



Genetic Variability and Character Association Studies in Introgressed lines of *Gossypium hirsutum*

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ABSTRACT

Eighty two introgressed lines along with two checks were evaluated for yield and its component traits. Wide range of genotypic coefficient of variation and phenotypic coefficient of variation, high heritability accompanied by high genetic advance were observed for number of bolls per plant, seed cotton yield per plant and number of monopodia revealing the role of additive gene action. The phenotypic and genotypic correlations revealed significant and positive correlation of number of bolls per plant with seed cotton yield. Path analysis further confirmed this relationship. It clearly indicated that boll number is amenable to selection. However care should be taken in boll weight and boll number since they are negatively correlated with each other *vis a vis* boll weight is positively correlated with important fibre characters.

Key words : *Gossypium hirsutum*, Introgression, Variability.

In the changing national and international textile scenario, competitiveness of Indian cotton in terms of price and quality assumes great significance. In order to meet the above challenges, genetic variability was created involving different wild species of cotton in different Cotton Research Centres across the country. Since the sources of phenotypic selection depends upon the range of genetic diversity available in the population for important economic traits and their inter relationships. So an attempt was made to assess the nature and extent of genetic variability for important traits, association among themselves and their relative contribution to yield. This information will be of great help to breeders while selecting genotypes for improvement programmes.

MATERIAL AND METHODS

The experiment was conducted at Regional Agricultural Research Station, Lam, Guntur during *kharif* 2003-04 with eighty two variable introgressed lines along with two local checks. Each entry was sown in two rows of six meters length spaced 120cm between rows and 60cm within the row. Observations were recorded on five randomly selected plants per entry for seventeen characters *viz.*, days to 50% flowering, number of monopodia, number of sympodia, number of bolls per plant, boll weight (g), number of seeds per boll, seed index (g), lint index (g), ginning out-turn (%), 2.5% span length (mm), maturity coefficient, uniformity ratio, micronaire (10^{-6} g/inch), bundle strength (g/tex), fibre elongation (%), fibre quality index, seed cotton

yield per plant (g). The mean values were subjected to analysis by using standard statistical procedures.

RESULTS AND DISCUSSION

The estimates of variability parameters *viz.*, range, mean, coefficient of variation (GCV and PCV), heritability (broad sense) and genetic advance as per cent of mean were worked out and presented in Table 1. The phenotypic coefficients of variability were more than the genotypic coefficients of variability. Wide range of variability was observed for number of bolls per plant followed by seed cotton yield per plant and number of monopodia per plant. High heritability accompanied by high genetic advance was observed in case of seed cotton yield per plant, number of monopodia, number of sympodia, number of bolls per plant, boll weight, seed index and micronaire. Similar results were also reported by Altaher and Singh (2003), Kaushik *et al.*, (2003) and Sambamurthy *et al.*, (2006)

The phenotypic and genotypic correlation coefficients were presented in Table 2. In the present study the genotypic correlation coefficients were higher than the phenotypic correlation coefficients revealing that the environmental factors had not played much role in educing their actual association. Seed cotton yield per plant was found significantly and positively correlated with number of bolls per plant followed by number of sympodia and lint index. The above findings are in accordance with the results reported by Samba Murthy and Rao (1999), Rao *et al.*, (2001), Altaher and Singh (2003) and Muthu *et al.*, (2004). Number of bolls per plant and boll weight

Table 1. Variability, heritability and genetic advance as per cent of mean for different characters in cotton.

S.No	Source	Range		Mean	GCV(%)	PCV(%)	Heritability (Broad sense)	GA as percent of mean
		Minimum	Maximum					
1	Days to 50% flowering	52.00	66.00	56.83	5.374	6.122	77.71	9.717
2	No. of monopodia	0.30	3.00	1.79	28.669	34.532	68.90	49.032
3	No. of sympodia	8.80	20.20	15.17	16.406	17.476	88.10	31.277
4	No. of bolls/plant	12.10	58.80	25.44	34.871	37.468	86.60	66.855
5	Boll weight (g)	2.42	4.57	3.50	14.053	14.590	92.80	27.883
6	No. of seeds /boll	21.50	32.00	27.35	6.919	8.571	65.20	11.504
7	Seed index (g)	5.93	11.03	7.99	14.432	14.865	94.30	28.863
8	Lint index (g)	3.22	7.08	5.29	15.807	16.118	96.20	31.993
9	Ginning outturn (%)	32.60	38.70	35.60	5.251	6.010	76.30	9.452
10	2.5% span length (mm)	20.69	30.97	25.67	7.084	8.431	70.60	12.262
11	Maturity coefficient	0.56	0.69	0.63	3.324	4.252	61.10	5.353
12	Uniformity ratio	44.20	53.90	48.81	4.967	5.411	84.30	9.391
13	Micronaire (10 ⁻⁶ g/inch)	2.66	4.89	3.70	11.869	12.223	94.30	23.743
14	Bundle strength (g/tex)	18.20	28.50	23.81	7.565	9.192	67.70	12.825
15	Fibre elongation (%)	6.10	6.90	6.49	1.847	2.971	38.60	2.365
16	Fibre quality index	233.70	444.60	318.89	11.379	13.615	69.90	19.590
17	Seed cotton yield/ plant (g)	40.00	163.57	76.24	31.618	32.281	95.90	63.795

