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Genetic Divergence for Yield and Yield Components in Brinjal

KAFYTULLAH, K. M. INDIRESH AND H. M. SANTHOSHA

Department of Horticulture, University of Agricultural Sciences, GKVK Bangalore 560065, Karnataka, India
E-mail : san3070@gmail.com

Abstract

In the present investigation 40 genotypes of brinjal were used to study the nature of genetic divergence and to assess the importance of a set of quantitative characters related to economic yield in genetic differentiation, using Mahalonobis D^2 statistic. The 40 genotypes formed 15 clusters, among 15 clusters, cluster III was largest with nine genotypes and highest inter-cluster distance was found between cluster XI and XIV. It was observed that characters like yield per hectare, yield per plant, wilt incidence and fruit volume contributed largely to the divergence. There was substantial variation in cluster mean for plant height. So to get high variability in brinjal, genotype R-2585 of cluster XIV and L-3260, L-3265 genotypes from cluster XI can be best utilized.

Key words : Brinjal, Genetic diversity, Variability, Inter and intra-cluster distance, D^2 analysis.

Brinjal (*Solanum melongena* L.) is an important vegetable crop belongs to the family Solanaceae, which is grown on a large area comprising about 5.53 lakh ha. with estimated production of 103.78 lakh tons and with productivity of 16.5 tons per ha (1). Over 50 species have been recorded in India belonging to the genus *Solanum*. Moreover 16 species, which are closely related to the cultivated brinjal are found grown wild in various parts of India. A great genetic variation with regard to color, maturity, fruit shape, fruit size and spinyness of plants exist among indigenous material. The D^2 statistic is a tool to evaluate large number of germplasm lines for their genetic diversity and helps in the identification of genetically divergent parents for their exploitation in hybridization programs as hybrids between lines of diverse origin display a greater heterosis than those between closely related strains. Murthy and Arunachalam (2) stated that multivariate analysis with Mahalonobis D^2 statistics is a powerful tool to know the clustering pattern to establish the relationship between genetic and geographic divergence and to determine the role of different qualitative characters towards the maximum divergence. Hence in present investigation genetic divergence was conducted in brinjal.

Methods

Forty brinjal genotypes collected from different sources formed the experimental material. The experiment was laid out in a RCBD with two replications

Table 1. Percent contribution of different parameters to the genetic divergence in Brinjal genotypes.

	Characters	Percent contribution
1	Plant height at 45 DAT (cm)	0.1282
2	Plant height at 60 DAT (cm)	0
3	Plant height at 75 DAT (cm)	0
4	Plant height at 90 DAT (cm)	0
5	Days to first flowering	0.5128
6	Days to 50% flowering	0
7	Number of branches at 45 DAT	0
8	Number of branches at 60 DAT	0
9	Number of flowers per cluster	0.1282
10	Number of clusters per plant	0
11	Leaf area (cm^2)	0
12	Leaf area index	0.1282
13	Number of fruits per cluster	0
14	Fruit set (%)	0
15	Number of fruits per plant	0
16	Yield per plant (kg)	13.9744
17	Yield per plot (kg)	0.2564
18	Fruit weight (g)	0
19	Fruit length (cm)	2.6923
20	Fruit diameter (cm)	3.4615
21	Fruit volume (ml)	6.9231
22	Yield per ha (ton)	62.5641
23	Wilt incidence (%)	9.2308
24	Shoot and fruit borer incidence (%)	0
25	Total chlorophyll content (mg/g)	0
	Total	100

Table 2. Grouping of brinjal genotypes based on D^2 analysis.

Clusters	Number of genotypes	Genotypes
I	2	SM-6, R-2585
II	2	R-3583, R-2589
III	9	Arks Shirish, IIHR-7, Arka Kusumakar, IIHR-3, WCGR, Arka anand, MEBH-9, L-3264, L-3268
IV	7	R-2580, R-2581, R-2582, R-2584, R-2586, R-2587, R-2588
V	2	L-2261, L-3267
VI	2	L-2262, L-3266
VII	2	WL-2230, L-3269
VIII	2	WL-2236, L-3263
IX	2	WL-2232, L-3272
X	2	R-2591, R-2595
XI	2	L-3260, L-3265
XII	2	R-2593, R-2594
XIII	2	R-2592, L-3270
XIV	1	R-2585
XV	1	L-3271

during *kharif* of 2009 at vegetable research block, Department of Horticulture, UAS, GKVK, Bangalore.

The observations from each replication on five random selected plants from 25 quantitative and qualitative characters like plant height (cm) at 45, 60, 75 and 90 days after transplanting, number of branches at 45 and 60 days after transplanting, number of flowers per cluster, number of clusters per plant, leaf area (cm^2), leaf area index, wilt incidence (%), shoot and fruit borer incidence (%), and total chlorophyll content (mg/g), days to first flowering, days to 50% flowering, number of fruits per cluster, fruit set (%), number of fruits per plant, yield per plant (kg), yield per plot (kg), fruit weight (g), fruit length (cm), fruit diameter (cm), fruit volume (ml) and yield per ha. (ton) were taken.

