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

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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.

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

(Anonymous, 2016). 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 ^{0}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.

Materials and Methods

The experiment was laid out in randomized complete block design with three replications of each genotype at Research Farm of the Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, (HP) during summer-rainy season of 2017. The observation were recorded on plant height, number of branches per plant, days to 50 per cent flowering, days to first harvest, total harvest duration, fruit shape, fruit colour, fruit length, fruit breath fruit weight, number of marketable fruits per plant, marketable fruit yield per plant, per plot and per ha, total soluble solids, ascorbic acid content, incidence of fruit rot, incidence of fruit borer. Genetic diversity was estimated using Mahalanobis D^2 statistics as suggested by Rao, 1952.

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	202.67	321.43	536.13
VI						0.00	171.76	337.99
VII							164.49	237.40
VIII								0.00

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

S. No.	Characters	Cluster Means							
		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.

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