



Short communication

Genetic variability studies for improvement in brinjal under hot arid agro-climate

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ABSTRACT

Variability studies in brinjal indicated good amount of genetic variation is the evaluated germplasm. PCV was in general higher than the GCV. PCV and GCV of higher order for average fruit yield of plant, fruit weight, number of fruits per plant, fruit length, and fruit width were desired. High heritability and high genetic advance was observed in traits like average fruit yield per plant and fruit weight, which indicates participation of additive genetic variance. Correlation studies among morphological and yield related traits revealed that average fruit yield had positive and significant correlation with fruit width, number of fruits per plant and average fruit yield per plant at phenotypic as well as genotypic levels. The path coefficient revealed that the total fruit yield per plant was positively dependent on traits like fruit weight, number of fruits per plant, leaf width and plant height. Multivariate analysis grouped the genotypes under five clusters, the highest being eight in clusters I. Intra-clusters distances was high in cluster IV, while the inter-cluster distances was highest between cluster III and cluster V, thus signifying their role in exploitation of heterosis.

Key words: Brinjal, correlation, multi-variate analysis, variability.

Egg plant or brinjal (*Solanum melongena* L.) is the most popular and widely cultivated vegetable crop in the central and southern Asia and in some African countries. The crop is extremely variable in India. Information generated from the studies of character association will serve as important plant characters that ought to be considered in the selection programmes. Such studies would also help us to know the suitability of multiple characters for indirect selection, because selection for one or more traits result in correlated response in several other traits. The genetic divergence analysis using D^2 statistics seems to be a powerful tool for quantifying the degree of divergence existing in the population, which helps in selecting the suitable parents for hybridization programmes. The present studies were therefore initiated with an objective to determine genetic variability for fruit yield and related attributes and their relationships in diverse brinjal genotypes.

The study was conducted under hot arid agro-climatic conditions of ICAR-Central Institute for Arid Horticulture, Bikaner situated at 28° north latitude and 73°18' E longitude at an altitude of 235 m msl. The agro-climate of location of study is characterized by low and erratic rainfall (150-350 mm), extremes of temperatures (-4°C), high solar radiation, high wind spread (12-16 km/h) with several dusty days and also prolonged summer duration. Besides, the soil is sandy and having poor fertility and water holding capacity.

Twenty germplasm were assessed in randomized block design during July, 2014 and 2015. Row to Row distance was kept 75 cm and plant to plant 60 cm along with three replications. The observations were recorded on five plants selected per replication for each genotype on nine quantitative characters. The recorded characters were plant height (cm), No. of primary branches, leaf length, leaf width, fruit length, fruit width, No. of fruits/ plant, fruit weight, average fruit yield/plant. The data were compiled and analyzed adopting standard statistical procedures using computer based SPAR-II (IASRI, New Delhi) package.

Substantial variability as evidenced from Range, PCV, GCV was noted for morphological and yield traits (Table 1). PCV was higher than GCV respectively. GCV for all the nine traits under study showed that contribution towards final phenotypic characters was slightly diluted by environmental factor acting on the genetic makeup of the accessions under study. PCV and GCV of higher order was observed for average fruit yield per plant, fruit weight, No. of fruits per plant, fruit length and fruit width. The results are in conformity with the findings of Baswana *et al.* (1), Kushwah and Bandhyopandhya (3) and Mili *et al.* (5). The lowest PCV and GCV was observed for leaf length, which depicts that the character concerned may hardly be improved and needs combination approach. High heritability and high genetic advance was observed in traits like average fruit yield per plant and fruit weight which implies additive genetic

Table 1. Genetic parameters of variability for different traits in brinjal.

Character	Grand mean	Range	PCV	GCV	h ² %	GA %	GA as % of mean
Plant height	33.63	25.15-46.60	15.33	14.99	95.67	10.16	30.21
No. of primary br.	6.21	3.62-8.78	21.81	21.48	96.96	2.71	43.56
Leaf length	6.91	5.67-8.50	11.90	11.60	95.05	1.61	23.31
Leaf width	4.15	3.51-5.30	14.52	13.71	89.23	1.11	26.68
Fruit length	16.66	11.75-25.43	24.99	24.72	97.82	8.39	50.37
Fruit width	5.80	3.87-9.27	24.58	24.20	96.94	2.95	49.08
No. of fruits/ plant	8.99	5.47-14.00	36.03	35.84	98.95	5.60	73.44
Fruit weight	120.75	61.13-200.92	43.78	43.76	99.87	108.77	90.08
Avg. fruit yield/ plant	1104.96	377.67-2455.00	59.92	59.77	99.50	1357.11	122.82

variance. However, genetic traits like No. of primary branches, fruit length, fruit width, No. of fruits per plant as well as plant height showed high genetic advance as per cent of mean. This reflects the selection for these traits in advance generation may be fruitful.

Correlation studies among morphological and yield related traits revealed that average fruit yield was having positive and significant correlation with fruit width, No. of fruits per plant and average fruit yield per plant at phenotypic as well as genotypic level (Table 2). However, fruits per plants showed negative and significant correlation with leaf length at phenotypic and genotypic level. Fruit width was also found to have a positive and significant correlation with fruit length. Enhanced selection of this trait is more reliable in maximizing the yield potential of the brinjal genotypes. Similar findings with high EGA were reported for the character by Mishra and Mishra (6), Lohakhare *et al.* (4) and Prabhu and Natrajan (7). The path coefficient analysis revealed that the total fruit yield per plant was positively dependent on characters

like fruit weight, No. of fruits per plant, leaf width and plant height (Table 3). Negative effects were exhibited by leaf length, No. of primary branches, fruit width and fruit length. Selection of characters having higher positive and direct effect on total fruit yield per plant will be more reliable.

