GENETIC VARIABILITY AND CHARACTER ASSOCIATION STUDIES IN *GOSSYPIUM HERBACEUM* COTTON UNDER COASTAL SALINE SOILS OF PRAKASHAM DISTRICT

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Abstract: Eleven promising *Gossypium herbaceum* cultivars were used to study genetic variability, character association and path analysis between yield and its contributing traits under saline soils in two environments. Irrespective of the environment high phenotypic and genotypic coefficients of variation, coupled with high heritability and high genetic advance in seed cotton yield, lint yield, number of sympodia, number of bolls per plant indicated the predominance of additive gene effects in controlling them. Difference in GCV estimates over the environments was found to be good aid to find out favourable environment to exploit genotypic variation and to exercise selection for improvement of traits. In both the environments seed cotton yield was found positively associated with number of sympodia, number of bolls per plant, boll weight, mean halo length and lint yield. However path analysis revealed that lint yield exerted maximum positive direct effect on yield and positive indirect effects via above traits.

Introduction: *Gossypium herbaceum* cottons are known for their inbuilt tolerance to drought, pest and disease tolerance. They are being grown in small pockets of Andhra Pradesh in poor soils under neglected management. Of late the species has been exploited in coastal saline soils of Gujarat. So under NATP CES *Herbaceum* project a study was conducted in Konanki and Uppugunduru villages of Prakasham district to exploit its potential under coastal saline soils of Andhra Pradesh. So development of high yielding genotypes under such situations requires a thorough knowledge of existing genetic variation and extent of association of yield contributing characters. The observed variability is a conserved estimate of genetic and environmental causes and the genetic variability alone is heritable. Correlation and path analysis will establish the extent of association between yield and yield components and bring out relative importance of their direct and indirect effects and thus give a clear understanding of their association with seed cotton yield, with intent to develop genotypes to the particular condition. The present study was undertaken to get information on the above genetic constants and character association.

Materials and methods: Eleven promising genotypes of *Gossypium herbaceum* developed across the country were grown in a randomized block design with three replications at two locations i.e., Konanki (E_1) and Uppugunduru (E_2) villages in farmers fields of Prakasham district, Andhra Pradesh under saline conditions. Each genotype was sown in four rows of six meters length spaced at 60x30cm apart. Five randomly selected plants were chosen in each replication and observations were recorded on plant height (cm), number of monopodia per plant, number of sympodia per plant, number of bolls per plant, boll weight (g), seed index (g), lint index (g), ginning out turn (%), mean halo length (mm), lint yield (kg/ha) and seed cotton yield (kg/ha). Standard statistical procedures were followed for estimating genetic components, correlations and path coefficients (Singh and Choudhary, 1977).

Results and discussion: Phenotypic and genotypic correlations of variation are presented in table 1. Although the influence of environment of each trait could be determined by the difference in phenotypic coefficient of variation and genotypic coefficient of variation the difference between genotypic coefficient of variation estimates across the environments might indicate more precisely the influence on the genetic variability (Johnson et al 1955). Irrespective of environment the differences between phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were low for seed cotton yield and lint yield. The direction in shift in genotypic coefficient of variation estimates of E_1 from E_2 for all the characters indicated that there was considerable increase in genotypic variation of these traits at E_1 as compared to E_2. Greater expression of genotypic variation might be considered as favorable environment to express the selection for the improvement of these traits in E1 situation. High variability values were observed for the traits seed cotton yield, lint yield, number of sympodia per plant, number of bolls per plant, seed index and lint index in both the environments. High heritability coupled with high genetic advance was observed in both the environments for seed cotton yield, lint yield, number of sympodia per plant, number of bolls per plant, indicated the preponderance of additive gene action in controlling them. So pure line

selection may be rewarding for improvement of these traits. These results are in broad agreement with Choudhari *et al* (1988), Aher *et al.* (1989), Tomar and Singh (1991), Patel *et al* (1996) and Yadav *et al* (2000) in arboreum cotton.

Phenotypic correlation coefficients between yield and related components for both the environments are presented in table 2. In general the magnitude of associations were not similar but trend was same for all most all the traits. This may be due to modifying effect of environment on association of characters. In both the environments seed cotton yield was found to be positively and significantly associated with number of sympodia per plant, number of bolls per plant, boll weight, mean halo length and lint yield. This is in conformity with Aher *et al.* (1989), Tomar and Singh (1991) in arboreum cotton. The other character pairs which showed positive and significant association at both the environments are plant height with boll weight, number of sympodia per plant with number of bolls per plant, boll weight, mean halo length, lint yield; number of bolls with boll weight, mean halo length, lint yield; boll weight with mean halo length and lint yield; seed index with lint index, mean halo length; lint index with mean halo length; mean halo length with lint yield.

