Genetic Divergence Analysis in
Eggplant (*Solanum melongena* L.)

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ABSTRACT. Genetic divergence using D^2 statistic of 43 eggplant (Solanum melongena L.) genotypes of different geographic origins revealed the existence of considerable diversity. The genotypes were grouped into 13 clusters. The cluster I was the largest containing 12 genotypes followed by cluster III with 6 genotypes. Cluster IX, X, XI, XII and XIII were unique and had only one genotype each. The diversity among the genotypes as estimated by inter-cluster distance was adequate for improvement of eggplant by hybridization and selection. The genotypes included in the diverse clusters can be used as promising parents for hybridization to obtain high heterotic response and thus better segregants in eggplant.

INTRODUCTION

Eggplant (*Solanum melongena* L.) commonly known as brinjal is one of the most popular and widely grown vegetables of India. It is grown throughout the year in the country, hence it provides continuous source of income to farmers. Eggplant is an important vegetable in South India due to its nutritive and medicinal value. The crop can be grown in all seasons *viz.*, wet season, winter and summer.

India is a rich centre of eggplant germplasm. There exists wild as well as various cultivated forms, with wide range of colour and shapes of fruits. It is well understood that in a crop improvement programme by hybridisation, use of diverse parents result in superior hybrids and desirable recombinants. The genetic divergence analysis using D^2 statistic (Mahalanobis, 1936) seems to be a powerful tool for quantifying the degree of divergence existing in the population, which in turn helps in selecting the suitable parents for hybridisation programme.

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MATERIALS AND METHODS

The experimental material consisting of forty three genotypes of eggplant (*Solanum melongena* L.) of diverse origin was collected and grown in a randomized complete block design with three replications in the Plant Breeding Farm, Faculty of Agriculture, Annamalai University, Chidambaram during 1997. The seeds of forty three genotypes were sown in separate rows on a raised bed nursery followed by normal nursery practices and transplanting was done with 35 days old seedlings. In each replication, the genotypes were planted in three rows of six metres length spaced 60 cm within a row and 75 cm between the rows. All the recommended agronomic practices were followed to raise the crop. Data were recorded on 10 randomly selected plants from each replication for the nine characters (days to first flower, plant height, number of branches, plant spread, fruit length, fruit girth, fruit weight, number of fruits and fruit yield per plant). Replication wise data for each character were subjected to analysis of variance. Multivariate analysis was done utilizing Mehalanobis D^2 statistic and genotypes were grouped into different clusters following Tocher's method as described by Rao (1952).

RESULTS AND DISCUSSION

The analysis of variance for each individual character showed highly significant differences among the cultivars except number of branches (Table 1). Using Tocher's procedure, 43 genotypes were grouped into 13 clusters (Table 2). Among these cluster I was the largest and consisted of 12 genotypes followed by cluster III with 6 genotypes. Cluster II and V had each 4 genotypes, whereas cluster IV, VI, VII and VIII each grouped 3 genotypes. Clusters IX, X, XI, XII and XIII were unique, since each had only one genotype. The random distribution of genotypes was evident from cluster I having maximum number of genotypes with wide distribution. The grouping pattern did not show any relationship between genetic divergence and geographic diversity, though its seems as an important factor. This was in accordance with the findings that the geographical distribution need not be directly related to genetic diversity as estimated by D^2 statistic, as reported by Murty and Arunachalam (1966). Similar results were also reported by Singh and Krishnaprasad (1991), Pramanick *et al.* (1992), Tambe *et al.* (1993) and Yadav *et al.* (1996).

Table 1.   Analysis of variance for nine characters in eggplant.

Source	DF	Mean sum of square								
		Days to flower	Plant height	Number of branches	Plant spread	Fruit length	Fruit girth	Fruit weight	Number of fruits	Fruit yield per plant
Replication	2	0.06	6.09	0.05	253056.00**	0.04	0.13	0.23	1.87	45.82.00
Genotype	42	60.48**	333.76**	8.21ⁿˢ	4278550.50**	5.99**	5.77**	185.62**	87.42**	92678.89**
Error	84	2.69	7.13	0.58	11.6849.71	0.07	0.11	7.22	5.56	2249.13

** Significant at 1% level   ns - non-significant

Table 2.   Distribution of forty three eggplant genotypes in 13 clusters based on D^2 values.

Cluster number	Number of genotypes	Genotypes	Origin
I	12	SM-7	Tamilnadu, India
		SM-10	Tamilnadu, India
		SM-11	Tamilnadu, India
		SM-26	USA
		SM-31	New Delhi, India
		SM-32	Uttar Pradesh, India
		SM-35	Indonesia
		SM-37	Ghana
		SM-38	Ghana
		SM-40	Tamilnadu, India
		SM-41	New Delhi, India
		SM-43	Pondicherry, India
II	4	SM-15	New Delhi, India
		SM-28	Netherlands
		SM-30	Netherlands
		SM-42	Tamilnadu, India
III	6	SM-2	Tamilnadu, India
		SM-3	Pondicherry, India
		SM-14	Tamilnadu, India
		SM-16	Tamilnadu, India
		SM-27	USA
		SM-34	Taiwan

