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GENETIC DIVERGENCE IN *GOSSYPIUM ARBOREUM* L.

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ABSTRACT

Genetic diversity was studied using multivariate analysis among 69 F_6 progenies and a commercial variety LD 327 of *G. arboreum L.* The grouping of material into twelve clusters indicated the presence of wide range of genetc diversity among the progenies. The study indicated no definite relationship between geographic and genetic diversity and geographic diversity can not be used as in index of genetic diversity. In general genetic diversity among the parents was reflected in their progenies. The diverse clusters derived could be used in hybridization programme to generate wide range of transgressive segregants in populations to develop high yielding cotton varieties with superior fibre traits.

Key words : *Gossypium arboreum*, cotton, Genetic divergence.

Genetic diversity among the parents is a pre-requisite to improve chances of selecting better segregants for various characters. The more diverse the parents within reasonable limits, more are the chances of improving the character under consideration. Singh and Gupta [1], Singh and Singh [2] and Sandhu *et al.* [3] have used the concept of generalized distance to isolate genetically diverse materials. Varieties belonging to distinct geographic regions are usually selected for hybridization programme presuming presence of consideable genetic diversity among them. The validity would, however, depend upon association between geographic and genetic diversity. Genetically diverse genotypes when used as parents in hybrid breeding programme generate a wide range of variability in the segregating populations, thereby enhancing the probability of new phenotypic expression due to accumulation of maximum desirable genes. The present study was planned to measure genetic diversity among advance generation progenies of *Gossypium arboreum* L. to identify diverse stocks for use in hybridization programme to improve yield and fibre characteristics.

MATERIALS AND METHODS

The experimental material comprising 69 F_6 progenies derived from 16 different crosses and a commercial variety LD 327 of *Gossypuvm arboreum* L. were grown during the summer of 1992 in a randomized complete block design with three replications at Punjab Agricultural University, Ludhiana and its Regional Research Station, Kheri. Each plot consisted of single row of nine plants spaced 45 cm within a row and 60 cm between rows. Data were recorded on six randomly tagged plants for seed-cotton yield/plant (g), bolls/plant, boll weight (g), halo length (mm), ginning outturn (%), seed index and lint index. Pooled data were subjected to statistical analysis. Wilk's criterion was used to test the significance of pooled differences in mean values of all the seven characters. Genetic diversity was studied using Mahalanobis's D^2, clustering of genotypes was done according to Tocher's method as described by Rao [4].

RESULTS AND DISCUSSION

The pooled analysis of variance for the experimental design over two locations showed highly significant differences among genotypes for all the characters studied. Wilk's test of significance (χ^2 = 2648.37 at 483 d.f.) showed highly significant progeny differences with respect to aggregate of all the characters. Multivariate analysis based on Mahalanobis's D^2 statistic revealed that progenies could be grouped into 12 clusters [Table 1]. This suggested the presence of high degree of divergence in the material.

LD 327 was genetically diverse from rest of the materials as it grouped independently in one cluster. This may be attributed to coadaptive gene complexes which LD 327 inherited from different parents. In the progenies of crosses involving LD 327 as a parent such coadaptive complexes may not be inherited at all or partially inherited resulting in their clustering in a different group. Cluster I contained five progenies of which three had G 27 as female parent and the other two had LD 230 and LD 327 as female parents. Cluster II had five progenies of which three progenies had LD 327 as female parent, whereas the other two had LD 230 as female parent. All the eight progenies of cluster III had either G 27 or LD 327 as the female parent. LD 327 also served as male parent in one of the crosses. Cluster IV consisted of seven progenies with G 27, LD 327 and LD 230 as female parents. Cluster V, VI, VII, VIII consisted of six progenies all of which were derived from a cross with G 27 as the female parent. The clustering pattern of these groups showed that the parental contribution with regard to genetic divergence was transmitted to its progenies. Progenies from similar crosses allotted to different clusters in the present

Table 1. Distribution of 69 F_6 progenies and LD 327 in different clusters in *arboreum* cotton

