Plant Archives Volume 20 No. 2, 2020 pp. 3754-3758 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

GENETIC DIVERSITY IN BRINJAL (*SOLANUM MELONGENA* L.)

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Abstract

Fifty diverse brinjal accessions were evaluated for thirteen biometric observations in the experimental field at Varagoorpettai village near Annamalainagar, Chidambaram during 2018-2020. The accessions were grouped into five clusters on the basis of Mahalanobis D^2 statistics. Cluster I was the largest comprising 32 accessions followed by cluster V which consisted of ten accessions, cluster III and IV had three accessions in each and cluster II possessed two accessions. Cluster IV showed maximum intra cluster distance of 14.51, followed by cluster I (13.05). Cluster II had the least intra cluster distance of 6.17. The maximum inter cluster distance was found between cluster III and IV (17.79), while inter cluster distance was least between cluster II and V (11.46). Cluster III recorded high mean values for yield contributing characters viz., plant height, leaf area, individual fruit weight and fruit yield per plant, while the lowest mean value was observed for days to 50% flowering and days to first harvest. Cluster I also registered high mean values for individual fruit weight, fruit length, fruit diameter and number of fruits per plant, next to cluster III. Individual fruit weight (28.81 percent) contributed maximum towards diversity followed by number fruits per plant (27.42 percent), fruit yield per plant (25.14 percent), seeds per fruit (8.32 percent), leaf area (6. 20 percent) and fruit length (3.18 percent). Thus there lies enormous scope for development of brinjal varieties with specially preferred features.

Key words : Brinjal, Genetic diversity.

Introduction

Brinjal (*Solanum melongena* L.), a member of the Solanaceae family, is one of the popular and principal vegetable crops cultivated in almost all parts of Indian plains for its tender fruits. Except in higher altitudes, this crop is grown all the year round. Tender fruits of brinjal contain protein, minerals, vitamins and iron (Gurbuz *et al.,* 2018). One-hundred-gram edible portion of brinjal fruits possess 5.9 g carbohydrates, 1.4 g protein, 0.3 g fats, 1.3 g fiber, 124 I.U Vitamin A, 11 mg Vitamin C. It also contains minerals like chlorine 52.0 mg, phosphorus 47.0 mg and 44.0 mg sulphur. Fruits are well utilised in Indian System of Medicine. Tender fruit extracts are used in the treatment of skin disease, uterine complaints and is used as a purgative. Brinjal being indigenous to India, variation in plant type, stem color, leaf size, leaf tip, midrib colour, fruit size, fruit shape, fruit colour, fruit yield, cooking quality and tolerance to pest and disease is apparent (Ullah *et al.,* 2014). The main objective is to measure the genetic divergence between and among different accessions and group them as clusters. Studies on the structure of the genetic diversity within ecotypes of a region are of great help to plan plant breeding programs for crop improvement (Rathi *et al.,* 2011).

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Materials and Methods

The experiment was carried out in a farmer's field at Varagoorpettai village near Annamalainagar, Chidambaram during 2018-2020. The experimental field was located at 5.280m altitude over mean sea level, with 11º 24'N latitude and 79º 41'E longitude. The study comprised fifty brinjal accessions (Table 5) raised in two seasons. First was from 05.12.2018 to 21.06.2019 and second was from 12.07.2019 to 26.02.2019. Both experiments were laid out in randomized block design with three replications. Six weeks old healthy seedlings were transplanted along the sides of ridges laid at 60 cm spacing. Plant to plant distance was maintained as 60cm. All the recommended package of practices for raising a healthy crop were followed. Observations were recorded on five randomly selected plants of each accession for thirteen various characters. Thirteen biometric characters viz., plant height, leaf area, days to 50% flowering, number of flowers per cluster, number of fruits per cluster, days to first harvest, individual fruit weight, fruit length, fruit diameter, number of fruits per plant, seeds per fruit, 100

Table 1: Composition of D^2 clusters in brinjal.