The brinjal genotypes were grouped under five clusters with highest number of genotypes being eight in cluster IV followed by six genotypes in cluster II, rest of the cluster having only two genotypes (Table 4). Twenty accessions grouped under five clusters itself speak of the high level of variability existing among the genotypes. This indicates that forces such as genetic drift, natural and artificial selection and exchange of genetic material might have played an important role in the diversity of brinjal germplasm. According to Falconer (2), larger the divergence between the accessions, higher will be the heterosis. Therefore, it would be desirable to attempt crosses between genotypes belonging to distant clusters for getting highly heterotic crosses. Inter-cluster D² values ranged from 10.429 to 47.764 (Tables 5 & 6). Whereas, intra-cluster was found to

Table 2. Phenotypic correlation coefficients among different traits under study in brinjal.

Trait	Plant height	No. of pr. branch	Leaf length	Leaf width	Fruit length	Fruit width	No. of fruits/ plant	Fruit weight	Avg. fruit yield/ plant
Plant height		0.309	0.276	-0.045	0.124	-0.067	-0.195	0.079	-0.060
No. of primary branch			0.030	0.167	-0.125	-0.387	-0.298	-0.110	-0.271
Leaf length				0.352	0.133	-0.207	-0.452*	0.083	-0.306
Leaf width					0.386	0.115	0.081	-0.015	-0.051
Fruit length						0.406	0.249	0.387	0.407
Fruit width							0.126	0.495*	0.481*
No. of fruits/ plant								0.177	0.689**
Fruit weight									0.792**
Avg. fruit yield/ plant									

* and ** are significant at 5 and 1% levels of significance, respectively.

Table 3. Path coefficient values of the traits under study in brinjal (dependent variable- total fresh yield per plant).

Trait	Plant height	No. of primary br.	Leaf length	Leaf width	Fruit length	Fruit width	No. of fruits/plant	Fruit weight
Plant height	0.07422	-0.03285	-0.06429	-0.00532	-0.00235	0.00164	-0.09121	0.05910
No. of primary br.	0.02395	-0.10182	-0.00695	0.01766	0.00271	0.00904	-0.13678	-0.08412
Leaf length	0.02182	-0.00324	-0.21865	0.03578	-0.00262	0.00506	-0.21316	0.06085
Leaf width	-0.00391	-0.01780	-0.07747	0.10099	-0.00791	-0.00258	-0.03560	-0.01281
Fruit length	0.0893	0.01414	-0.02940	0.04093	-0.01952	-0.00950	0.11946	0.28662
Fruit width	-0.00535	0.04056	0.04869	0.01149	-0.00816	-0.02271	0.05838	0.36869
No. of fruits/plant	-0.01477	0.03038	0.10168	-0.00784	-0.00509	-0.00289	0.45836	0.13141
Fruit weight	0.00597	0.01166	-0.01812	-0.00176	-0.00762	-0.01140	0.08202	0.73439

Residual effect = 0.1785336; direct effects on main diagonal.

Table 4. Grouping of brinjal genotypes under study in clusters.

Cluster	No. of genotypes	Name of genotype(s)
I	2	Brinjal-6-12, Brinjal-6-17
II	6	Brinjal-1-2, Brinjal-6-9, Brinjal-6-10, Brinjal-6-18, Brinjal-6-9-3, Brinjal-6-9-5
III	2	Brinjal-6-9-2, Brinjal-6-9-4
IV	8	Brinjal-6-22, Brinjal-6-19, Brinjal-6-19-A, Brinjal-6-9-1, Brinjal-6-9-6, Brinjal-6-9-7, Brinjal-6-11-1-3, Brinjal-6-13-1-3
V	2	Brinjal-6-13-1, Brinjal-6-15-1

Table 5. Average inter- and intra-clusters distances among five clusters in 20 brinjal genotypes.

Cluster	I	II	III	IV	V
I	10.429	81.571	91.464	56.247	40.084
II		44.841	34.536	57.414	95.452
III			14.673	62.356	106.219
IV				47.764	64.660
V					33.561

be highest in cluster IV (47.764) followed by cluster V (33.561). Inter-cluster distances showed that cluster V recorded maximum divergence from cluster III (106.21) followed by cluster II (95.452). Besides, cluster II also showed a good level of divergence from cluster I (91.464). The maximum intra- and inter-cluster distance indicating the wider genetic diversity and this might be due to limited gene exchange or selection practices among the genotypes for diverse characters. Intra-cluster was found to be highest in

Table 6. Cluster mean of the traits under study towards divergence in brinjal genotypes.

Trait	Cluster				
	I	II	III	IV	V
Plant height	34.933	34.358	34.425	32.599	33.488
No. of primary branch	5.618	6.312	6.518	6.768	3.978
Leaf length	8.175	7.066	7.260	6.693	5.727
Leaf width	3.753	4.040	4.598	4.359	3.570
Fruit length	14.908	15.750	12.000	18.962	16.562
Fruit width	5.800	5.344	4.575	5.844	8.237
No. of fruits/ plant	6.117	7.458	8.608	9.994	12.850
Fruit weight	193.508	83.079	61.667	130.527	181.00
Avg. fruit yield/ plant	1188.540	624.322	522.733	1290.078	2305.00

cluster IV (47.764) followed by cluster V (33.561).

The cluster wise mean value (Table 6) revealed substantially high differences in cluster means for traits like average fruit yield per plant, fruit weight, fruit length and No. of fruits per plant. Cluster V was having the highest mean value for average fruit yield per plant (2305.00), No. of fruits per plant and fruit width. Cluster IV was having the highest mean value fruit length and No. of primary branches. Cluster III was having the highest mean value for leaf width only.

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