Cluster number	No. of progenies per cluster	Parentage
I	5	G 27 × H 436, LD 230 × AC 3402, LD 327 × LD433, G 27 × (G 27 × AKA 592)
II	5	LD 230 × AC 3402, LD 327 × LD 433, LD 327 × LD 381
III	8	LD 327 × LD 381, G 27 × LD 327, G 27 × 853
IV	7	LD 230 × AC 3402, LD 327 × LD 381, G 27 × LD 380
V	6	G 27 × LD 327, G 27 × IC 30850, G 27 × (G 27 × AKA 592), G 27 × LD 380
VI	8	G 27 × LD 327, G 27 × LD 230, G 27 × IC 30850, G 27 ×853
VII	6	G 27 × LD 327, G 27 × IC 30850, G 27 × 85.3 G 27 × (G 27 × AKA 592)
VIII	6	G 27 × LD 327, G 27 × IC 30850, G 27 × 853
IX	6	G 27 × 6373, LD 327 × LD 433, LD 327 × LD 381, G 27 × LD 327
X	10	G 27 × LD 380, LD 230 × LD 380, LD 341 × LD 460, LD 341 × LD 360, LD 341 × Assam-2, LD 341 × LD 475
XI	2	LD 327 × LD 381, G 27 × LD 327
XII	1	LD 327

case clearly indicated that recombination and selection history had played an important role. Similar conclusions were also drawn by [5]. Cluster IX consisted of six progenies with G 27 and LD 327 as female parents. Ten progenies of cluster X consisted of three female and five male parents from diverse geographic regions. Other clusters also showed that the progenies of crosses which involved geographically diverse parents were included in one cluster. This suggested that during hybridization programme emphasis should be laid on genetic diveristy as measured by D^2 technique along with their performance rather than on the basis of geographic diversity. Many workers [5-7] have stressed the importance of genetic diversity over geographic diversity.

The statistical distances revealed group XII to be diverse from all other groups. The commercial variety LD 327 included in this group is much superior and genetically diverse from rest of the 69 progenies [Table 2]. The intra-cluster mean values also

Table 2. Average intra (along diagonal) and inter-cluster values of D^2 among different clusters in *arboreum* cotton

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
I	19.79	47.08	55.51	46.32	61.36	39.53	92.13	87.06	90.78	152.14	104.32	158.77
II		20.77	84.02	51.12	63.13	55.70	121.67	121.87	68.89	67.97	70.30	178.79
III			18.67	45.05	36.22	36.64	41.06	69.45	106.98	22.59	39.48	177.43
IV				17.73	30.80	42.22	58.03	48.51	64.11	39.64	92.36	133.73
V					17.82	30.58	30.31	75.44	101.94	24.87	45.64	76.20
VI						19.13	41.67	69.06	90.39	22.72	86.28	87.20
VII							10.29	81.13	131.30	31.06	98.34	94.91
VIII								17.26	112.21	63.95	80.23	104.42
IX									18.72	90.10	77.68	91.41
X										16.49	55.10	77.32
XI											21.84	94.76
XII												0.00

Table 3. Average intra cluster-mean values for different characters in *arboreum* cotton

Cluster number	Seed cotton yield(g)	Boll number	Boll weight (g)	Halo length (mm)	Ginning outturn (%)	Seed index	Lint index
I	47.79	23.43	2.04	17.59	39.96	6.02	3.36
II	47.90	21.26	2.25	17.07	38.85	6.11	3.75
III	64.77	30.84	2.10	17.96	39.93	5.05	5.52
IV	65.90	39.14	2.18	18.76	39.77	5.99	3.11
V	42.13	20.31	2.07	18.10	38.74	5.11	3.35
VI	54.75	27.07	2.03	17.70	39.27	5.41	3.39
VII	51.78	25.07	2.05	18.75	38.91	4.78	3.05
VIII	76.35	37.92	2.01	18.86	39.93	5.58	3.71
IX	67.89	31.00	2.13	17.96	39.63	6.38	3.87
X	58.12	28.32	2.04	18.04	39.54	5.13	3.37
XI	57.06	27.73	2.06	15.36	40.73	5.25	3.45
XII	104.42	49.37	2.11	16.92	41.55	4.26	3.15

substantiated this observation as LD 327 (cluster XII) had maximum value for seed cotton yield, boll number and ginning outturn [Table 3]. The most diverse groups are II and XII followed by III and XII, I and XII and I and X. Cluster II had the highest value for boll weight, cluster VIII for halo length and cluster IX for seed index and lint index. Crosses between these diverse groups could generate wide range of variability and provide transgressive segregants in a hybridization programme. LD 327 being genetically diverse from rest of the progenies could be used in hybridization with all other clusters.

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