

## Genetic Variability among Indian and Exotic Brinjal Genotypes for Reaction against Shoot and Fruit Borer

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**Abstract** High yield combined with good quality as well as resistance to shoot and fruit borer is the ultimate aim in most of the brinjal breeding programs. Assessment of genetic diversity in germplasm collections provides information which is useful for both germplasm management and breeding. Variability studies were carried out in thirty six brinjal genotypes of Indian and exotic origin. High estimates of GCV and PCV was observed for number of fruits per plant, fruits yield per plant and percent shoot borer infestation and all the biochemical traits under study were high. PCV was slightly higher than GCV for all the charac-

ters indicating lesser role of environment on the expression of these traits. The characters like number of fruits per plant, fruit yield per plant and shoot borer infestation had high GCV along with high heritability while trichome density, average fruit weight, percent fruit borer infestation both by number and weight showed moderate GCV coupled with high heritability suggesting that selection will be more effective for these characters. Fruits per plant, yield per plant, average fruit weight, percent shoot borer infestation, percent fruit borer infestation by number and weight, days to 1<sup>st</sup> flowering and trichome density, had high heritability coupled with high genetic advance as percentage of mean suggesting governance of additive gene effects. Therefore, the selection based on phenotypic performance of these characters would be useful for achieving desired results. High heritability along with high genetic advance was reported for all the biochemical characters under study. Hence selection will be effective for all these characters due to preponderance of additive gene effect.

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### Introduction

Brinjal or eggplant or aubergine, *Solanum melongena* L. is one of the most important vegetable crops grown

in India and other parts of the world. It is highly cosmopolitan and popular vegetable grown as poor man's crop in India. Brinjal, being a native to India has great variability existing in the country. However, it is highly infested by shoot and fruit borer, *Leucinodes orbonalis*, an obnoxious pest causing fruit ranging from 40.79 to 71.84% [1]. The pest is very active during the summer and rainy season and often causes more than 90% damage [2]. Pesticide application is not the only solution of managing the pest as repeated use of pesticide leads to health hazards, destruction of beneficial insects, pest resurgence and environmental pollution. In this context, the knowledge about variability present in the brinjal germplasm is very useful for selecting the finest lines for making quick increase in yield, quality and other desirable characters. Therefore, we need to know the biophysical and biochemical traits that often result intolerance mechanism. Hence the present experiment was carried out to assess the genetic variability among thirty six genotypes for biophysical and biochemical traits.

### Materials and Methods

The experiment consisting of 36 brinjal genotypes was laid out in randomized block design with three replications maintained at 60 cm × 60 cm spacing at Vegetable Research Farm of Department of Horticulture (Vegetable and Floriculture), Bihar Agricultural University, Sabour, Bhagalpur (Bihar) during spring-summer season, 2015–16 (Table 1). The observations for shoot borer infestation were recorded at 30 days interval and expressed as percentage. Percent infestation of fruit borer, both on number and weight basis were recorded at each harvest. Different morphological traits, viz., plant height, number of primary branches, days to first and 50% flowering and first fruitset, fruit length, fruit girth, average fruit weight, trichome density, shoot diameter were noted. Besides, biochemical parameters like total sugar, ascorbic acid, leaf and fruit phenol, leaf and fruit anthocyanin, leaf and fruit chlorophyll, antioxidant activity of fruits and polyphenol oxidase activity of the leaves at seedling stage before exposure to fruit and shoot borer activity were also recorded.

