Original Research Article

Genetic Diversity in Brinjal (*Solanum melongena* L.)

ABSTRACT

Genetic divergence among 25 brinjal genotypes for 13 characters was evaluated in a breeding programme aimed at improving yield potential by using Mahalanobis D^2 statistics. The genotypes were grouped into six clusters suggesting considerable amount of genetic diversity in the study material. The cluster I had constituted maximum of 17 genotypes followed by cluster II which had three genotypes and cluster IV with two genotypes. The cluster III, cluster V and cluster VI each had one genotype. The intra-cluster D^2 value ranged from 0.00 to 61.67 and the inter-cluster D^2 value ranged from 89.49 to 343.51. The maximum intra-cluster distance of 61.67 was exhibited by the cluster I followed by cluster IV and cluster III, V, VI~~-~~. The inter cluster distance was found to be high between cluster II and IV followed by cluster IV and V, cluster II and VI and cluster II and V. The contribution of different characters towards divergence indicated that, fruit yield per plant ~~$^{-1}$~~ contributed the maximum percentage of 79.00 towards genetic divergence followed by individual fruit weight (8.00 per~~-~~cent) and number of fruits per cluster~~$^{-1}$~~ (3.00 per~~-~~cent). Thus, it indicated that the genotypes from cluster IV (fruit yield per plant~~$^{-1}$~~), cluster VI (individual fruit weight) and cluster IV (number of fruits cluster^{-1}) could be selected for crop improvement in brinjal as they recorded higher cluster mean values for traits contributing maximum towards genetic divergence.

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Keywords: Brinjal, Clusters, Diversity, Genetic divergence, Intra and Inter cluster distance

INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the most popular vegetable crops grown in tropics and subtropics among solanaceous vegetables due to its high productivity and round the year availability. According to Zeven and Zhukovsky (1975), it originated from India. India is the ~~centre~~center of variation for brinjal and is recommended even for patients with diabetes, asthma, cholera and bronchitis (Medina *et al.,* 2014).

Knowledge on genetic divergence among the genotypes is very essential to a plant breeder for an efficient choice of parents in a crossing ~~programme~~program to obtain high yielding progenies in crop improvement. Crossing involving parents selected on the basis of genetic divergence may produce transgressive segregates. Mahalanobis D^2 statistics permits precise comparison among all possible pairs of population and effecting actual crosses. Hence, it has been shown to be very useful in selecting parents for hybridization to meet the objective of the breeder. The present study was conducted to generate information on genetic diversity present in 25 brinjal genotypes in coastal region of Karaikal so as to help the breeder in selecting promising and genetically diverse parents for hybridization.

MATERIALS AND METHODS

~~Twenty five~~Twenty-five brinjal genotypes, collected from different sources, were evaluated in the College orchard, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, India during Rabi-Summer in 2021 which is situated at 10^{0}49’ and 11^{0}01’N latitude and 78^{0}43’ and 79^{0}52’E longitude with an altitude of four meters from mean sea level. The field experiment was laid out in a randomized block design (RBD) with two replications. One month old seedlings from the polybags were transplanted on the sides of ridges adopting a spacing of 75 cm x 60 cm. Fertilizer at the rate of 100:50:30 kg N:P$_2$0$_5$:K$_2$O hectare^{-1}, of which full dose of P and K in the form of single super phosphate and murate of potash and 50 per cent N in the form of Urea were applied as basal dose. The observations were recorded on days to first flowering, days to 50 per cent flowering, plant height (cm), number of primary branches plant^{-1}, number of flowers cluster^{-1}, number of clusters plant^{-1}, number of fruits cluster^{-1}, fruit length (cm), fruit girth (cm), number of fruits plant^{-1}, individual fruit weight (g), days to first harvest and fruit yield plant^{-1} (kg). The D^2 analysis suggested by Mahalanobis (1936) was used for estimating the divergence among the 25 genotypes. Based on degree of divergence (D^2 values) between any two genotypes, grouping of genotypes was done by using Tocher’s method (Rao, 1952). Ranking was done as per the method outlined by Singh and Chaudhary (1977). The relative contribution towards genetic divergence was worked out by using TNAU stat software.