Table 2. Phenotypic (P) and genotypic (G) correlation coefficients among seed cotton yield and its attributing characters in cotton.

S.N	Source	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Days to 50% flowering	G -0.2665**	0.0772	0.0753	0.0659	0.1328	0.2869**	0.1709*	-0.0070	0.2621**	0.2346**	0.0157	-0.0449	-0.3713**	-0.2381**	-0.0733	0.1578*
		P -0.2098**	0.0719	0.0707	0.0437	0.0731	0.2497**	0.1647*	0.0051	0.1659**	0.1621*	0.0304	-0.0388	-0.2520**	-0.1055	-0.0546	0.1348
2	No. of monopodia	G 1.0000	-0.0401	-0.0976	-0.0013	-0.0811	-0.0474	0.0107	0.1269	0.0831	-0.1878	-0.3075**	0.0252	-0.02322	0.2441**	0.0450	-0.0869
		P 1.0000	-0.0226	-0.0775	-0.0224	-0.0237	-0.0296	0.0216	0.1551*	0.0492	-0.1293	-0.2256**	0.0249	0.0072	0.1178	0.0321	-0.0703
3	No. of sympodia	G 1.0000	0.1060	0.1445	0.0064	-0.0587	-0.0479	0.1634*	0.0279	0.1576*	0.0094	-0.1246	-0.0858	0.0943	-0.2033**	0.1980*	0.1915*
		P 1.0000	0.1060	0.1445	0.0064	-0.0587	-0.0479	0.1634*	0.0279	0.1576*	0.0094	-0.1246	-0.0858	0.0943	-0.2033**	0.1980*	0.1915*
4	No. of bolls/plant	G 1.0000	-0.4715**	1.0000	0.0226	0.0325	-0.1447	-0.0842	-0.0054	0.0983	-0.0373	-0.1268	-0.0797	0.0773	-0.1128	0.1396	0.1740*
		P 1.0000	-0.4715**	1.0000	0.0226	0.0325	-0.1447	-0.0842	-0.0054	0.0983	-0.0373	-0.1268	-0.0797	0.0773	-0.1128	0.1396	0.1740*
5	Boll weight (g)	G 1.0000	-0.4383**	1.0000	0.0459	0.0402	-0.1216	-0.0787	-0.0221	-0.1741*	0.0433	-0.0121	0.0053	0.1317	-0.0602	-0.0319	0.7592**
		P 1.0000	-0.4383**	1.0000	0.0459	0.0402	-0.1216	-0.0787	-0.0221	-0.1741*	0.0433	-0.0121	0.0053	0.1317	-0.0602	-0.0319	0.7592**
6	No. of seeds/boll	G 1.0000	-0.0126	1.0000	0.0200	0.0200	0.3211**	0.1651*	0.1725*	0.1860*	-0.1210	0.0510	0.1107	-0.0811	-0.0354	0.0060	-0.0907
		P 1.0000	-0.0126	1.0000	0.0200	0.0200	0.3211**	0.1651*	0.1725*	0.1860*	-0.1210	0.0510	0.1107	-0.0811	-0.0354	0.0060	-0.0907
7	Seed index (g)	G 1.0000	-0.0316	1.0000	1.0000	1.0000	0.3647**	0.3397**	-0.3047**	0.4425**	-0.0009	-0.2505**	-0.1490	-0.2362**	0.0063	0.1999*	0.0610
		P 1.0000	-0.0316	1.0000	1.0000	1.0000	0.3647**	0.3397**	-0.3047**	0.4425**	-0.0009	-0.2505**	-0.1490	-0.2362**	0.0063	0.1999*	0.0610
8	Lint index (g)	G 1.0000	0.1562*	1.0000	1.0000	1.0000	0.1562*	0.1239	0.1949*	0.0836	-0.1284	0.0661	0.0428	0.1242	-0.0332	0.2495**	0.1670*