Multivariate analysis using Mahalonobis (3) D^2 statistics was used for assessing the divergence and grouping of the genotypes was done according to Toucher's method (4).

Results and Discussion

The analysis of variance revealed significant difference among the genotypes for all the 25 quantitative and qualitative characters except total chlorophyll content indicating considerable amount of variability existed in the genotypes under study. The relative contribution of different characters for genetic divergence (D^2) is presented in Table 1.

Total yield per ha. (62.56%) contributed maximum to the genetic diversity among the genotypes followed by yield per plant (13.97%), wilt incidence (9.23%), fruit volume (6.92%), fruit diameter (3.46%) and fruit length (2.6%). While there was negligible to zero contribution to total genetic divergence was observed from remaining characters. The results are in confirmative with the results of Senapati and Senapati (5) in brinjal. Hence considerable emphasis should be given on these characters to increase yield

Table 3. Inter and intra-cluster distance among brinjal genotypes.

Cluster	I	II	III	IV	V	VI	VII	VIII
I	34.40	84.68	132.65	78.79	90.63	100.41	105.96	206.64
II		35.69	154.55	95.31	106.10	141.21	232.66	136.04
III			112.42	150.92	99.24	114.96	98.63	100.07
IV				97.58	110.86	264.45	117.84	257.33
V					47.84	66.72	74.21	72.14
VI						48.75	94.90	61.10
VII							53.97	85.08
VIII								54.46
IX								
X								
XI								
XII								
XIII								
XIV								
XV								

Table 3. Continued.

Clusters	IX	X	XI	XII	XIII	XIV	
I	127.19	85.01	104.28	80.71	111.65	92.84	147.26
II	160.28	107.22	135.98	90.43	170.72	132.73	161.09
III	140.12	180.22	154.86	257.00	149.62	170.66	91.89
IV	160.61	120.36	124.33	85.45	143.29	218.32	159.57
V	113.38	134.36	237.24	122.20	114.55	102.01	96.74
VI	268.26	130.25	76.76	133.15	104.24	85.87	129.33
VII	149.90	260.88	134.74	135.47	153.43	170.66	77.79
VIII	88.36	129.66	100.26	134.02	104.99	121.72	113
IX	54.93	126.26	107.84	219.01	80.37	126.67	163.62
X		64.56	211.28	105.99	105.87	108.78	208.11
XI			71.14	116.08	112.35	272.76	178.90
XII				77.16	145.57	167.99	184.87
XIII					89.08	138.44	171.39
XIV						0	158.92
XV							0

in brinjal.

In cluster composition, 40 genotypes were grouped into fifteen clusters. The distribution pattern of entries into various clusters is represented in Table 2. Cluster III was the largest cluster having 9 genotypes followed by cluster IV with seven genotypes, cluster XIV and XV with only one genotype and remainining cluster each with two genotypes.

Intra and inter cluster average D^2 values are presented in Table 3. Among 15 clusters, cluster III with nine genotypes showed maximum intra cluster diversity (D^2+112.42) it is followed by cluster IV (D^2=97.58). Based on distance between cluster (inter-cluster), the maximum divergence was observed between cluster XI and XIV (D^2=272.76) followed by cluster VI and IX (D^2=268.26). The distance between cluster V and III was the least (D^2=61.10). Genotypes belonging to the cluster with maximum inter-cluster distance are genetically more diverged; selection of parents for hybridization should be done from two clusters having

Table 4. Cluster means for growth and quality characters in brinjal genotypes. X_1 : Plant height at 45 DAT (cm), X_2 : Plant height at 60 DAT (cm), X_3 : Plant height at 75 DAT (cm), X_4 : Plant height at 90 DAT (cm), X_5 : Number of branches at 45 DAT, X_6 : Number of branches at 60 DAT, X_7 : Number of flowers per cluster, X_8 : Number of clusters per plant, X_9 : Leaf area (cm^2), X_{10} : Leaf area index, X_{11} : Wilt incidence (%), X_{12} : Shoot and fruit borer incidence (%), X_{13} : Total chlorophyll content (mg/g).

