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Estimation of genetic diversity among the genotypes of brinjal (*Solanum melongena* L.)

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Abstract
The research experiment was conducted to study genetic diversity for quantitative traits among genotypes of brinjal (*Solanum lycopersicum* L.). The investigation was conducted during *Rabi*, 2020-21 at the Main Experiment Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology Narendra Nagar, (Kumarganj), Ayodhya (U.P.) using Mahalanobis D^2statistic. The 40 genotypes were grouped into five clusters, indicating the presence of diversity among the genotypes for different traits. The cluster first had the highest number containing 24 genotypes followed by cluster II containing ten genotypes. However, the cluster III, IV and V were containing two genotypes. The maximum intra-cluster distance was recorded within cluster IV (1034.56) and the maximum inter-cluster distance was observed between clusters IV and V (31520.82). Based on cluster mean analysis, the superior and genetically divergent genotypes can be used in crop improvement programme in brinjal.

Keywords: Genetic diversity, *Solanum melongena*, brinjal, cluster

Introduction
Brinjal or egg plant (*Solanum melongena* L.) is one of the most valuable tropical and sub-tropical vegetables grown in India. The name brinjal is popular in Indian subcontinents and is derived from Arabic and Sanskrit, whereas the name eggplant has been derived from the shape of the fruit of some varieties, which are white and resemble in shape to chicken eggs. It is also called aubergine (French word) in Europe. Brinjal or guinea Squash belongs to the family Solanaceae (Nightshades) with diploid chromosome number 2n=2x=24. It is known by different names in different regions of India like bagun (Bengali), ringna (Guajarati), baingan (Hindi). It is popular among people of all social strata and hence, it is rightly called as vegetable of masses.

Considering the importance of this crop, there is a need for improvement and to develop varieties suited to specific agro-ecological conditions and also for specific end use. Study of genetic divergence among the existing genetic stocks provides an opportunity for selecting the diverse parents for hybridization. Such parents are expected to produce superior segregants in combination with others and thus are most valuable for breeders. Moreover, evaluation of genetic diversity is important to know the source of genes for a particular trait within the available germplasm. D^2 technique of Mahalanobis appears to be a fruitful approach which is based on multivariate analysis and serves as a good index for estimating genetic diversity.

Information on genetic divergence among the available genotypes is vital to plant breeder for an efficient choice of parents for hybridization. It is an established fact that genetically diverse parents are likely to contribute desirable segregates. It is noticed that more diverse the parents, greater the chance of obtaining high heterotic F1's and broad spectrum of variability in the segregating generations**.** Hence, this experiment was conducted to study genetic diversity for quantitative traits among genotypes of brinjal (*Solanum lycopersicum* L.).

Material and Methods
The present experiment was carried out during winter season 2020-21, at the Main Experiment Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology (Narendra Nagar), Kumarganj, Ayodhya (U.P.). The experimental materials for the present investigation were comprised of 40 different genotype (39 genotype + 1 check) of brinjal selected on the basis of genetic variability from the germplasm stock maintained in the Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) India.

The experiment was laid out in Randomized Block Design with three replications with three replications. The observations were recorded for days to 50 per cent flowering, days to first fruit harvest, plant height (cm), number of primary branches per plant, fruit length (cm), fruit circumference (cm), average fruit weight (g), number of fruits per plant, marketable fruit yield per plant (kg), total fruit yield per plant (kg). The study of genetic divergence among the 40 genotypes of brinjal was carried out using Mahalanobis (1928) D^2 statistics.

Result and Discussions

The 40 genotypes were grouped into five different non over lapping clusters (Table-1). Cluster I had highest number of genotypes (24) followed by cluster II (10) and cluster II, III, IV and V (2) genotypes. Arti *et al.* (2018) [1], Gurve *et al.* (2019) [3], Mohanty *et al.* (2021) [5] also classified the genotypes into different group.

The estimates of inter and intra-cluster distances represented by D^2 values are given in table-2. The intra cluster D^2 values ranged from 0.00 (cluster V) to 1034.56 (cluster IV) suggesting therefore the minimum and maximum divergence within the genotypes of cluster V and cluster IV, respectively. The maximum inter-cluster distance was observed between clusters IV and V (31520.82) which suggested that members of these two clusters were genetically very diverse to each other. The inter cluster values between cluster III and cluster V (14638.12), cluster II and IV (19289.26)), cluster I and IV (8348.47), cluster II and III (6882.10) and cluster I and II (2858.03) were very high. The minimum inter-cluster D^2 values were recorded between cluster III and cluster IV (3631.27). The higher inter-cluster distance indicated greater genetic divergence between the genotypes of these clusters while lower inter-cluster values between the clusters suggested that the genotypes of the clusters were not much genetically diverse from each other. Sindhuja *et al.* (2019) [8], Dash *et al.* (2020) [2] and Mohanty *et al.* (2021) [5] also found similar result.

