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Genetic diversity in *desi* cotton (*Gossypium arboreum* L)

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ABSTRACT : On the basis of D^2 analysis 50 genotypes of *Gossypium arboreum* were grouped into 19 clusters. Genetic diversity was found to be unrelated with geographic origin of the genotypes. D^2 statistic showed adequate diversity among the genotypes. Among the 12 characters studied the most important character contributing to the divergence was halo length followed by days to maturity, plant height and 100 seed weight. According to D^2 values and cluster means, genetically diverse genotypes were identified and crossing programme has been suggested involving Gbav 127, PA 183, PA 255, JLA 505, SVA 1118, JLA 794, ARBAS 131, DAS 1042, PA 402, NDLA 2981, G 27, RG 590, AKA 7, AKA 8 and CAN 1009.

Key words : D^2statistic, *desi* cotton, genetic diversity

Desi cotton (*Gossypium arboreum* L.) is very well adapted to the fluctuating rainfall and adverse climatic conditions and suits well to scanty resources. Diverse germplasm is of vital importance in breeding and improvement of any crop. Several scientists have used the concept of generalized distance to isolate genetically diverse materials in *Gossypium arboreum*. Therefore present investigation was undertaken to measure the divergence among the genotypes using D^2 statistic.

Fifty genotypes of *desi* cotton (*Gossypium arboreum*) of different geographic origin were collected from Agriculture Research Station, MPKV, Jalgaon. The experiment was conducted at experimental farm of Agriculture Botany Section, College of Agriculture, Dhule during *kharif*, 2012-2013. All the genotypes were planted in randomized block design with three replications. Each genotype was planted in a single row of 4.5 m length with a spacing of 22.5 cm between plants and row to row distance was kept 45 cm. Observations were recorded on 5 randomly selected plants of each genotype in each replication for characters *viz* days to first flower, days to 50 per cent flowering, days to maturity, plant height (cm), monopodia, sympodia/plant, boll weight (g), bolls/plant, halo length (mm), ginning percentage, 100 seed weight (g) and seed cotton yield/plant (g).

The genetic diversity among all the genotypes was computed by means of Mahalnobis D^2 technique and genotypes were grouped into clusters by following Tocher's method.

The analysis of variance revealed that, mean squares due to genotypes were highly significant indicating that genotypes differed significantly for all the characters studied. Wilk's criterion showed significant differences between the genotypes for pooled effect of 12 characters studied. Based on D^2 values 50 genotype were grouped into 19 clusters (Table 1) indicating the presence of appreciable amount of diversity among the genotypes. Maximum genotypes (16) were grouped into cluster I followed by cluster II (9 genotypes), cluster IV (6 genotypes), cluster V (4 genotypes). The remaining clusters *viz.* III, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, XVII, XVIII and XIX were solitary. The genotypes which are included in the solitary clusters can be good source for broadening the genetic base of the existing germplasm.

The distribution pattern of genotypes in different clusters showed that genetic divergence is not related to geographic differentiation. Same results were reported by Kumar *et al.,* (2000) and Gururajan and Manickam (2002). It suggested that selection of genotypes for hybridization should be based on genetic diversity rather than geographic diversity.

The average intra and inter cluster D^2 values are presented in Table 2. Maximum intra cluster distance was observed in cluster V (3.37) followed by cluster IV (2.86), cluster II (2.62) and cluster I (2.36) suggesting that the genotypes in cluster V are relatively more diverse than the genotypes in other selected clusters.

The maximum inter cluster distance was observed between cluster V and XVI (7.84) followed by cluster II and XVI (7.74), cluster VIII and XVI

Table 1. Clusterwise distribution of 50 diverse genotypes of *desi* cotton

Cluster	Number of genotypes	Name of genotypes
I	16	GBav 124, JLA 703, PA 719, J Tapti, PA 405, Y 1, JLA 802, PA 08, RAAS 1031,Sarvottam, KWA 1001, CCA 1010, CCA A 1, GAM 147,GAM 141, GAM 67.
II	9	ARBAS 131, JLA 0794, DAS 1041, DAS 1042,GAM 162, AKA 2005 3, RAC 024, AKA 5,HD 496
III	1	CNA 1008
IV	6	FDK 190, RG 585, CISA 7R, LD 973, RG 600, Dhanvantari
V	4	GBav 127, PA 183, PA 255, JLA 505
VI	1	FDK 178
VII	1	NDLA 2981
VIII	1	PA 402
IX	1	LD 949
X	1	CNA 1009
XI	1	CISA 1005
XII	1	AKA 7
XIII	1	PA 710
XIV	1	AKA 06 5
XV	1	NDLA 2977
XVI	1	SVA 1118
XVII	1	RG 590
XVIII	1	AKA 8
XIX	1	G 27

