8.33	5.78	83.87	4.80
IC 89933	107.56	4.56	4.74	123.45	8.38	5.19	81.29	4.68
IC 90087	107.66	4.22	4.80	78.27	9.88	5.17	68.84	4.88
IC 90121	96.78	3.89	4.31	79.31	10.02	5.39	55.89	8.81
IC 90148	107.33	3.89	4.48	91.64	8.75	4.11	69.30	3.00
IIHR 562	100.00	3.44	4.53	75.25	11.15	4.28	68.20	6.63
IIHR 563	104.33	4.11	4.91	86.23	13.07	5.39	62.79	10.08
IIHR 586	94.33	4.22	4.78	89.09	12.47	5.10	71.51	11.66
BRBL-02	111.33	4.00	4.73	86.20	9.17	4.28	85.77	11.78
Muktakeshi	118.89	4.78	5.55	111.36	10.51	3.70	97.92	5.60
Pant Rituraj	96.22	3.93	4.88	81.88	7.20	5.56	85.18	4.50
BRBL-07	92.78	4.11	4.78	116.14	7.62	4.17	82.98	2.80
Punjab Brinjal 67	112.78	5.89	4.44	96.39	9.17	4.62	114.12	1.55
Pusa Purple Cluster	111.39	4.45	4.85	106.01	8.33	4.55	77.30	8.79
Pusa Purple Long	114.11	4.78	4.37	98.41	11.63	4.27	60.57	18.17
BRBL-04	103.61	4.67	4.97	108.94	9.31	4.22	57.44	11.45
RCMBL-04	100.89	5.11	5.02	99.26	11.57	4.72	73.97	5.95
BRBL-01	73.28	3.33	4.91	103.84	9.65	4.61	76.89	13.62
Swarna Mani	106.78	4.33	5.36	90.52	7.90	6.78	90.64	5.07
Swarna Manjari	100.67	4.56	5.10	72.70	10.25	4.27	65.38	4.82
Swarna Shree	114.33	4.22	4.58	52.02	9.29	7.18	83.05	7.22
Swarna Shyamli	90.22	3.67	4.67	81.03	12.14	3.28	64.12	6.05
Mean	100.33	4.14	4.79	91.05	9.52	4.98	73.25	6.36
S.E. (±)	7.81	0.36	0.11	4.06	0.72	0.49	1.06	0.22
C.D. 5%	22.04	1.02	0.31	11.46	2.02	1.39	2.98	0.62

Characters: Plant height (cm) (PH), Number of primary branches / plant (PB), Shoot Diameter (mm) (SD), Trichome density (TD), Fruit length (cm) (FrL), Fruit Diameter (cm) (FrD), Average fruit weight (g) (FrW), Number of fruit / plant (FrP).

Table.4 Correlation between weather parameters and fruit and shoot borer infestation

Weather parameters	Correlation coefficient (r^2)	
	Shoot borer incidence	Fruit borer incidence
Maximum temperature	0.1269	-0.9405
Minimum temperature	0.9682	-0.9219
Maximum relative humidity	0.4007	0.9659
Minimum relative humidity	0.7638	0.9559
Rainfall	0.7457	0.7844
Sunshine hours	-0.7007	-0.8334

The genotype BRBL-01 was found to be least infested by fruit borer on number and weight basis thereby having maximum marketable yield (208.11 q/ha) followed by PPC and BRBL-02. The morphological traits of these genotypes (Table 3) showed that they had higher number of primary branches, high trichome density, smaller fruit diameter, fruit girth and lesser average fruit weight than the genotypes that were higher infested by the fruit and shoot borer. Previous work of Ali *et al.,* (1994), Hossain *et al.,* (2002), Hazra *et al.,* (2004), Amin *et al.,* (2014), Mishra *et al.,* (1988), Thangamani *et al.,* (2012) also reported that the presence of more number of primary branches, more spines, high trichome density, smaller fruit diameter, fruit girth, length and weight may be responsible for lower infestation of the pest.

Weather parameters and fruit and shoot borer incidence

A moderate range of temperature coupled with high humidity was found to be favourable for the borer. Brinjal crop planted during February to September recorded shoot damage range between 10.43–32.46% and fruit damage between 29.63 and 52.04%, which is highest compared to the crops planted during other seasons. The results are in confirmation with Tripathi and Senapathi (1998), Singh *et al.,* (2009). In the summer crop at the South Bihar alluvial region, it was found that maximum temperature did not have any significant influence, while minimum temperature, maximum and minimum relative humidity, rainfall had high positive influence on the shoot borer infestation, whereas, sunshine hours had significant negative correlation (Table 4). On fruit borer infestation in the summer crop grown between February and September, maximum and minimum relative humidity and rainfall had significant positive correlation, while maximum and minimum temperature and sunshine hours had highly significant negative association. Infestation in shoots decreased after fruit setting and completely disappeared thereafter. Similar results were found by Kumar *et al.,* (1997) and Singh *et al.,* (2011), suggesting that the effect of abiotic factors such as maximum temperature, evaporation and sunshine hours had some positive association with borer incidence while minimum temperature had negative association. Thus, it can be said that climate change likely affects the population dynamics of eggplant fruit and shoot borer.

Among these thirty six genotypes none was found to be resistant to brinjal shoot and fruit borer; one was found to be tolerant, 21 were susceptible and 14 highly susceptible to brinjal fruit and shoot borer. The varieties which are high yielders and have less fruit infestation can be opted for cultivation over

wide range locations. So, here in this study the genotypes BRBL-01, Pusa Purple Cluster and BRBL-02 were found to be high yielding, coupled with less fruit borer infestation can be recommended for cultivation over wide range of locations in Bihar for hot summer season. Thus, host plant resistance would be useful either as a complete control measure or as a part of the integrated pest management programme with limited dependence on pesticides to mitigate the effect of climate change due to continuous use of harmful pesticides.

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