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RESULTS AND DISCUSSION

The clustering pattern of the genotypes revealed the presence of genetic diversity among the 25 brinjal genotypes by grouping them into six clusters (Table 1). Among the six clusters, cluster I had constituted maximum of 17 genotypes out of 25 genotypes assembled from different geographical locations. Seventeen genotypes were grouped in single cluster (cluster I) which showed that they are genetically related or similar in their performance.

Table 1. Clustering pattern of brinjal genotypes through Mahalanobis D^2 analysis

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Cluster number	Number of genotypes	Genotypes
I	17	CVK (Covai Vari Kathiri), Purple Round, PLR 2, Sevanthampatti Local, Kalanjpatti Kathiri, Paramathy Local, IC 089875, Udumalai Samba, Gulabi, Bhavani Gold, Pusa Kranti, Manjari Gota, Pusa Purple Long, Pusa Uttam, Thenilai Local, Pusa Purple Round, Pusa Shyamala
II	3	IC 136349, IC 135251, Madanthai Local
III	1	Pusa Hara Baingan 1
IV	2	BR 112, Poiyur Local
V	1	IC 136257
VI	1	Elavambadi Mullu Kathiri

Cluster II had three genotypes, cluster IV with two genotypes. Clusters III, V and VI are mono genotypic which indicated that these clusters contain most diverse genotypes. The clustering pattern revealed that the genotypes did not resolve according to their geographical origin. Singh and Prasad (1991) opined that the geographical distribution need not directly be related to genetic diversity as estimated by D^2 statistics. Similar findings were reported by Parmanick *et al.* (1992), Tambe *et al.* (1992) and Yadav *et al.* (1996).

Average intra and inter cluster D^2 values are given in Table 2. The lowest intra cluster distance of 0.00 was recorded by cluster III, V and VI which shows the existence of closer relation between the genotypes in these clusters, while the highest intra cluster distance of 61.67 was exhibited by the cluster I and it was followed by cluster IV with a distance of 48.56 which indicated that the genotypes in these clusters are more diverse.

The inter cluster distance was found to be high between cluster II and IV (343.51) followed by cluster IV and V (301.28), cluster II and VI (301.05) indicating greater divergence and cluster II and V (89.49) recorded the least inter cluster distance revealing the closer relationship among the genotypes in the clusters. The genotypes belonging to the clusters with maximum inter cluster distance show high genetic diversity and crossing of genotypes from these genetically divergent clusters produces transgressive segregants in advanced generations and hence it would be useful in hybridization programmes. Similar reports were proposed by Reddy (2013).

Table 2. Mean intra cluster (diagonal) and inter cluster D^2 and D values

Clusters	I	II	III	IV	V	VI
I	**3803.46** **(61.67)**	13729.32 (117.17)	10140.20 (100.69)	59036.20 (242.97)	8627.88 (92.88)	41239.14 (203.07)
II		**1721.01** **(41.48)**	38781.72 (196.93)	117999.53 (343.51)	8009.591 (89.49)	90634.96 (301.05)
III			**0.00** **(0.00)**	24196.14 (155.55)	26642.34 (163.22)	13230.41 (115.02)
IV				**2358.88** **(48.56)**	90772.87 (301.28)	9779.66 (98.89)
V					**0.00** **(0.00)**	73113.58 (270.39)
VI						**0.00** **(0.00)**

Table 3. Cluster mean for biometric characters of brinjal genotypes

S. No.	Characters	Clusters					
		I	II	III	IV	V	VI
1	Days to first flowering	40.02	41.96	38.40	39.10	**38.10**	**43.00**
2	Days to 50 per cent flowering	46.41	**52.33**	**45.00**	44.75	47.50	49.50
3	Plant height (cm)	52.22	65.61	55.50	**67.74**	40.78	**40.27**
4	Number of primary branches plant^{-1}	6.63	5.23	**5.00**	**10.70**	10.25	6.50
5	Number of flowers cluster^{-1}	2.64	2.81	2.33	2.33	**3.10**	**2.31**
6	Number of clusters plant^{-1}	5.08	7.50	5.00	3.05	**8.70**	**2.60**
7	Number of fruits cluster^{-1}	1.86	**1.49**	2.37	**2.71**	2.32	2.50
8	Fruit length (cm)	9.53	9.97	9.41	**10.12**	**5.83**	9.16
9	Fruit girth (cm)	15.83	**10.05**	16.96	21.27	10.55	**24.13**
10	Number of fruits plant^{-1}	16.46	**10.06**	16.30	24.85	**31.60**	17.00
11	Individual fruit weight (g)	61.60	36.59	88.78	99.98	**29.87**	**148.17**
12	Days to first harvest	61.65	62.10	**50.20**	58.45	60.40	**63.30**
13	Fruit yield plant^{-1} (kg)	0.83	**0.46**	1.14	**1.69**	0.68	1.46