Data were statistically analyzed by analysis of

**Table 1.** Morphology of the genotypes under study.

Genotype	Fruit shape	Fruit color
BRBL-05	Oval small	Green with white stripes
Arka Neelkanth	Oblong	Blackish purple
BRBR-01	Round	Dark purple
BSB-31	Oblong	Dark purple
BRBL-06	Round	Green with white stripes
DRNKV-03-26	Round	Purple with white stripes
EC 169084	Oblong	Green
EC 382524	Oblong	Green
EC 384606	Long	Green
BRBL-08	Oblong	Green with white stripes
IC 107769	Oval	Whitish green
IC 215020	Oblong	Light green
IC 261802	Round	Dark purple
IC 545920	Oblong	Green
IC 89837	Round	Green
IC 89933	Oblong	Dark purple
IC 90087	Long curved	Dark purple glossy
IC 90121	Oblong	Purple
IC 90148	Oblong	Dark purple
IIHR 562	Long in cluster	Purple
IIHR 563	Small Long in cluster	Purple black
IIHR 586	Round to oval	Purple
BRBL-02	Long	Purple black
Muktakeshi	Oblong	Blackish dark purple
Pant Rituraj	Round	Purple black
BRBL-07	Oblong	Dark blackish purple
Punjab Brinjal 67	Long	Purple
Pusa Purple Cluster	Long	Blackish purple
Pusa Purple Long	Long	Blackish purple
BRBL-04	Oblong	Green with white stripes
RCMBL-04	Long	Deep purple
BRBL-01	Round	Green with white stripes
Swarna Mani	Round	Blackish purple
Swarna Manjari	Oval	Green
Swarna Shree	Round	White
Swarna Shyamli	Round	Dark purple with green stripes

variance as suggested by Panse and Sukhatme [3]. Phenotypic and genotypic coefficients of variation were calculated by the method suggested by Burton and DeVane [4]. Heritability present in the brinjal broad sense and genetic advance as per formulae described by Johnson et al. [5].

### Results and Discussion

Genotypic coefficient of variation helps in measuring the range of diversity in character and provides a

**Table 2.** Mean sum of squares for 25 morpho-biochemical characters under study. \*, \*\* are significant at 1% and 5% levels of significance respectively.

Characters	Replication (df=2)	Mean sum of square Genotypes (df=35)	Error (df=70)
Plant height (cm)	515.83	668.25**	183.12
Primary branches/plant	0.38	1.57**	0.39
Days to first flowering	1.37	101.57**	5.19
Days to 50% flowering	2.49	38.65**	4.37
Days to 1 <sup>st</sup> fruit set	4.36	129.58**	10.32
Shoot diameter (mm)	0.01	0.27**	0.04
Trichome Density	5.36	566.96**	49.56
Fruit length (cm)	1.38	5.84**	1.54
Fruit diameter (cm)	0.25	2.07**	0.73
Fruit weight (g)	8.13	535.60**	3.35
Fruits/Plant	0.01	40.81**	0.15
Fruit yield/Plant	7.13	192127.84**	532.04
Shoot borer infestation	1.01	76.58**	1.36
Fruit borer infestation % by number	2.31	109.69**	1.17
Fruit borer infestation by weight	2.50	103.17**	1.15
Leat Phenol	3.22	131.23**	5.50
Fruit Phenol	7.48	197.42**	4.63
Antioxidant	0.65	41.53**	1.27
Leaf Chlorophyll	0.61	3.34**	0.28
Fruit Chlorophyll	0.003	1.37**	0.02
Leaf Anthocyanin	0.01	241.19**	1.95
Fruit Anthocyanin	0.05	241.99**	0.38
Ascorbic Acid	0.14	3.28**	0.35
Total sugar	0.08	2.84**	0.10
Polyphenol Oxidase Activity	0.36	1024.38	3.01

means to compare the genetic variability in the quantitative characters (Table 2). However, it is not possible to estimate heritable variations with the help of GCV alone. According to Burton and DeVane [4] genotypic coefficient of variation together with the heritability estimates would give the best picture of the amount of advance to be expected by selection.

The high estimates of GCV and PCV was observed for number of fruits per plant, fruits yield per plant and percent shoot borer infestation. These findings are in conformity with the results of Senapati et al. [6], Samadia et al. [7], Naliyadhara et al. [8], Kushwah and Bandhyopadhyay [9] and Singh and Kumar [10]. Low estimates of GCV and PCV were ob-

tained for days to 50% flowering and shoot diameter and moderate estimates for fruit length, fruit diameter, average fruit weight, percent fruit borer infestation both by number and weight. Similar type of findings was reported by Kumar et al. [11].

The estimates for GCV and PCV for all the biochemical traits under study were high (Table 3). PCV was slightly higher than GCV for all the characters indicating lesser role of environment on the expression of these traits. This result was in agreement to the findings of Kumar et al. [12] in brinjal. Also, these traits were comparatively stable and heritable suggesting selection for such traits could be effective based on phenotypic performance which is in accordance with the findings of Dhaka and Soni [13].

