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# Genetic Divergence Studies in Brinjal (*Solanum melongena* L.). Genotypes

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**A B S T R A C T**

Using the Mahalanobis $D^2$ statistic, the genetic divergence among 32 genotypes of brinjal for 23 characters was examined. On the basis of the relative magnitude of the $D^2$ values, the genotypes were divided into eight clusters. The largest of the eight clusters, cluster I, had 18 genotypes. It was followed by cluster V (five), cluster III (four), and the remaining clusters, which each had a single genotype. The largest intra-cluster distance (8277.51) was in cluster V, which was followed by cluster I (4488.09) and cluster III (3908.52). The remaining clusters had very small intra-cluster distances. The highest inter-cluster $D^2$ value (23195.60) was found between clusters III and VI, while the lowest value (5777.13) was found between clusters IV and VI. In cluster VI, the mean value for almost all of the characteristics was greatest. Maximum genetic divergence was caused by traits including fruit weight, days to first harvest, number of fruits per cluster, and percentage of fruit set in pseudo short-styled flowers.

## Introduction

The most common and popular vegetable crop growing in tropical and subtropical regions is the brinjal (*Solanum melongena* L.). In India, where there is an extensive amount of variation and many landraces have grown in different agro-ecological zones, brinjal originated.

Divergence analysis-based parent selection for a hybridization program may have greater potential Ahmad *et al.,* (2014). High heterotic $F_1$s and a wide range of diversity in the segregating generation have been demonstrated to be more likely to result from more divergent parents (Arunachalam, 1981). Genetic divergence, which is essential in assessing variety and establishing links among cultivated species, enables the development of conservation strategies, the use of genetic resources in breeding programs, and the investigation of agricultural evolution Mishra *et al.,* (2013). Rao (1952) proposed a successful method for measuring genetic divergence based on Mabalanobis $D^2$ technique, which appears to be an appropriate measure of

genetic diversity for brinjal since it shows greater variance in fruit production and its constituent traits. Due to the great degree of heterogeneity in the genotypes, more analysis of genetic divergence needs to be conducted Mehta *et al.,* (2004).

## Materials and Methods

The research work was done at HRS, Venkataramannagudem, Dr. YSRHU to study genetic diversity in 32brinjal genotypes in two replications with RBD design during Rabi 2022-23. In the experiment, 32 genotypes were examined, and they were all obtained from NBPGR Hyderabad. 75 cm x 40 cm inter and intra-row spacing was used for planting. Twelve traits were observed on five randomly chosen plants in each genotype.

According to the procedure described by (Mahalanobis, 1936), the recorded data was examined for genetic divergence. While Rao (1952) described the Tocher's approach for cluster composition of genotypes. Average distances between and within clusters were calculated in accordance with Singh and Chaudhary (1985).

## Results and Discussion

Thirty two different genotypes have been grouped into eight clusters based on $D^2$ values, demonstrating that there is enough genetic diversity to select superior and diversified parents for any brinjal development program. Out of 8 clusters formed, cluster I (IC 089910, IC 90963, IC 99758, IC 11024, IC 089906, IC 89864, IC 90777, IC 127252, IC 11025, IC 111064, IC 90957, IC 90135, IC 99748, IC 89815, IC 90093, IC 111066, IC 256276, IC 90795) was the largest group comprising of 18 genotypes, followed by cluster V comprising of 5 genotypes (IC 90844, IC 260115, IC 99701, IC 90804, IC 135929), cluster III comprising of 4 genotypes (IC 90964, Gulabi, IC 11040, IC 99658), cluster II (IC 90872), cluster IV (IC 90762), cluster VI (IC 90081), cluster VII (IC 446654) and cluster VIII (IC 253953).

There was no connection between genetic and regional diversity as indicated by the clustering pattern. These results are similar with findings of Madhavi *et al.,* (2015); Ahmed *et al.,* (2014); Kumar *et al.,* (2013); Mishra *et al.,* (2013); Rathi *et al.,* (2011) and Mehta and Sahu (2009) in brinjal. The genotypes that originated in one location were distributed into several clusters, suggesting that genotypes with the same geographic origin may have undergone modification for a number of attributes under selection. This may be due to factors that increase diversity rather than genetic distance, such as selection pressure, genetic drift, and introduction.

Cluster V had the highest intra-cluster distance (8277.51), followed by Cluster I (4488.09) and Cluster III (3908.52) indicating genetic divergence among the genotypes of the respective clusters. Inter cluster distance was always higher than intracluster distance. Similar results were reported by Kumar *et al.,* (2007); Dutta *et al.,* (2009) and Islam *et al.,* (2011) in brinjal. Cluster III and VI had the greatest intercluster distance (23195.60), which was followed by cluster III and V (22593.05), indicating greater genetic diversity among the genotypes represented in these groups. Selecting parents for the hybridization program from these various clusters would aid the development of superior recombinants. Similar observations were reported by Mohanty (2001); Babu and Patil (2005); Sherly and Shanthi (2008); Muniappan *et al.,* (2010); Islam *et al.,* (2011) and Lokesh *et al.,* (2013).

