Assessment of Genetic Divergence in Brinjal (Solanum melongena L.) Genotypes

Divya Arti*, A.K. Sharma and Ramesh Kumar

Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP)-173 230, India

*Corresponding author

A B S T R A C T

Genetic divergence among 50 eggplant (Solanum melongena L.) genotypes was estimated using Mahalanobis $D^2$ Statistics. The 50 genotypes were grouped into eight distinct clusters. Among the different clusters, cluster II, V and VIII consisted maximum number of genotypes(9) followed by cluster cluster IV (7) and in cluster I, III, VI and VII each were having 4 genotypes. The intra cluster distance was maximum in cluster VII (164.49) and minimum in cluster V, VI and VIII (0.00). However, maximum inter cluster distance was recorded between cluster VII and VIII (536.13) indicated wide diversity between these two clusters, while lowest (59.63) was observed between cluster IV and V. The highest contribution in manifestation of genetic divergence was exhibited by ascorbic acid content (18.53 %), number of marketable fruits per plant (17.88 %), plant height (14.12 %), total soluble solids (12.65 %) and number of branches per plant (11.27 %). Cluster VIII had highest mean values for plant height, number of branches per plant, fruit breadth and ascorbic acid content. Cluster I showed higher mean values for earliest flowering and harvesting, total harvest duration, fruit yield per plant. Cluster V had highest mean values for number of marketable fruits per plant and total soluble solids whereas, cluster IV had maximum fruit length and cluster VII had maximum fruit weight. Considering the genetic divergence, clustering pattern and mean performance of genotypes for fruit yield and contributing characters 13 genotypes comprising UHF BRL-3, IC-074224-1, DB-144, DB-181, PBHL-4, Punjab Barsati, PBH-3, UHF BRL-2, DB-143, DBL-139, DB-110, DB-30 and DB-109 may be considered as elite genotypes and hybridization involving these genotypes are likely to give desirable segregants for yield and its components characters.

Keywords
- Divergence
- Mahalanobis $D^2$
- Cluster analysis
- Hybridization

Article Info
- Accepted: 18 August 2018
- Available Online: 10 September 2018

Introduction

Brinjal or eggplant (Solanum melongena L.) a member of solanaceae family, is one of the most important vegetable crops grown in India. In India, it is cultivated over an area of 733 thousand hectares with production of 12510 metric tonnes and productivity of 17.07 t/ha (Anonymous, 2017). West Bengal, Orissa, Andhra Pradesh, Gujarat, Bihar are the leading states in the country. In Himachal Pradesh, it is grown in Bilaspur, Chamba, Hamirpur, Kangra, Mandi, Una, Shimla, Solan, and Sirmour districts in an area of 1.21 thousand hectare with a production of 27.71 thousand tonnes and productivity of 22.90 t/ha.
Brinjal is a perennial plant but grown commercially as an annual crop. A number of cultivars are grown in India but consumer’s preference depends upon fruit colour, size and shape. Prolonged warm growing season with a mean temperature of 20-30 °C is most favourable for its successful production. Many of the round varieties set fruits at slightly lower temperature but are highly susceptible to frost whereas, the long fruited varieties set fruit at higher temperature and show tolerance to frost. In view of above climatic adaptation, it can be successfully grown both in rainy and summer seasons.

Hybridization between genetically divergent parents may result in heterotic and/or transgressive recombinants. More diverse the parents within a reasonable range, better are the chances of improving economic characters under consideration in the offspring. Mahalanobis $D^2$ statistic of multivariate analysis is recognized as a powerful tool in quantifying the degree of genetic divergence among the population. The use of Mahalanobis $D^2$ studied for their (cluster), mean performance, intra and inter cluster distance and contribution towards divergence. Based on the mean performance, genetic distance, clustering pattern and per cent contribution, inter-varietal crosses can be made, which may be advantageous in creating wider variability for better transgressive segregants as well as heterotic hybrids in brinjal.