However in addition to the above at E_1 seed cotton yield was positively and significantly associated with plant height while in E_2 with seed index, and ginning out turn. In E_1 plant height was found to be positively and significantly associated with number of sympodia per plant, number of bolls per plant, mean halo length and lint yield. Significant and positive association on number of monopodia with seed index and lint index was observed in E_1. At E_2 number of sympodia was found positively associated with seed index and negatively with ginning out turn at E_1. At E_1 boll weight was found positively associated with seed index and negatively with ginning out turn. Significant and positive association was observed between seed index and lint yield at E_2 while in negative direction with ginning out turn at E_1. Ginning out turn and mean halo length in negative direction at E_1 and with lint yield in positive direction at E_2. These results indicated that the association between different traits differed with environment and hence the correlation response of different traits to section may vary with the environments.

Path analysis (tabe 3) revealed that in both the environments lint yield exhibited high direct effect in both the environments confirming their strong phenotypic correlation coefficients with seed cotton yield. Number of sympodia, number of bolls per plant, boll weight which showed high positive correlation with seed cotton yield, had low effect on yield and exhibited positive indirect effects via lint yield. This shows that while aiming for improvement of seed cotton yield due weightage may be given for lint yield with simultaneous selection for the above component traits.

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Table 1: Genetic parameters of variation for E_1 (Konanki) and E_2 (Uppugunduru) environments.

S. No	Source		Range		Mean	GCV (%)	PCV (%)	PCV-GCV	GCV-PCV (E1-E2)	Variability (Broad sense)	GA as % of mean
			Maximum	Minimum							
1	Plant height (cm)	E_1 E_2	83.00 80.60	114.6 132.7	94.42 104.40	10.49 16.43	13.67 19.30	3.18 2.87	-5.94	72.5 58.9	28.81 16.59
2	No. of monopodia	E_1 E_2	0.80 1.00	1.40 1.36	1.11 1.19	12.48 9.84	21.71 15.75	9.23 5.91	-2.64	33.1 39.1	14.78 12.68
3	No. of sympodia	E_1 E_2	6.80 6.26	13.36 11.40	9.96 8.40	21.99 20.88	23.44 21.99	1.45 1.11	-1.11	88.0 90.1	42.50 40.84
4	No. of bolls per plant	E_1 E_2	1.84 2.50	11.97 6.78	6.47 4.02	45.94 31.92	49.07 34.43	3.13 2.51	-14.02	87.6 56.0	88.60 60.97
5	Boll weight (g)	E_1 E_2	1.65 1.72	2.06 2.01	1.83 1.87	6.10 4.24	8.23 6.69	2.13 2.45	-1.86	54.9 40.2	9.30 5.54
6	Seed index (g)	E_1 E_2	5.62 5.33	7.45 6.86	6.09 5.77	8.88 8.06	10.36 8.68	1.48 0.62	-0.82	73.4 86.3	15.67 15.43
7	Lint index (g)	E_1 E_2	3.53 3.50	4.88 4.54	3.93 3.79	11.28 7.22	11.80 8.65	0.52 1.43	-4.06	91.3 69.6	22.21 12.41
8	Ginning out turn (%)	E_1 E_2	32.00 32.20	34.06 33.33	33.27 32.79	1.46 0.51	2.65 2.03	1.19 1.52	-0.95	30.5 6.4	1.67 0.26
9	Mean halo length mm)	E_1 E_2	21.23 20.40	25.00 24.20	22.63 21.78	4.31 5.05	6.76 5.93	2.45 0.88	-0.74	40.7 72.4	5.66 8.85
10	Lint yield (kg/ha)	E_1 E_2	49.80 49.90	264.8 188.3	163.50 102.34	45.89 41.34	45.95 41.45	0.06 0.11	-4.55	99.7 99.4	94.42 84.93
11	Seed cotton yield kg/ha)	E_1 E_2	150.50 155.10	814.8 567.1	493.26 311.01	46.79 40.70	46.80 40.74	0.01 0.04	-6.09	99.9 99.8	96.36 83.78

Table 2a: Phenotypic correlation coefficients among different yield and its component traits in *Gossypium herbaceum* in E_1 (Konanki)

S.No	Source	2	3	4	5	6	7	8	9	10	11
1	Plant height (cm)	-0.0808	0.8035**	0.8259**	0.5390**	0.2419	0.2291	-0.1740	0.6057**	0.8453**	0.8530**
2	No. of monopodia		-0.0490	-0.2091	-0.0207	0.3616*	0.3695*	-0.3142	0.1310	-0.1210	-0.1077
3	No. of sympodia			0.8576**	0.6491**	0.2609	0.2478	-0.3599*	0.6073**	0.9386**	0.9433--
4	No. of bolls per plant				0.6849**	0.1516	0.0845	-0.2364	0.4634**	0.9328**	0.9284**
5	Boll weight (g)					0.4046*	0.3366	-0.4214*	0.5239**	0.7214**	0.7334**
6	Seed index (g)						0.8201**	-0.5606**	0.4533**	0.2438	0.2795
7	Lint index (g)							-0.5880**	0.5259**	0.1823	0.2281
8	Ginning out turn (%)								-0.4883**	-0.2912	-0.3148
9	Mean halo length (mm)									0.5757**	0.5943
10	Lint yield (kg/ha)										0.9979**
11	Seed cotton yield (kg/ha)										