Cluster number	No. of accessions	Accessions
I	32	Acc 1, Acc 2, Acc 3, Acc 4, Acc 5, Acc 6, Acc 7, Acc 8, Acc 9, Acc 10, Acc 11, Acc 12, Acc 13, Acc 14, Acc 15, Acc 16, Acc 17, Acc 18, Acc 19, Acc 20, Acc 21, Acc 22, Acc 23, Acc 24, Acc 25 (PLR 2), Acc 26 (Paramathi local), Acc 27 (Namakkal local), Acc 28 (PLR 1), Acc 29 (Kalanjipatti brinjal), Acc 30 (Co 2), Acc 36 (Arka Nidhi), Acc 41 (Arka Harshitha)
II	2	Acc 32 (Thennilai local), Acc 43
III	3	Acc 31 (Annamalai), Acc 39 (Karur local), Acc 42 (Paravai local)
IV	3	Acc 33 (Ujawla fleshy), Acc 47, Acc 49
V	10	Acc 34 (Mallanatham local), Acc 35 (Elavambadi mullu kathiri), Acc 37 (Paramathy Vellore local), Acc 38 (Udumalai samba), Acc 40 (Karnataka brinjal), Acc 44, Acc 45, Acc 46, Acc 48, Acc 50

seed weight and fruit yield per plant. The data on biometric observations recorded from two seasons (Season I and Season II) were subjected to pooled analysis (Kachouli *et al*., 2019). Mahalanobis (1936) D^2 statistic was used for estimating the genetic diversity among the 50 accessions. The D^2 values between the population as estimated from the sample on the basis of 'P' character is,

$$D^2p = \sum_{i=1}^{P}\sum_{j=1}^{P}(\lambda ij)\sqrt{i\sqrt{j}}$$

Where,

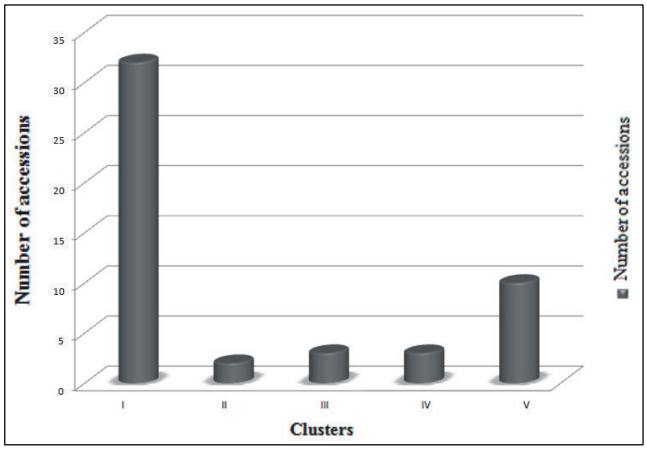

Fig. 1: Composition of D^2 clusters in brinjal.

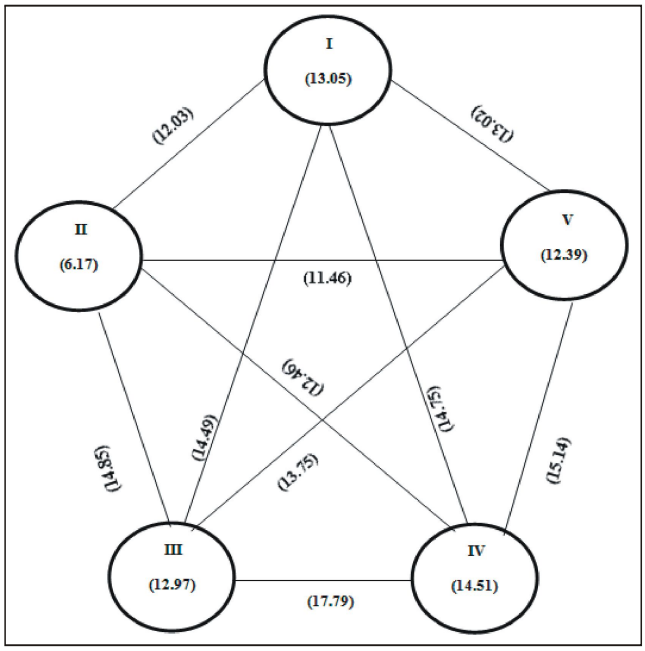

Fig. 2: Inter and intra cluster distance in brinjal.

ij = Reciprocal matrix to the pooled common dispersion obtained from the error maytix.

i = Difference in mean values for the i^{th} character of two populations.

j = Difference in mean values for the j^{th} character of the two populations.

The constellations of groups were formed according to Tocher's method (Rao, 1952). The relative contributions of different characters towards total genetic divergence were also computed.