The Intra- clusters means for ten characters in brinjal are given in table-3. A perusal of table 3 showed that cluster means for different traits indicated considerable differences between the clusters. Cluster V was found for earliest mean values for days to 50% flowering (53.67 days). Cluster IV showed earliest mean values for the days to first harvesting (55.3), Cluster IV showed maximum mean value for number of primary branches per plant (4.20). Cluster IV showed maximum mean values for the plant height (75.05 cm). Cluster IV exhibited maximum fruit length (22.97 cm). Cluster III showed maximum mean values for the fruit circumference (4.23) and average fruit weight (81.98), Cluster IV showed maximum mean values for the number of fruits per plant (9.86) and cluster IV showed maximum values for total fruit yield per plant (770.36). Cluster II showed minimum mean values for primary branches (3.31) cluster V plant height (54.87). Cluster III fruit length (14.47) and cluster V showed minimum mean values for fruit circumference (3.22 cm) and average fruit weight (60.66) Cluster V showed minimum values for number of fruits per plant (3.13) and marketable fruit yield per plant (71.67) and total fruit yield per plant (102.50). Similar findings were also recorded by; Pandey *et al.* (2019) [7] and Nand *et al.* (2018) [6] for genetic divergence in brinjal.

The analysis of per cent contribution towards total genetic divergence was made between forty genotypes of brinjal had been given in table 4. The maximum contribution in manifestation of total genetic divergence was made by total fruit yield per plant (48.24%) followed by marketable fruit yield per plant (47.11%). The minimum contribution was noticed in case of number of primary branches per plant (0%) and days to first harvesting (0.028%) towards genetic divergence. Similar results were also noticed by Arti *et al.* (2018) [1], Gurve *et al.* (2019) [3] and Dash *et al.* (2020) [2].

Table 1: Clustering pattern of 40 genotypes of brinjal on the basis of Mahalanobis D^2 statistics

Cluster Number	Number of Genotypes	Genotypes
I	24	2020/BRLVAR-8, 2019/BRLVAR-3, 2020/BRLVAR-1, 2018 BRLVAR-6,NDB-129,2020/BRLVAR-6, 2020/BRLVAR-5,2019/BRLVAR-1,2019/BRLVAR-2,NDB-123, NDB-132, 2019/BRLVAR-8,NDB-128,2019/BRLVAR-3,2018/BRLVAR-1,Punjab Sadabahar,NDB-131, 2020/BRLVAR-4, 2019/BRLVAR-9, 2020/BRLVAR-10, NDB-125, 2020/BRLVAR-9,NDB-121
II	10	2020/BRLVAR-12, 2018/BRLVAR-12,2018/BRLVAR-8,2018/BRLVAR-10, 2020/BRLVAR-7, 2019/BRLVAR-7, 2020/BRLVAR-3, 2019/BRLVAR-4, 2019/BRLVAR-5,2020/BRLVAR-11
II	2	NDB-134,2018/BRLVAR-9
IV	2	NDB-122,NDB-127
V	2	2018/BRLVAR-11,NDB-126

Table 2: Average intra and inter clusters D2 values for six clusters in brinjal

Cluster	I	II	II	IV	V
I	528.33	2858.03	1405.05	8348.47	8095.89
II		484.61	6882.10	19289.26	1802.80
II			418.88	3631.27	14638.12
IV				1034.56	31520.82
V					0.00

Table 3: Intra cluster group mean for ten characters in brinjal germplasm

Cluster	Days to 50% Flowering	Days to first harvesting	Number of primary branches	Plant height	Fruit length	Equatorial diameter of fruit (cm)	Average fruit weight (g)	Number of fruits per plant	Marketable fruit yield per plant	Total fruit yield per plant
I	55.90	60.13	3.46	62.21	17.36	3.83	64.66	7.81	374.52	426.27
II	57.52	59.77	3.31	61.38	18.84	3.62	60.66	5.48	195.86	256.02

II	54.17	60.17	3.37	58.93	14.47	4.23	81.98	7.92	476.09	555.56
IV	55.00	55.33	4.20	75.05	22.97	3.36	68.33	9.86	657.98	770.36
V	53.67	62.11	3.67	54.87	18.20	3.22	68.55	3.13	71.67	102.50

Table 4: Per cent contribution of ten characters towards total genetic divergence in brinjal

S. No.	Traits	Percent contribution
1	Days to 50% Flowering	0.086
2	Days to first harvesting	0.028
3	Number of primary branches	0
4	Plant height	0.226
5	Fruit length	0.576
6	Fruit circumference (cm)	0.537
7	Average fruit weight(g)	1.84
8	Number of fruits per plant	1.337
9	Marketable fruit yield per plant	47.113
10	Total fruit yield per plant	48.241

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