		P 1.0000	0.1562*	1.0000	1.0000	1.0000	0.1562*	0.1239	0.1949*	0.0836	-0.1284	0.0661	0.0428	0.1242	-0.0332	0.2495**	0.1670*
9	Ginning outturn (%)	G 1.0000	0.1095	1.0000	1.0000	1.0000	0.1095	0.1095	0.1095	0.0745	-0.0111	0.0206	-0.934	-0.0533	-0.0316	-0.0925	0.1573*
		P 1.0000	0.1095	1.0000	1.0000	1.0000	0.1095	0.1095	0.1095	0.0745	-0.0111	0.0206	-0.934	-0.0533	-0.0316	-0.0925	0.1573*
10	2.5% span length (mm)	G 1.0000	-0.0866	1.0000	1.0000	1.0000	-0.0866	-0.2891**	-0.2729**	0.3081**	-0.3081**	-0.2167**	-0.3728**	-0.1870*	-0.0694	-0.1732*	0.0910
		P 1.0000	-0.0866	1.0000	1.0000	1.0000	-0.0866	-0.2891**	-0.2729**	0.3081**	-0.3081**	-0.2167**	-0.3728**	-0.1870*	-0.0694	-0.1732*	0.0910
11	Maturity coefficient	G 1.0000	0.1876*	1.0000	1.0000	1.0000	0.1876*	0.1640*	0.1422	0.1363	0.1422	0.1363	0.1422	0.1363	0.1422	0.1363	0.0741
		P 1.0000	0.1876*	1.0000	1.0000	1.0000	0.1876*	0.1640*	0.1422	0.1363	0.1422	0.1363	0.1422	0.1363	0.1422	0.1363	0.0741
12	Uniformity ratio	G 1.0000	0.0029	1.0000	1.0000	1.0000	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0610
		P 1.0000	0.0029	1.0000	1.0000	1.0000	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0029	0.0610
13	Micronaire (10 ⁶ g/inch)	G 1.0000	0.0954	1.0000	1.0000	1.0000	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0582
		P 1.0000	0.0954	1.0000	1.0000	1.0000	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0954	0.0582
14	Bundle strength (g/tex)	G 1.0000	0.4810**	1.0000	1.0000	1.0000	0.4810**	0.4669**	0.1491	0.1623*	1.0000	1.0000	1.0000	1.0000	0.4977**	0.1164	0.1491
		P 1.0000	0.4810**	1.0000	1.0000	1.0000	0.4810**	0.4669**	0.1491	0.1623*	1.0000	1.0000	1.0000	1.0000	0.4977**	0.1164	0.1491
15	Fibre elongation (%)	G 1.0000	0.1974*	1.0000	1.0000	1.0000	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.0257
		P 1.0000	0.1974*	1.0000	1.0000	1.0000	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.1974*	0.0257
16	Fibre quality index	G 1.0000	0.0240	1.0000	1.0000	1.0000	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240
		P 1.0000	0.0240	1.0000	1.0000	1.0000	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240	0.0240
17	Seed cotton yield/plant (g)	G 1.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		P 1.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