**Results and Discussion**

The 50 genotypes taken for genetic divergence analysis and clustered for 12 quantitative characters into different group based on Mahalanobis $D^2$ statistics. On the basis of $D^2$ values, the 50 genotypes were cluster into eight clusters, presented in Table 1. Among the different clusters, cluster II, V and VIII (9) followed by cluster IV (7) and in cluster I, III, VI and VII each were having 4 genotypes. Das and Das (2017) studied the genetic divergence in brinjal and grouped 26 genotypes into 11 clusters and also reported maximum and minimum inter and intra cluster distances. A perusal of Table 2 shows that the highest intra-cluster distance was recorded for cluster VII (164.49) while, minimum in cluster V, VI and VIII (0.00). The maximum inter cluster distance was recorded between cluster VII and VIII (536.13) and lowest (59.63) was observed between cluster IV and V. Similar types of results were obtained by Das and Das (2017).

Further, for getting the reliable conformity on the basis of cluster means, it was calculated for various horticultural traits and has been presented in Table 3. Cluster VIII had highest mean values for plant height, number of branches per plant, fruit breadth and ascorbic acid content and lowest for number of marketable fruits per plant. Cluster I showed higher mean values for earliest flowering and harvesting, total harvest duration, fruit yield per plant.
**Table 1** Clustering pattern of fifty genotypes of brinjal on the basis of genetic divergence

| Cluster | Number of genotypes | Name of genotypes                                                                 |
|---------|---------------------|------------------------------------------------------------------------------------|
| I       | 4                   | Arka Nidhi, Arka Neelkanth, Pant Samrat, Swarn Anubhav                             |
| II      | 9                   | Punjab Sadabahar, Arka Keshav, Arka Shirish, Arka Kusumakar, PPL, PB-4, PB-6, BARI, PPC |
| III     | 4                   | H-295-3, UHF BRL-4, UHF BRL-5, DBR-134                                             |
| IV      | 7                   | UHF BRL-1, BH-2, BR-322-2, BR-16, PBHR-41, PBHR-42, Pusa Kranti                   |
| V       | 9                   | SR-303, SR-333, SR-312, SR-301, SR-305, SR-321, BR-123, BR-101, Punjab Nagina     |
| VI      | 4                   | DBR-128, UHF BRL-6, UHF BRL-7, UHF BRL-8                                           |
| VII     | 4                   | UHF BRL-3, IC-074224-1, DB-144, DB-181                                              |
| VIII    | 9                   | PBHL-4, Punjab Barsati, PBH-3, UHF BRL-2, DB-143, DBL-139, DB-110, DB-30, DB-109   |

**Table 2** Intra (diagonal) and inter cluster (\(\sqrt{D^2}\)) values among fifty genotypes of brinjal

|     | I     | II    | III   | IV    | V     | VI    | VII   | VIII  |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|
| I   | 32.88 | 152.41| 106.12| 180.01| 59.63 | 238.45| 267.42| 422.38|
| II  | 53.85 |       | 140.78| 118.36| 103.24| 104.22| 243.83| 464.61|
| III | 77.44 | 157.04| 114.74|       | 116.58| 180.00| 330.43|       |
| IV  |       | 110.52| 167.17| 171.85|       | 245.67| 433.92|       |
| V   | 0.00  |       | 0.00  |       | 0.00  |       | 536.13|       |
| VI  |       | 164.49|       |       |       |       | 337.99|       |
| VII |       |       |       |       |       |       | 237.40|       |
| VIII|       |       |       |       |       |       | 0.00  |       |

**Table 3** Intra cluster group means for various components of fruit yield in brinjal

| S. No. | Characters                               | I         | II        | III       | IV        | V         | VI        | VII       | VIII       |
|--------|------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| 1      | Plant height (cm)                        | 70.85     | 101.90    | 84.60     | 82.91     | 75.77     | 115.53    | 109.35    | 129.77     |
| 2      | Number of branches per plant             | 4.65      | 4.03      | 5.02      | 5.25      | 4.01      | 4.36      | 6.83      | 11.56      |
| 3      | Days to 50 per cent flowering            | 34.02     | 42.05     | 38.06     | 39.72     | 35.00     | 44.67     | 49.84     | 46.00      |
| 4      | Days to first harvest                    | 59.73     | 78.50     | 74.09     | 69.12     | 73.83     | 92.50     | 75.48     | 94.50      |
| 5      | Total harvest duration                   | 106.47    | 87.43     | 92.60     | 85.13     | 100.33    | 76.50     | 85.78     | 103.50     |
| 6      | Fruit length (cm)                        | 7.17      | 11.96     | 8.14      | 15.21     | 6.28      | 8.44      | 12.06     | 7.73       |
| 7      | Fruit breadth (cm)                       | 5.04      | 2.89      | 5.24      | 3.08      | 4.64      | 3.24      | 5.19      | 5.34       |
| 8      | Fruit weight (g)                         | 71.02     | 47.39     | 94.16     | 67.62     | 63.19     | 42.89     | 123.40    | 85.33      |
| 9      | Number of marketable fruits per plant    | 22.24     | 20.86     | 8.98      | 14.50     | 25.00     | 2.85      | 5.98      | 2.65       |
| 10     | Marketable fruit yield per plant (kg)    | 0.89      | 0.59      | 0.50      | 0.62      | 0.80      | 0.18      | 0.59      | 0.19       |
| 11     | Total soluble solids (°Brix)             | 3.82      | 4.32      | 4.18      | 4.44      | 5.30      | 3.89      | 3.70      | 3.54       |
| 12     | Ascorbic acid content (mg/100g)          | 15.55     | 10.39     | 12.40     | 12.73     | 13.66     | 7.97      | 11.48     | 16.45      |
Table 4 Contribution of different plant growth and fruit yield characters to Total divergence in brinjal