Results and Discussion

By the application of clustering technique, fifty accessions were grouped into five clusters. The constituents of different clusters are presented in table 1 and fig. 1. Cluster I was the largest comprising 32 accessions followed by cluster V which consisted of ten accessions, cluster III and IV had three accessions in each and cluster II possessed two accessions. Intra and

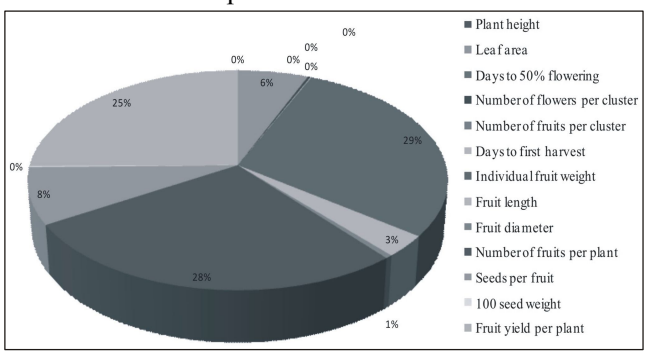

Fig. 3: Relative contribution of different characters to genetic diversity in brinjal.

Table 2: Intra and Inter cluster distance in brinjal.

Cluster	I	II	III	IV	V
I	170.477(13.05)	144.878(12.03)	209.367(14.49)	217.626(14.75)	169.656(13.02)
II		38.096(6.17)	220.707(14.85)	155.391(12.46)	131.405(11.46)
III			168.337(12.97)	316.103(17.79)	189.047(13.75)
IV				210.567(14.51)	229.482(15.14)
V					153.629(12.39)

Table 3: Cluster mean for various biometric characters in brinjal.

Characters	Plant height (cm)	Leaf area (cm^2)	Days to 50% flowering	Number of flowers per cluster	Number of fruits per cluster	Days to first harvest	Individual fruit weight (g)	Fruit length (cm) Per plant	Fruit Diameter (cm)	Number of Fruits	Seeds per fruit	100 Seed weight (g)	Fruit yield per plant (kg)
I	72.46	110.98	65.51	3.14	2.09	73.56	58.31	13.43	4.47	22.14	339.97	0.33	1.24
II	83.90	117.64	67.59	3.12	2.18	74.88	45.84	12.71	4.18	16.78	289.16	0.31	0.75
III	87.63	136.86	63.24	3.84	2.79	72.63	82.99	13.19	5.90	19.06	529.14	0.35	1.59
IV	78.84	91.95	65.20	3.93	2.91	72.80	31.78	10.95	3.60	21.88	180.95	0.30	0.64
V	79.77	116.49	65.52	2.75	1.71	73.56	62.45	14.41	4.20	15.90	361.75	0.32	0.95

inter cluster distance were computed for five clusters and values are presented in table 2 and fig. 2. Intra cluster distance ranged from 6.17 to 14.51. Cluster IV showed maximum intra cluster distance of 14.51, followed by cluster I (13.05) and cluster III (12.97). Cluster II had the least intra cluster distance of 6.17. The maximum inter cluster distance was found between cluster III and IV (17.79), while inter cluster distance was least between cluster II and cluster V (11.46). The cluster means for various characters were worked out and are presented in table 3. Cluster III recorded the highest desirable mean values for majority of the yield contributing traits viz., plant height, leaf area, individual fruit weight and fruit

Table 4: Relative contribution of different characters to genetic diversity in brinjal.

Characters	Number of first rank	Percentage of contribution
Plant height (cm)	0	0.00
Leafarea (cm2)	76	6.20
Days to 50% flowering	0	0.00
Number of flower per cluster	3	0.24
Number of fruits per cluster	0	0.00
Days to first harvest	0	0.08
Individual fruit weight	353	28.81
Fruit length (cm)	39	3.18
Fruit diameter (cm)	6	0.48
Number of fruits per plant	336	27.42
Seeds per fruit	102	8.32
100 seed weight (g)	2	0.16
Fruit yield per plant (kg)	308	25.14
TOTAL	1225	100

Table 5: Salient features of the Accessions.