*, ** significant at 5% and 1% respectively

Table 3. Phenotypic path of ten characters towards seed cotton yield

S.N	Source	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	SCY
1	Days to 50% flowering	0.0387	-0.0081	0.0028	0.0027	0.0017	0.0028	0.0097	0.0064	0.0002	0.0064	0.0063	0.0012	-0.0015	-0.0041	-0.0097	-0.0021	0.1348
2	No. of monopodia	-0.102	0.0489	-0.0011	-0.0038	-0.0011	-0.0012	-0.0014	0.0110	0.0076	0.0024	-0.0063	-0.0110	0.0012	0.0058	0.0004	0.0016	-0.0703
3	No. of sympodia	0.0049	-0.0015	0.0680	0.0072	0.0015	-0.0014	-0.0029	0.0098	0.0042	0.0067	-0.0025	-0.0086	-0.0054	-0.0077	0.0053	0.0095	0.1740*
4	No. of bolls/plant	0.0623	-0.0683	0.0934	0.8814	-0.3863	0.0354	-0.1072	-0.0694	-0.0195	-0.1535	0.0382	-0.0106	0.0046	-0.0531	0.1161	-0.0281	0.7592**
5	Boll weight (g)	-0.0118	-0.0060	0.0061	-0.1180	0.2693	0.0054	0.0865	0.1145	0.0445	0.0501	-0.326	0.0137	0.0298	-0.0095	-0.0218	0.0016	-0.0907
6	No. of seeds/boll	-0.0068	0.0022	0.0020	-0.0037	-0.0019	-0.0928	0.0029	0.0021	-0.0092	-0.0060	-0.0068	-0.0071	-0.0105	0.0013	-0.0053	-0.0011	-0.0369
7	Seed index (g)	0.0002	0.0000	0.0000	-0.0001	0.0003	0.0000	0.0008	0.0003	-0.0002	0.0003	0.0000	-0.0002	-0.0001	0.0000	-0.0001	0.0001	0.0550
8	Lint index (g)	0.0158	0.0021	0.0138	-0.0076	0.0408	-0.0022	0.0326	0.0960	0.0119	0.0187	-0.0080	0.0053	-0.0038	-0.0009	0.0114	0.0200	0.1573*
9	Ginning outturn (%)	-0.0007	-0.0213	-0.0084	0.0030	-0.0226	-0.0136	0.0347	-0.0170	-0.1371	*-0.0049	-0.0052	0.0049	-0.0005	0.0073	0.0089	0.0062	-0.0869
10	2.5% span length (mm)	0.0584	0.0173	0.0346	-0.0613	0.0655	0.0227	0.1209	0.0687	0.0125	0.3524	-0.0144	-0.0794	-0.0823	0.0706	-0.0764	0.2018	-0.0244
11	Maturity coefficient	0.0174	-0.0138	-0.0040	0.0046	-0.0130	0.0078	-0.0020	-0.0089	0.0041	-0.0044	0.1071	0.0249	0.0046	-0.0074	-0.0200	-0.0186	0.0910
12	Uniformity ratio	0.0014	-0.0103	-0.0058	-0.0006	0.0023	0.0035	-0.0104	0.0025	-0.0016	-0.0103	0.0106	0.0456	0.0075	-0.0032	0.0065	-0.0064	0.0610
13	Micronaire (10 ⁶ g/inch)	0.0057	-0.0037	0.0118	-0.0008	-0.0163	-0.0167	0.0215	0.0058	-0.0005	0.0345	-0.0063	-0.0242	-0.1475	-0.0141	0.0013	0.0872	0.0555
14	Bundle strength(g/tex)	-0.0843	0.0024	0.0259	0.0441	-0.0272	0.0190	-0.0592	0.0398	-0.0218	-0.0725	-0.0626	0.0476	-0.0030	0.0543	0.3367	0.01834	0.1164
15	Fibre elongation (%)	-0.0036	0.0040	-0.0038	-0.0020	-0.0012	-0.0005	-0.0003	-0.0003	-0.0018	0.0068	-0.0024	-0.0024	0.032	0.0340	0.0055	0.0067	-0.0133
16	Fibre quality index	0.0239	-0.0141	-0.0612	0.0140	-0.0026	-0.0051	-0.0710	-0.0939	0.0200	-0.2511	0.0760	0.0613	0.2590	-0.0865	-0.2403	-0.4385	0.0240

Residual effect = 0.5385 SCY = Seed Cotton Yield

were negatively correlated. Boll weight is positively associated with seed index, lint index, ginning out turn and 2.5% span length. Similar results were earlier reported by Rao *et al.*, (2001), Altaher and Singh (2003) and Muthu *et al.*, (2004). Fibre quality index involves the important parameters to decide the fibre quality and ultimately the yarn quality. The fibre quality index in the present study is found positively associated with lint index, 2.5% span length, bundle strength, fibre elongation ratio and seed index and negatively correlated with maturity coefficient and micronaire. Altaher and Singh (2003) and Kaushik *et al.*, (2003) also observed similar association. Individually, 2.5% span length showed negative association with uniformity ratio, micronaire and bundle strength while it had positive association with fibre elongation.

Partitioning of the correlation coefficient estimates into direct and indirect effects through path analysis (Table 3) showed that direct positive effects of boll number were higher followed by 2.5% span length and boll weight. These findings are in agreement with Altaher and Singh (2003). Direct selection for these traits can be made to improve the yield. Fibre quality index showed considerable negative direct effect on seed cotton yield but its correlation value was positive and non significant. However by improving the fibre quality index related fibre parameters these negative effects can be minimized to some extent. High residual effect revealed the inadequacy of traits studied for path analysis and involvement in modifying these character association as reported by Gururajan (2000).

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