Table 2b: Phenotypic correlation coefficients among different yield and its component traits in *Gossypium herbaceum* in E_2 (Uppugunduru)

S.No	Source	2	3	4	5	6	7	8	9	10	11
1	Plant height (cm)	-0.0715	0.5775**	0.1926	0.3827*	0.0341	-0.0340	0.2266	0.3217	0.2673	0.2650
2	No. of monopodia		0.2722	0.2563	0.2770	0.0353	-0.2839	-0.0017	0.1724	0.2672	0.2664
3	No. of sympodia			0.6036**	0.5747**	0.4088**	0.0582	0.0795	0.6640**	0.6942**	0.6974**
4	No. of bolls per plant				0.4502**	0.6378**	0.2743	0.2924	0.6303**	0.9453**	0.9453**
5	Boll weight (g)					0.3088	0.1510	0.2012	0.5507**	0.5370**	0.5499**
6	Seed index (g)						0.7530**	0.0954	0.7356**	0.6393**	0.6427**
7	Lint index (g)							-0.1033	0.4181*	0.2804	0.2941
8	Ginning out turn (%)								0.1840	0.3716*	0.3536*
9	Mean halo length (mm)									0.7331**	0.7396**
10	Lint yield (kg/ha)										0.9981**
11	Seed cotton yield (kg/ha)										

Table 3a: Direct and indirect effects of yield components on seed cotton yield in *Gossypium herbaceum* in E_1 (Konanki)											
S.No	**Source**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Plant height (cm)	**0.0303**	0.0006	0.0299	-0.0051	0.0100	0.0000	0.0102	0.0001	-0.0058	0.7826
2	No. of monopodia	-0.0025	**-0.0079**	-0.0018	0.0013	-0.0004	0.0001	0.0165	0.0003	-0.0012	-0.1120
3	No. of sympodia	0.0244	0.0004	**0.0372**	-0.0053	0.0121	0.0000	0.0111	0.0003	-0.0058	0.8689
4	No. of bolls per plant	0.0251	0.0017	0.0319	**-0.0062**	0.0127	0.0000	0.0038	0.0002	-0.0043	0.8636
5	Boll weight (g)	0.0164	0.0002	0.0242	-0.0043	**0.0186**	0.0001	0.0150	0.0004	-0.0050	0.6678
6	Seed index (g)	0.0073	-0.0029	0.0097	-0.0009	0.0075	**0.0002**	0.0367	0.0005	-0.0046	0.2257
7	Lint index (g)	0.0070	-0.0029	0.0092	-0.0005	0.0063	0.0002	**0.0447**	0.0050	-0.2366	0.1688
8	Ginning out turn (%)	-0.0053	0.0025	-0.0134	0.0015	-0.0078	-0.0001	-0.0263	**-0.0008**	0.0046	0.2696
9	Mean halo length (mm)	-0.0184	-0.0010	0.0226	-0.0029	0.0098	0.0001	0.0235	0.0004	**-0.0095**	0.5330
10	Lint yield (kg/ha)	0.0256	0.0010	0.0350	-0.0058	0.0134	0.0000	0.0081	0.0002	-0.0055	**0.9258**

Table 3b: Direct and indirect effects of yield components on seed cotton yield in *Gossypium herbaceum* in E_2 (Uppugunduru)											
S.No	**Source**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Plant height (cm)	**-0.0140**	-0.0002	0.0094	0.0094	0.0058	-0.0017	-0.0015	-0.0014	0.0081	0.2511
2	No. of monopodia	0.0010	**0.0030**	0.0044	0.0125	0.0042	-0.0018	-0.0123	0.0000	0.0043	0.2510
3	No. of sympodia	-0.0081	0.0008	**0.0163**	0.0295	0.0087	-0.0207	0.0025	-0.0005	0.0167	0.6521
4	No. of bolls per plant	-0.0027	0.0008	0.0098	**0.0489**	0.0068	-0.0322	0.0119	-0.0018	0.0016	0.8880
5	Boll weight (g)	-0.0054	0.0008	0.0094	0.0220	**0.0151**	-0.0156	0.0065	-0.0013	0.0138	0.5044
6	Seed index (g)	-0.0005	0.0001	0.0067	0.0312	0.0047	**-0.0505**	0.0326	-0.0006	0.0185	0.6005
7	Lint index (g)	0.0005	-0.0009	0.0009	0.0134	0.0023	-0.0380	**0.0433**	0.0006	0.0105	0.2634
8	Ginning out turn (%)	-0.0032	0.0000	0.0013	0.0143	0.0030	-0.0048	-0.0045	**-0.0063**	0.0046	0.3491
9	Mean halo length (mm)	-0.0045	0.0005	0.0108	0.0308	0.0083	-0.0372	0.0181	-0.0012	**0.0251**	0.6887
10	Lint yield (kg/ha)	-0.0038	0.0008	0.0113	0.0462	0.0081	-0.0323	0.0122	-0.0023	0.0184	**0.9394**

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