(7.70), cluster XIII and XVI (7.46). This showed that the genotypes belonging to these clusters are more diverse and may be utilized in future hybridization programme to produce wide variability and transgressive segregants with high heterotic effect. Use of genetically distant genotypes as a parent to get most promising breeding material has also been suggested. The minimum inter cluster distance was observed between cluster VI and XIII (2.22) followed by cluster X and XI (2.26), cluster XIII and XV (2.30) which indicates the close genetic relationship among the genotypes in the clusters.

Relative contribution of various characters towards divergence showed that, the most important character contributing the divergence was halo length (39.43 %) followed by days to maturity (14.94 %), plant height (10.04 %) and 100 seed weight (8.41 %). It indicated that above characters are more responsible for the total divergence. Higher contribution to total divergence was also reported by Pushpam *et al.,* (2004) for Bolls/plant and seed cotton yield/plant. The above results suggest that in order to incorporate diversity among the existing genotypes, the genotypes which are more diverse

Table 2 Average intra and inter cluster D^2 values in *desi* cotton

Clusters	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX
I	**2.36**	3.22	2.87	5.21	3.38	2.73	2.91	3.07	4.75	2.90	2.72	2.86	2.82	3.02	3.54	6.83	3.64	3.95	3.45
II		**2.62**	3.91	6.28	3.66	3.02	4.11	4.33	5.81	4.39	4.18	3.28	2.99	3.26	3.51	7.74	4.45	3.88	4.67
III			**0.00**	5.20	3.25	3.68	3.12	3.02	5.52	3.08	3.28	3.60	4.05	3.29	4.55	6.46	4.38	4.49	4.30
IV				**2.86**	6.52	4.76	5.29	5.66	3.51	4.96	5.07	4.92	5.48	5.54	4.60	3.45	4.72	5.73	4.56
V					**3.37**	3.88	4.17	4.38	6.39	4.26	4.12	3.83	3.81	3.89	4.83	**7.84**	4.88	4.38	4.97
VI						**0.00**	3.14	3.56	4.35	3.97	3.82	3.12	**2.22**	2.39	2.40	6.34	3.54	4.34	3.32
VII							**0.00**	2.98	4.65	3.65	3.46	3.81	4.09	2.91	4.39	6.83	3.59	5.09	2.67
VIII								**0.00**	4.80	2.65	2.95	4.46	3.34	3.56	4.07	7.70	5.12	5.87	3.48
IX									**0.00**	4.53	4.50	4.52	4.51	4.87	3.75	5.30	4.48	5.59	2.88
X										**0.00**	2.26	4.07	3.39	4.09	3.80	6.85	4.73	4.66	4.04
XI											**0.00**	3.14	3.27	4.48	4.04	6.79	4.33	4.67	3.59
XII												**0.00**	3.34	3.66	3.92	6.17	2.56	2.60	3.44
XIII													**0.00**	3.43	2.30	7.47	4.68	4.28	3.75
XIV														**0.00**	3.39	6.90	3.55	4.26	3.73
XV															**0.00**	6.31	4.59	4.62	4.07
XVI																**0.00**	5.63	6.66	6.53
XVII																	**0.00**	3.67	3.35
XVIII																		**0.00**	5.13
XIX																			**0.00**