| SN | Characters                        | Number of times appearing first in ranking | Percent contribution |
|----|----------------------------------|------------------------------------------|----------------------|
| 1. | Plant height (cm)                | 173                                      | 14.12                |
| 2. | Number of branches per plant     | 138                                      | 11.27                |
| 3. | Days to 50 per cent flowering    | 5                                       | 0.41                 |
| 4. | Days to first harvest            | 9                                       | 0.73                 |
| 5. | Total harvest duration           | 52                                      | 4.24                 |
| 6. | Fruit length (cm)                | 89                                       | 7.27                 |
| 7. | Fruit breadth (cm)               | 117                                      | 9.55                 |
| 8. | Fruit weight (g)                 | 33                                       | 2.69                 |
| 9. | Number of marketable fruits per plant | 219                                      | 17.88                |
| 10.| Marketable fruit yield per plant (kg) | 8                                       | 0.65                 |
| 11.| Total soluble solids (°Brix)     | 155                                      | 12.65                |
| 12.| Ascorbic acid content (mg/100g)  | 227                                      | 18.53                |

Cluster V had highest mean values for number of marketable fruits per plant and total soluble solids whereas, cluster IV had maximum fruit length and cluster VII had maximum fruit weight. Variable cluster mean for different plant growth and fruit yield characters have also been reported by Singh et al., (2006), Golani et al., (2007), Quamruzzaman et al., (2009), Muniappan et al., (2010), Shekar et al., (2012), Begum et al., (2013), Rahman et al., (2014), Vidhya and Kumar (2014), Ullah et al., (2014), Uddin et al., (2014), Rekha and Celine (2015), Madhavi et al., (2015), Prabakaran et al., (2015), Sadarunnisa et al., (2015), Gupta et al., (2015), Karim et al., (2016), Kumar et al., (2016), Das and Das (2017), Gupta et al., (2017) and Nand et al., (2018).

High inter cluster distance was recorded between cluster VII and VIII (536.13) indicated wide diversity between these two clusters and considered as elite genotypes and hybridization involving these genotypes are likely to give desirable segregants for yield and its components characters. In the present investigation the highest contribution in manifestation of genetic divergence was exhibited by ascorbic acid content, number of marketable fruits per plant, plant height, total soluble solids, number of branches per plant, fruit breadth, fruit length, total harvest duration, fruit weight whereas, days to first harvest, marketable fruit yield per plant and days to 50 per cent flowering showed lowest percentage contribution towards genetic divergence presented in Table 4. Such contribution towards the genetic divergence has been also reported by Madhavi et al., (2015) and Das and Das (2017). The characters contribution maximum to the divergence are given greater emphasis for deciding on the clusters for the purpose of further selection and choice of parents for hybridization.

References

Anonymous. 2016. Horticultural Statistics at a glance 2016. Oxford university press. pp. 13-197.
Anonymous. 2017. National Horticulture Board Database. www.nhb.gov.in
Begum F, Islam AKMA, Rasul MG, Mian MAK and Hossain MM. 2013. Morphological diversity of eggplant (*Solanum melongena* L.) in Bangladesh. *Emirates Journal of Food and Agriculture* 25: 45-51.