The magnitude of heritability estimates in broad sense revealed that all the biochemical traits and most of the morphological characters except plant height, number of primary branches per plant, fruit length and fruit diameter and exhibited high estimates of heritability and were highly heritable in nature. The characters like number of fruits per plant, fruit yield per plant and shoot borer infestation had high GCV along with high heritability while trichome density, average fruit weight, percent fruit borer infestation both by number and weight showed moderate GCV coupled with high heritability suggesting that selection will be more effective for these characters.

Heritability estimates in conjunction with genetic advance is more useful than the heritability alone in predicting the resultant effects for selecting the best individuals. According to Johnson et al. [5] genetic advance as percent of mean depends upon selection differentials, genetic coefficient of variation and heritability estimated. In the present investigation, the characters viz. fruits per plant, yield per plant, average fruit weight, percent shoot borer infestation, percent fruit borer infestation by number and weight, days to 1<sup>st</sup> flowering and trichome density, had high heritability coupled with high genetic advance as percentage of mean. The higher genotypic variation of these characters is probably due to additive gene effects. Therefore, the selection based on phenotypic performance of these characters would be useful for achieving desired results. These findings are corrob-

**Table 3.** GCV, PCV, heritability, genetic advance and genetic advance as percentage of mean for biophysical characters.

Characters	GCV	PCV	h <sup>2</sup>	GA	GA % of Mean
Plant height (cm)	12.68	18.51	0.47	17.94	17.88
Primary branches/ plant	15.15	21.44	0.50	0.91	22.07
Days to 1 <sup>st</sup> flowering	12.89	13.90	0.86	10.83	24.64
Days to 50% flowering	6.00	7.06	0.72	5.92	10.51
Days to 1 <sup>st</sup> fruiting	9.53	10.70	0.79	11.57	17.50
Shoot diameter (mm)	5.82	7.04	0.68	0.47	9.91
Trichome density	14.42	16.37	0.78	23.84	26.19
Fruit length (cm)	12.58	18.12	0.48	1.71	17.99
Fruit diameter (cm)	13.48	21.81	0.38	0.85	17.16
Average fruit weight (g)	18.18	18.35	0.98	27.18	37.11
Fruits/plant	57.92	58.24	0.99	7.54	118.68
Fruit yield/plant	55.42	55.65	0.99	518.44	113.68
Shoot borer infestation	23.83	24.46	0.95	10.05	47.81
Fruit borer infec- tion % by number	14.81	15.05	0.97	12.19	30.03
Fruit borer infes- tation by weight	14.28	14.52	0.97	11.81	28.92
Leaf Phenol	24.70	26.27	0.88	12.53	47.83
Fruit Phenol	31.63	32.75	0.93	15.95	62.92
Antioxidant	35.67	37.31	0.91	7.21	70.23
Leaf Chlorophyll	23.07	26.00	0.79	1.85	42.15
Fruit Chlorophyll	68.43	69.89	0.96	1.36	138.01
Leaf Anthocyanin	96.70	97.88	0.98	18.18	196.81
Fruit Anthocyanin	68.16	68.32	1.00	18.44	140.07
Ascorbic Acid	23.49	27.33	0.74	1.75	41.59
Total sugar	38.69	40.76	0.90	1.87	75.66
Polyphenol Oxidase Activity	93.42	93.83	0.99	37.84	191.60

relative with the findings of Maitra et al. [14] and Dhaka and Soni [13]. Shoot diameter showed moderate heritability and low genetic advance indicating predominant role of non-additive gene action for these traits. Moderate genetic advance as percentage of mean and high heritability for suggests that individual plant selection will be more effective. These results get support from the findings of Roychowdhury et al. [15] and Prasad et al. [16]. High heritability along with high genetic advance was reported for all the biochemical characters under study. Hence selection will be effective for all these characters due to preponderance of additive gene effect.

## Conclusion

Highest GCV and PCV were observed for number of fruits per plant and yield per plant. PCV and GCV values for all the biochemical characters were high, fruit borer infestation by number which showed moderate values. High heritability ( $h^2_b$ ) was recorded for all the characters except number of primary branches, fruit length and diameter which have moderate value. Moreover, highest heritability was observed in total anthocyanin content of fruit. The highly heritable traits with high genetic advance as percent of mean such as number of fruits per plant, fruit yield/plant, fruit borer infestation by number, shoot borer infestation, fruit and leaf anthocyanin, polyphenol oxidase and antioxidant can be considered for direct selection pressure for improvement of the crop.

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