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Cluster number	Number of genotypes	Genotypes	Origin
IV	3	SM-18	Maharashtra, India
		SM-29	Netherlands
		SM-39	Tamilnadu, India
V	4	SM-4	Tamilnadu, India
		SM-8	Tamilnadu, India
		SM-9	Tamilnadu, India
		SM-13	Tamilnadu, India
VI	3	SM-6	Tamilnadu, India
		SM-17	Tamilnadu, India
		SM-24	USA
VII	3	SM-1	Tamilnadu, India
		SM-5	Tamilnadu, India
		SM-22	Tamilnadu, India
VIII	3	SM-12	Tamilnadu, India
		SM-23	Tamilnadu, India
		SM-25	USA
IX	1	SM-19	Tamilnadu, India
X	1	SM-20	Tamilnadu, India
XI	1	SM-36	Assam, India
XII	1	SM-21	Tamilnadu, India
XIII	1	SM-33	Ethiopia

Average intra and inter-cluster D^2 values among 43 genotypes presented in Table 3 revealed that cluster II showed a minimum intra-cluster value of 53.2 indicating that the genotypes within this cluster were similar. While cluster VII showed maximum intra-cluster D^2 value (121.6) followed by cluster III (98.3) revealing the existence of diverse genotypes in these clusters. The inter-cluster D^2 values ranged from 122.3 to 706.3. Minimum inter-cluster value D^2 was observed between cluster II and XIII (122.3) indicating the close relationship among the genotypes included in these clusters. Maximum inter-cluster value was observed between cluster X and XIII (706.3) which indicated that the genotypes included in these clusters had maximum divergence. Hence, hybridization between the genotypes included in these different clusters may give high heterotic responses and thus better segregants.

Table 3. Average intra (bold) and inter cluster D² values in 13 clusters of eggplant.

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
I	**70.2**	129.5	137.3	141.9	286.9	167.4	189.5	244.5	210.0	277.4	187.5	201.3	271.9
II		**53.2**	175.9	155.5	410.7	164.3	293.3	262.1	171.7	356.2	130.4	327.3	122.3
III			**98.3**	184.1	392.5	238.9	166.3	439.1	376.2	347.5	221.4	326.6	352.8
IV				**90.3**	465.9	204.7	242.8	310.4	283.1	595.5	161.7	134.5	207.2
V					**82.5**	307.3	267.4	349.7	599.7	332.4	581.4	395.4	595.2
VI						**83.0**	307.3	267.4	350.4	459.6	310.0	298.8	151.3
VII							**121.6**	519.7	542.2	461.6	427.7	325.5	351.0
VIII								**74.2**	262.8	391.5	357.0	201.7	492.8
IX									**-**	414.0	280.1	411.9	263.2
X										**-**	460.1	662.2	706.3
XI											**-**	274.8	307.2
XII												**-**	457.0
XIII													**-**

Table 4. Cluster mean values for nine characters in eggplant.

Cluster	Days to first flower	Plant height (cm)	Number of branches	Plant spread (cm³)	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Number of fruits per plant	Yield per plant (g)
I	76.02	75.59	12.61	5406	6.65	13.44	42.57	15.37	636.97
II	70.24	83.40	10.16	5482	5.89	15.31	45.90	13.77	637.02
III	71.20	72.76	11.15	3978	5.53	12.80	34.69	15.48	505.64
IV	72.48	68.54	12.44	5665	5.26	14.25	38.69	22.01	816.28
V	64.69	66.01	12.18	4854	9.83	12.52	46.29	16.49	762.23
VI	73.20	68.74	11.65	4844	7.63	15.88	38.81	17.01	647.54
VII	73.30	56.76	10.31	3669	7.09	12.93	34.21	17.91	583.08
VIII	72.47	93.22	12.75	7400	7.78	19.55	44.63	25.07	1012.40
IX	81.33	95.40	14.56	5729	6.03	15.44	65.17	13.79	768.38
X	73.20	99.33	12.56	4578	8.37	11.92	44.22	7.49	328.77
XI	69.17	84.87	12.22	7689	4.84	14.64	32.38	15.61	504.86
XII	74.30	68.77	14.47	6761	6.58	12.93	31.43	33.34	1043.61
XIII	73.67	71.53	9.41	4813	5.66	17.65	51.22	13.94	711.49

The average cluster means for nine characters (Table 4) indicate that genotypes included in cluster V were of early flowering (65 days) and with maximum fruit length (9.83 cm). Cluster VII had the minimum plant height (56.76 cm), whereas cluster VIII showed maximum plant spread (7400 cm²). Cluster IX gave both maximum number of branches (14.56) and fruit weight (65.17 g), while, genotypes in the cluster XII had the highest number of fruits per plant (33), fruit yield (1043.61 g) and was the best cluster with all the other characters at desirable levels.

CONCLUSIONS

From the present analysis, the genotypes included in the diverse clusters *viz.*, cluster V, VII, VIII, IX, X, XII and XIII, hold good promise as parents for obtaining potential hybrids and thereby creating large variability for these characters in eggplant, which will be useful for further crop improvement.

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