Das and Das. 2017. Assessment of genetic diversity for brinjal in Terai Zone of West Bengal, India. *International Journal of Current Microbiology and Applied Science* 6: 2401-2406.

Das and Das. 2017. Assessment of genetic diversity for brinjal in Terai Zone of West Bengal, India. *International Journal of Current Microbiology and Applied Science* 6: 2401-2406.

Golani IJ, Mehta DR, Naliyadhara MV, Pandya HM and Purohit VC. 2007. A study on genetic diversity and genetic variability in brinjal. *Agriculture Science Digest* 27: 22-25.

Gupta SK, Yadav GC, Kumar A and Yadav AK. 2015. Genetic divergence in eggplant (*Solanum melongena* L.). *Research Environment Life Sciences* 8: 615-618.

Karim MR, Rahman MM and Quamruzzaman AKM 2016. Genetic divergence in eggplant (*Solanum melongena* L.) genotypes. *Bangladesh Journal of Agricultural Science* 41: 433-439.

Kumar SR, Arumugam T and Ulanganathan V. 2016. Genetic diversity in eggplant germplasm by principal component analysis. *SABRAO Journal of Breeding and Genetics* 48: 162-171.

Madhavi N, Mishra AC, Pushpavathi Y and Kumari VLP. 2015. Genetic diversity in brinjal (*Solanum melongena* L.). *Plant Archives* 15: 1107-1110.

Muniappan S, Saravana K and Ramya B. 2010. Studies on genetic divergence and variability for certain economic characters in eggplant (*Solanum melongena* L.). *Electronic Journal of Plant Breeding* 1: 462-65.

Nand N, Adarsh A, Kumar A, Akhtar S, Kumar R and Ray PK. 2018. Morphological characterization of different genotype of brinjal (*Solanum Melongena* L.). *International Journal of Current Microbiology and Applied Sciences* 7: 2218-2226.

Prabakaran S, Balakrishnan S and Kumar RS. 2015. Evaluation of brinjal germplasm for yield, fruit borer and little leaf incidence. *Environment and Ecology* 33: 500-503.

Quamruzzaman AKM, Rashid MA, Ahmad S and Moniruzzaman M. 2009. Genetic divergence analysis in eggplant (*Solanum melongena* L.). *Bangladesh Journal of Agricultural Research* 34: 705-712.

Rahman MO, Rabbani MG, Yesmin R, Garvey EJ. 2014. Genetic diversity of brinjal (*Solanum melongena* L.) through multivariate analysis. *International Journal of Natural and Social Sciences* 1: 85-93.

Rao R. 1952. *Advanced Statistical Methods in Biometrical Research*. John Wiley and Sons Inc., New York. pp. 357-363.

Rekha GK and Celine VA. 2015. Genetic divergence in round fruited brinjal (*Solanum melongena* L.). *Plant Archives* 15: 919-921.

Sadarunnisa S, Reddy RVSK, Begum H, Reddy TD and Reddy PN. 2015. Genetic divergence in brinjal (*Solanum melongena* L.). *Electronic Journal of Plant Breeding* 6: 331-336.

Shekar K, Ashok P and Sasikala K. 2012. Studies on Heritability and Multivariate Analyses in Brinjal (*Solanum melongena* L.). *Vegetable Crops Research Bulletin* 76: 79-88.

Singh AK, Ahmed N and Narayanan S. 2006. Genetic divergence studies in brinjal under temperate conditions. *Indian Journal of Horticulture* 63: 407-409.
Uddin MS, Rahman MM, Hossain, MM and Mian MAK. 2014. Genetic diversity in eggplant genotypes for heat tolerance. *SAARC Journal of Agriculture* 12: 25-39.

Ullah S, Ijaz U, Iqbal Shah T, Najeebullah M and Niaz S. 2014. Association and genetic assessment in brinjal. *European Journal of Biotechnology and Bioscience* 2:41-45.

Vidhya C and Kumar N. 2014. Genetic divergence in brinjal. *The Ecoscan* 6:197-200.

How to cite this article:

Divya Arti, A. K. Sharma and Ramesh Kumar. 2018. Assessment of Genetic Divergence in Brinjal (*Solanum melongena* L.) Genotypes. *Int.J.Curr.Microbiol.App.Sci.* 7(09): 2567-2572. doi: [https://doi.org/10.20546/ijcmas.2018.709.319](https://doi.org/10.20546/ijcmas.2018.709.319)