Tables 3. Clusterwise mean values for 12 characters in *desi* cotton

Clusters	Days to 1st flowering	Days to 50 per cent flowering	Days to maturity	Plant height	Monopodia	Sympodia	Boll weight	Bolls/plant	Halo length	Ginning percentage	100 seed weight	Seed cotton yield/plant
I	59.52	67.63	144.31	115.12	2.98	13.73	1.94	17.36	21.54	36.51	5.70	31.82
II	61.30	71.52	152.63	102.46	2.80	11.83	1.94	16.41	22.50	35.82	5.62	30.44
III	60.33	72.00	140.67	109.67	3.07	13.07	2.03	18.73	21.20	35.21	6.11	42.33
IV	61.00	70.72	141.56	95.58	3.09	12.10	1.98	14.91	14.88	38.02	5.45	27.79
V	60.33	66.17	144.92	112.63	3.32	13.78	2.17	16.93	23.20	35.36	6.43	34.58
VI	59.67	72.67	150.00	116.87	3.40	13.87	2.09	20.27	20.53	37.38	5.54	32.48
VII	62.00	69.67	139.67	111.03	3.87	12.33	1.80	20.27	21.00	36.55	5.10	33.00
VIII	60.67	72.00	143.33	146.87	3.20	16.00	1.82	22.27	21.47	35.99	5.50	44.96
IX	66.00	72.33	145.00	109.53	3.33	14.07	1.75	12.80	16.53	40.27	4.75	22.43
X	59.33	65.67	140.00	127.33	2.60	14.47	1.92	14.87	20.40	33.23	5.50	30.75
XI	57.33	64.67	141.00	118.93	2.80	14.60	1.60	14.73	20.87	36.58	6.24	26.64
XII	60.00	67.67	146.00	92.37	2.33	11.80	1.85	13.93	20.87	41.22	5.87	26.29
XIII	62.00	72.00	151.33	128.33	2.73	15.27	2.00	16.73	21.53	35.98	5.98	27.73
XIV	62.67	75.67	149.00	107.35	3.53	14.20	2.14	19.53	21.80	36.95	4.74	38.10
XV	61.67	73.33	155.00	111.40	3.27	13.87	1.93	15.00	19.20	34.80	5.17	26.59
XVI	57.00	72.33	140.00	62.47	3.67	10.13	2.04	11.13	13.07	39.42	5.54	22.98
XVII	58.67	62.33	143.00	86.73	2.80	12.73	1.97	18.20	19.73	41.63	4.87	31.42
XVIII	63.00	70.67	145.33	71.13	1.67	9.40	2.13	7.27	21.20	38.04	5.51	14.02
XIX	65.33	67.33	142.33	119.73	3.33	14.27	1.78	19.87	19.40	40.72	5.12	33.12

in respect of the characters like halo length, days to maturity, plant height and 100 seed weight may be invariably utilized for future breeding programme.

Cluster means for 12 characters studied are given in Table 3. A considerable variation was observed in all the characters studied. Considering the mean values cluster XVI has taken least number of days to flower (57 days). While cluster XVII required minimum days (62.33 days) for 50 per cent flowering. The cluster VII was earliest to mature (139.67 days), which suggests differential response of genotypes to environmental changes for initiation of flower, 50 per cent flowering and maturity. Cluster means for plant height ranged from 62.47 cm (XVI) to 146.87 cm (VIII). Maximum numbers of monopodia per plant were recorded by the cluster VII (3.87). The cluster V showed highest mean value for boll weight (2.17 g), halo length (23.20 mm) and 100 seed weight (6.43 g). Amongst all clusters, the cluster VIII is most important as it recorded highest seed cotton yield/plant (44.96 g), highest bolls/plant (22.27) and sympodia/plant (16.00).

Being the resistant to pest and diseases, *desi* cotton yield potential mainly depends on important yield contributing characters like monopodia/plant, sympodia/plant, bolls/plant and boll weight. Hence to get maximum heterosis it advisable to select the genotypes from the source clusters (Table 4) pertaining to the above mentioned characters.

Considering the intra cluster and inter cluster distances the following genotypes may be more effective for improvement in yield and yield contributing characters. These are Gbav 127, PA 183, PA 255, JLA 505, SVA 1118, JLA 794, ARBAS 131, DAS 1042, PA 402, NDLA 2981, G 27, RG 590, AKA 7, AKA 8 and CAN 1009.

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Table 4. Characters and source cluster

Characters	Source cluster (s)
Days to first flowering (Early)	XVI, XI
Days to 50 per cent flowering (Early)	XVII, XI
Days to maturity(Early)	VII, X,
Plant height (cm) (Tall and Dwarf)	VIII, XVI
Monopodia/plant (Min)	XVIII, XII
Sympodia/plant(Max)	VIII, XIII
Boll weight (g) (Max)	V, XIV, XVIII
Bolls/plant(Max)	VIII, VI, VII
Halo length (mm) (Long)	V, II
Ginning percentage(Max)	XVII, XII, XIX
Hundred seed weight (g) (Max)	V, XI
Seed cotton yield/plant (g) (Max)	VIII, III, V

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