The genotype of cluster VI recorded highest mean values for the traits plant height (119.00 cm), number of secondary branches per plant (10.24), per cent fruit set in long styled flowers (85.86 %), per cent fruit set in medium styled flowers (53.16 %), per cent fruit set in short styled flowers (10.95 %), fruit length (18.76 cm), total phenols (58.35mg/100gm). Highest mean for plant spread (129.68 cm), fruit diameter (7.43 cm), fruit weight (207.57 kg), fruit yield per plant (1.32kg) were recorded in genotypes of cluster V.

**Table.1** Cluster classification of thirty two genotypes in brinjal.

| Cluster | No. of genotypes | Genotypes |
|---|---|---|
| **I** | 18 | IC 089910, IC 90963, IC 99758, IC 11024, IC 089906, IC 89864, IC 90777, IC 127252, IC 11025, IC 111064, IC 90957, IC 90135, IC 99748, IC 89815, IC 90093, IC 111066, IC 256276, IC 90795 |
| **II** | 1 | IC 90872 |
| **III** | 4 | IC 90964, Gulabi, IC 11040, IC 99658 |
| **IV** | 1 | IC 90762 |
| **V** | 5 | IC 90844, IC 260115, IC 99701, IC 90804, IC 135929 |
| **VI** | 1 | IC 90081 |
| **VII** | 1 | IC 446654 |
| **VIII** | 1 | IC 253953 |

**Table.2** Percent contribution of different characters towards genetic divergence in thirty two genotypes of brinjal.

| | Source | TimesRanked1$^{st}$ | Contribution (%) |
|---|---|---|---|
| **1** | Plant height(cm) | 14 | 2.82% |
| **2** | Plant spread (cm) | | |
| **3** | No. of primary branches | | |
| **4** | No. of secondary branches | | |
| **5** | Days for first flowering | 6 | 1.21% |
| **6** | Daysfor50 % flowering | | |
| **7** | No. of flower clusters per plant | | |
| **8** | No. of flowers per cluster | 9 | 1.81% |
| **9** | No. of fruits per cluster | 71 | 14.31% |
| **10** | No. of fruits per plant | 14 | 2.82% |
| **11** | Per cent fruit set in long style flowers | | |
| **12** | Per cent fruit set in medium style flowers | 12 | 2.42% |
| **13** | Per cent fruit set in short style flowers | 9 | 1.81% |
| **14** | Per cent fruit set in pseudo short style flowers | 52 | 10.48% |
| **15** | Fruit length(cm) | 19 | 3.83% |
| **16** | Fruit diameter (cm) | 6 | 1.21% |
| **17** | Average fruit weight(g) | 153 | 30.85% |
| **18** | Days to first harvest | 74 | 14.92% |
| **19** | Duration of harvest period | 14 | 2.82% |
| **20** | Fruit yield per plant (kg) | 16 | 3.23% |
| **21** | Ascorbic acid content (mg/100g) | | |
| **22** | Total phenol content (mg/100g) | 2 | 0.40% |
| **23** | Shoot and fruit borer infestation (%) | 25 | 5.04% |