Clusters/ Characters	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}
I	53.12	64.26	74.93	89.83	2.97	4.35	5.62	17.05	71.15	3.36	12.00	45.25	0.0050
II	49.00	59.80	71.95	84.98	3.35	4.90	4.25	18.85	86.20	8.66	34.12	25.00	0.0067
III	44.07	56.30	67.14	79.72	3.06	4.71	5.57	19.72	80.93	5.36	17.81	40.65	0.0051
IV	45.42	55.03	65.96	80.32	2.62	4.43	4.63	16.64	86.06	5.11	10.42	45.17	0.0064
V	54.95	66.85	77.20	91.07	4.22	6.25	3.87	16.92	63.54	3.49	27.87	37.25	0.0078
VI	54.87	66.75	76.00	92.25	3.37	5.00	4.22	22.05	56.30	1.92	27.62	55.75	0.0073
VII	45.30	55.22	65.77	80.55	3.76	5.30	4.12	19.27	65.32	2.36	2.87	43.25	0.0065
VIII	42.85	51.37	64.72	78.00	3.15	5.17	4.77	16.30	62.03	4.01	21.75	58.87	0.0059
IX	45.95	56.87	67.97	84.34	3.15	4.35	4.27	16.05	72.12	3.98	46.62	55.65	0.0067
X	50.97	63.65	73.92	86.75	3.45	5.50	4.40	18.90	68.04	4.69	34.12	53.62	0.0053
XI	55.65	67.32	77.15	91.52	3.60	5.90	4.35	17.32	63.94	4.41	33.87	65.12	0.0062
XII	40.70	52.57	63.37	75.32	3.15	4.97	4.37	13.45	64.73	4.32	15.37	53.37	0.0067
XIII	37.65	48.97	59.27	74.05	2.47	4.30	4.30	16.35	66.53	4.05	46.87	46.87	0.0063
XIV	48.90	61.25	72.00	86.47	3.30	4.70	5.30	19.15	75.04	3.71	18.25	10.40	0.0057
XV	42.75	53.70	65.70	80.30	3.15	5.50	5.30	15.20	87.60	4.30	12.25	25.50	0.0068

Table 5. Cluster means for yield and its attributes in brinjal genotypes. X_1 : Days to first flowering, X_2 : Days to 50% flowering, X_3 : Number of fruits per cluster, X_4 Fruit set (%), X_5 : Number of fruits per plant, X_6 : Yield per plant (kg), X_7 : Yield per plot (kg), X_8 : Fruit weight (g), X_9 : Fruit length (cm), X_{10} : Fruit diameter (cm), X_{11} : Fruit volume (ml), X_{12} : Yield per ha. (ton).

Clusters/ Characters	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
I	37.25	53.72	1.42	26.69	11.66	1.03	15.66	113.75	8.55	7.29	197.25	25.22
II	36.65	52.62	1.32	31.16	10.97	1.95	18.65	113.75	8.27	7.27	208.50	20.25
III	37.61	50.81	2.57	46.11	25.80	1.42	17.95	76.74	21.73	4.20	114.46	30.31
IV	37.79	52.08	1.37	29.88	12.10	1.22	16.49	117.05	8.18	7.14	213.38	27.53
V	39.25	50.87	1.87	48.43	23.67	1.31	16.80	62.40	21.57	3.85	87.12	26.35
VI	39.00	50.65	2.32	53.36	27.67	1.34	13.36	62.80	24.20	4.01	85.85	25.39
VII	39.52	51.87	1.85	45.06	24.26	1.32	18.43	64.82	17.95	4.41	89.95	33.96
VIII	46.90	55.05	2.60	52.01	24.15	1.22	11.54	64.82	21.15	3.47	93.55	18.98
IX	41.75	52.75	1.87	44.11	28.50	1.25	15.89	65.75	21.10	4.92	95.92	29.28
X	44.70	56.25	1.52	34.67	11.25	1.14	11.32	124.25	8.72	7.43	216.00	14.34
XI	36.27	45.85	2.42	55.79	26.35	1.32	15.41	57.55	15.25	4.47	87.22	21.92
XII	39. 95	51.05	1.25	28.62	11.17	1.14	13.17	100.00	8.63	7.81	240.25	23.54
XIII	40.52	52.45	1.72	37.78	19.97	1.34	10.77	92.35	16.30	6.01	161.35	18.07
XIV	38.50	51.60	1.55	29.23	3.30	1.46	15.64	52.00	15.55	9.71	867.00	25.49
XV	35.90	48.90	2.05	38.67	21.40	1.39	21.78	60.60	24.20	3.62	38.80	35.91

wider inter-cluster distance to get more variability. Hence the genotypes L-3260, L-3265 from cluster XI and R-2585 from cluster XIV are best choice for hybridization.

Difference in cluster means existed for almost all the characters (Tables 4 and 5). Mehta et al. (6) also reported appreciable differences in means of different characters like, fruit weight, plant height, yield per plant and also fruit yield per ha. The highest cluster means for yield per ha. was observed in cluster XV and it is lower in cluster X. It is observed from Table 4 & 5 that crossing between genotypes of cluster XV with genotypes of cluster X are likely to be exploited for higher heterosis for brinjal yield and yield contributing characters.

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