The cluster mean values for all 13 characters of 25 brinjal genotypes is presented in Table 3. Almost all the six clusters exhibited distinct mean values for all the characters studied. The cluster mean values serve to select the parents for recombination breeding. Cluster II recorded the lowest mean performance for number of fruits cluster^{-1} (1.49), fruit girth (10.05), number of fruits plant^{-1} (10.06), yield plant^{-1} (0.46) and the highest mean performance for days to 50 per cent flowering (52.33). Cluster III recorded the lowest mean performance for days to 50 per cent flowering (45.00), number of primary branches plant^{-1} (5.00) and days to first harvest (50.20). The cluster IV recorded the highest mean performance for plant height (67.74), number of primary branches plant^{-1} (10.70), number of fruits cluster^{-1} (2.71), fruit length (10.12) and yield plant^{-1} (1.69). Cluster V recorded the highest mean performance for number of flowers cluster^{-1} (3.10), number of clusters plant^{-1} (8.70) and number of fruits plant^{-1} (31.60). The traits days to first flowering (38.10), fruit length (5.83) and individual fruit weight (29.87) were found to be the minimum in cluster V. The cluster VI exerted lowest mean values for plant height (40.27), number of flowers cluster^{-1} (2.31) and number of clusters plant^{-1} (2.60), whereas it had shown the maximum mean performance for days to first flowering (43.00), fruit girth (24.13), individual fruit weight (148.17) and days to first harvest (63.30).

Noteworthy is that cluster IV recorded the highest mean performance for most characters *viz.,* plant height, number of primary branches plant^{-1}, number of fruits cluster^{-1}, fruit length and yield plant^{-1} whereas, mean performance for days to first flowering, fruit girth, individual fruit weight and days to first harvest were found to be maximum in cluster VI. The cluster mean for fruit yield plant^{-1} was maximum in cluster IV followed by cluster VI. Selection of genotypes from this cluster allows intermating with genotypes in cluster V (maximum cluster mean for number of fruits plant^{-1}) to produce superior segregants. The genotypes in cluster III recorded early performance for days to 50 per cent flowering and days to first harvest. Hence, these genotypes would be used for selection for earliness in crop improvement programme.

The contribution of different characters towards divergence indicated that the trait, yield plant^{-1} contributed the maximum percentage of 79.00 towards genetic divergence followed by individual fruit weight (8.00 per cent) and number of fruits cluster^{-1} (3.00 per cent). The importance of individual fruit weight in genetic divergence of brinjal had been observed by Bhushan *et al*. (2018). The relative contribution of number of primary branches plant^{-1} and number of flowers cluster^{-1} for divergence among the genotypes were found nil.

Thus, it indicated that the genotypes from cluster IV (fruit yield plant^{-1}), cluster VI (individual fruit weight) and cluster IV (number of fruits cluster^{-1}) could be selected for crop improvement in brinjal as they recorded higher cluster mean values for traits contributing maximum towards genetic divergence.

CONCLUSION

The contribution of different characters towards divergence indicated that, fruit yield plant-1 contributed the maximum percentage of 79.00 towards genetic divergence followed by individual fruit weight (8.00 per cent) and number of fruits cluster-1 (3.00 per cent). Thus, it indicated that the genotypes from cluster IV (fruit yield plant-1), cluster VI (individual fruit weight) and cluster IV (number of fruits cluster-1) could be selected for crop improvement in brinjal as they recorded higher cluster mean values for traits contributing maximum towards genetic divergence.

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