**Table.3** Mean values of clusters for twenty three characters in thirty two brinjal genotypes.

| Cluster | Plant height(cm) | Plant spread(cm) | No. of primary branches | No. of secondary branches | Days to first flowering | Days to 50% flowering | No. of flower clusters per plant | No. of flowers per cluster | No. of fruits per cluster | No. of fruits per plant | Per cent fruit set in Long style flowers | Per cent fruit set in medium style flowers | Per cent fruit set in short style flowers | Per cent fruit set in pseudo short style flowers | Fruit length (cm) | Fruit diameter(cm) | Fruit weight (g) | Days to first harvest | Duration of harvest period | Fruit yield per plant (kg) | Ascorbic acid (mg/100 gm) | Total phenols(mg/100 gm) | Shoot and fruit borer infestation(%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **I** | 109.67 | 121.92 | 2.64 | 6.58 | 45.44 | 48.28 | 15.32 | 3.08 | 1.36 | 6.22 | 64.78 | 35.31 | 8.97 | 1.31 | 10.26 | 4.89 | 96.76 | 68.06 | 92.97 | 0.84 | 6.28 | 45.63 | 19.69 |
| **II** | 72.27 | 118.86 | 2.99 | 7.47 | 37.49 | 40.04 | 18.61 | 3.49 | 1.51 | 7.25 | 55.97 | 39.11 | 10.17 | 1.22 | 15.77 | 4.09 | 135.87 | 67.20 | 85.48 | 1.26 | 5.76 | 49.42 | 21.70 |
| **III** | 102.29 | 108.95 | 2.43 | 7.37 | 41.59 | 44.85 | 17.48 | 4.23 | 3.55 | 9.12 | 71.69 | 47.71 | 10.55 | 1.25 | 11.43 | 3.22 | 84.44 | 66.63 | 96.88 | 1.01 | 6.42 | 44.31 | 16.24 |
| **IV** | 116.98 | 119.11 | 3.33 | 6.19 | 52.69 | 55.29 | 13.94 | 3.29 | 1.11 | 9.81 | 77.69 | 51.85 | 9.89 | 2.74 | 8.88 | 6.01 | 145.13 | 85.77 | 67.36 | 1.19 | 6.14 | 37.44 | 31.80 |
| **V** | 118.48 | 129.68 | 3.00 | 8.82 | 46.97 | 50.63 | 15.03 | 2.33 | 1.06 | 5.06 | 65.51 | 44.65 | 10.29 | 1.33 | 10.43 | 7.43 | 207.57 | 77.94 | 101.71 | 1.32 | 5.79 | 46.00 | 22.70 |
| **VI** | 119.00 | 96.16 | 2.61 | 10.24 | 39.08 | 41.77 | 15.84 | 3.85 | 0.98 | 6.03 | 85.86 | 53.16 | 10.95 | 2.54 | 18.76 | 4.58 | 111.22 | 70.51 | 100.58 | 0.86 | 5.72 | 58.35 | 18.43 |
| **VII** | 114.14 | 106.28 | 2.88 | 6.31 | 56.23 | 60.10 | 20.16 | 3.05 | 1.00 | 3.33 | 71.60 | 30.07 | 8.29 | 0.77 | 10.41 | 7.17 | 175.89 | 87.63 | 95.97 | 0.74 | 6.14 | 50.60 | 42.22 |
| **VIII** | 49.95 | 100.65 | 2.74 | 6.50 | 40.74 | 44.79 | 12.33 | 1.84 | 1.12 | 3.89 | 67.54 | 48.31 | 8.91 | 2.83 | 5.47 | 4.92 | 70.51 | 67.85 | 106.80 | 0.54 | 6.75 | 55.99 | 13.94 |

**Table.4** Average intra and inter-cluster $D^2$ values for eight clusters in thirty two genotypes of brinjal.

| Clusters | I | II | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|
| **I** | 4488.09 | 6978.21 | 10209.63 | 7314.06 | 16733.76 | 9916.71 | 9056.74 | 15109.96 |
| **II** | | 0.00 | 7771.40 | 7067.25 | 8616.80 | 6209.78 | 9954.15 | 12682.22 |
| **III** | | | 3908.52 | 11362.97 | 22593.05 | 12508.72 | 23195.60 | 19466.56 |
| **IV** | | | | 0.00 | 11657.29 | 5777.13 | 12186.36 | 11003.51 |
| **V** | | | | | 8277.51 | 13524.89 | 11231.28 | 16848.93 |
| **VI** | | | | | | 0.00 | 17306.09 | 6838.93 |
| **VII** | | | | | | | 0.00 | 20594.03 |
| **VIII** | | | | | | | | 0.00 |

The genotype of cluster IV recorded highest mean values for the traits number of primary branches per plant (3.33), number of fruits per cluster (3.55), per cent fruit set in pseudoshort styled flowers (2.74 %). Highest mean values for number of flowers per cluster (4.23), number of fruits per cluster (3.55) and minimum days to first harvest (66.63) were recorded in genotypes of cluster III.

The genotype of cluster VIII recorded highest mean values for the traits duration of harvest period (16.80), ascorbic acid content (6.75 mg/100 gm) and minimum shoot and fruit borer infestation percentage (13.94 %).

The genotype of cluster II recorded minimum number of days for days to first flowering (37.49) and days to 50% flowering (40.04). Highest mean value for number of flower clusters per plant (20.16) was recorded in the genotype of cluster VII. These results are in accordance with the findings of Madhavi *et al.*, (2015); Ahmed *et al.*, (2014); Kumar *et al.*, (2013); Mishra *et al.*, (2013); Rathi *et al.*, (2011) and Mehta and Sahu (2009) in brinjal.

Maximum contribution towards genetic divergence includes fruit weight (30.85 %), days to first harvest (14.92 %), number of fruits per cluster (14.31 %), per cent fruit set in pseudo short styled flowers (10.48 %)followed by other characters like shoot and fruit borer infestation (5.04 %), fruit length (3.83 %), fruit yield per plant (3.23 %), number of fruits per plant, duration of harvest period and plant height (2.82 %), per cent fruit set in medium styled flowers (2.42 %), per cent fruit set in short styled flowers (1.81 %), number of flowers per cluster (1.81 %), fruit diameter (1.21 %), days to first flowering (1.21 %), and total phenols (0.40 %).

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