Accessions	Identity	Source of seeds
Acc 1	IC – 136461	NBPGR, New Delhi
Acc 2	IC – 089876	NBPGR, New Delhi
Acc 3	IC – 136181	NBPGR, New Delhi
Acc 4	IC – 386589	NBPGR, New Delhi
Acc 5	IC – 136300	NBPGR, New Delhi
Acc 6	IC – 136349	NBPGR, New Delhi
Acc 7	IC – 136148	NBPGR, New Delhi
Acc 8	IC – 136249	NBPGR, New Delhi
Acc 9	IC – 136196	NBPGR, New Delhi
Acc10	IC – 136222	NBPGR, New Delhi
Acc 11	IC – 136290	NBPGR, New Delhi
Acc 12	IC – 136006	NBPGR, New Delhi
Acc 13	IC – 136309	NBPGR, New Delhi
Acc 14	IC – 136455	NBPGR, New Delhi
Acc 15	IC – 136266	NBPGR, New Delhi
Acc 16	IC – 136093	NBPGR, New Delhi
Acc 17	IC – 446655	NBPGR, New Delhi
Acc 18	IC – 136268	NBPGR, New Delhi
Acc 19	IC – 111074	NBPGR, New Delhi
Acc 20	IC – 112315	NBPGR, New Delhi
Acc 21	IC – 089875	NBPGR, New Delhi
Acc 22	IC – 136299	NBPGR, New Delhi
Acc 23	IC – 13258	NBPGR, New Delhi
Acc 24	IC – 136182	NBPGR, New Delhi
Acc 25	PLR – 2	Vegetable Research station, Tamil Nadu Agricultural University, Palur
Acc 26	Paramathi local	Namakkal

Table 5 Continue ...

Table 5 Continue ...

Acc 27	Namakkal local	Namakkal
Acc 28	PLR – 1	Vegetable Research station, Tamil Nadu Agricultural University, Palur
Acc 29	Kalanjipatti kathiri	Dindigul
Acc 30	Co – 2	TNAU, Coimbatore
Acc 31	Annamalai	Annamalai University, Chidambaram
Acc 32	Thennilai local	Namakkal
Acc 33	Ujala fleshy	Karur
Acc 34	Mallanatham local	Karur
Acc 35	Elavambadi mullu kathiri	Agriculture research station, Virinjipuram, Vellore
Acc 36	Arka Nidhi	IIHR, Bangalore
Acc 37	Paramathy vellore local	Karur
Acc 38	Udumalai samba	Dindigul
Acc 39	Karur local	Karur
Acc 40	Karnataka kathiri	Namakkal
Acc 41	Arka Harshitha	IIHR, Bangalore
Acc 42	Paravai local	Nagapattinam
Acc 43	IC – 089905	NBPGR, New Delhi
Acc 44	IC – 136292	NBPGR, New Delhi
Acc 45	IC – 136296	NBPGR, New Delhi
Acc 46	IC – 136251	NBPGR, New Delhi
Acc 47	IC – 136189	NBPGR, New Delhi
Acc 48	IC – 154517	NBPGR, New Delhi
Acc 49	IC – 136297	NBPGR, New Delhi
Acc 50	Sevathapatti local	Cuddalore

yield per plant, while the lowest mean value was observed for days to 50% flowering and days to first harvest. Early flowering and early harvest could be helpful for breeding an early plant type as stated by Banerjee *et al*., (2018) and Bundela *et al*., (2019). The highest mean value of number fruits per plant was recorded in cluster I and cluster IV recorded high mean performance for the traits like number of flowers per cluster and number of fruits per cluster. These results are in accordance with the earlier work of Gupta *et al*., (2017); Islam *et al*., (2018) and Gurve *et al*., (2019).

Relative contribution of different characters to genetic diversity in brinjal follows the idea of proof by contradiction and estimates the impact of absence of each parameter, based on the fact that the absence of a parameter with more contribution will bring more diversity. The relative contribution of different plant characters towards genetic diversity as investigated is presented in Table 4 and Fig 3. Individual fruit weight (28.81 percent) contributed maximum towards genetic diversity followed by number of fruits per plant (27.42 percent), fruit yield per plant (25.14 percent), seeds per fruit (8.32 percent), leaf area (6.20 percent), fruit length (3.18 percent) in order. The remaining characters values were meager. The characters viz., plant height, days to 50% flowering, days to first harvest, number of flowers per cluster, number of fruits per cluster, fruit diameter and 100 seed weight. Similar results were reported by Patel *et al*., (2014), Ravali *et al*., (2017) and Aparajita Das and Soumithra Sankar Das, (2017). Evaluation of the accessions based on higher fruit yield per plant showed Acc 31-Annamalai (2420 g) followed by Acc 16-IC-136093 (1800g) and Acc 25- PLR 2 (1790 g) as the top three ranking accessions.

It could be inferred from this study that greater diversity in the accessions existed for the thirteen characters mentioned above. There also exists ample scope for development of better ideotypes by selecting accessions from the clusters. Cluster III had high mean performance for plant height, leaf area, individual fruit weight and fruit yield per plant, coupled with favourable performance for days to 50% flowering and days to first harvest. Cluster I also registered high mean values for individual fruit weight, fruit length, fruit diameter and number of fruits per plant, next to cluster III. Thus there lies enormous scope for development of brinjal varieties with specially preferred features.

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