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Genetic variability for morpho-physiological traits in parental lines of *Gossypium*

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SUMMARY

In present investigation attempt is being made to study genetic variability at both morphological and physiological level so as assess different traits of parental lines of cotton which will help to develop varieties and hybrids suitable for rainfed condition. Genotypes having CSI lower than the checks coupled with yield higher than or at least comparable with the checks (LH-1556, RHC-2004 and RHBB-9923) will be useful for water stress condition and high temperature and are traced out in present study. The high magnitude of PCV and GCV was recorded in all the traits studied except GP suggesting the presence of wide variability for these traits.

Key words : Genetic variability, morpho-physiological traits and *Gossypium*

Cotton is the most important textile fiber crop and is the second most important oilseed crop in the world (Cherry and Leffler, 1984). While developing ideal plant types, they become less and less diverse because of genetic erosion. Therefore, study of variability of material to be used for breeding need to be focused because it is prerequisite for any successful breeding programme. Though India ranks 1st in respect of cotton area in world, most of it is under rainfed condition and there are limitations to bring more and more area under irrigated condition. Hence, it is very much important to develop varieties suitable for rainfed situation. However, very few attempts have been made to study genetic variability jointly at morphological and important physiological attributes like CSI, stomata density, leaf area etc which influence water requirement of plant. Therefore, present study was undertaken to know genetic variability for morphological and physiological traits in maintainer and restorer lines of *G. hirsutum*.

MATERIALS AND METHODS

A field experiment was conducted with twenty-six genotypes of *Gossypium hirsutum* which were sown in randomized block design with three replications at All India Co-ordinated Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri during *Kharif* 2007. Each entry was sown in two rows of 4.8 m length spaced 90 cm apart. Plants were spaced at 60 cm within a row. All the routine cultural practices were followed to grow good crop. Fertilizers were applied @ 100 kg N: 50 kg P_2O_5: 50 kg K_2O/ ha. Ten plants were randomly taken in each treatment within each replication for recording the observations on 10 quantitative characters. The data on physiological parameters were recorded at 50 per cent flowering while that on yield and yield components were recorded after harvesting. The observations were recorded on trichome density, adaxial and abaxial stomata density, number of leaves per plant, CSI, leaf area, seed cotton yield per plant, lint yield per plant, harvest index and ginning percentage. The analysis of variance was done as suggested by Panse and Sukhatme (1985). The phenotypic and genotypic variances were calculated as per formula suggested by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The existence of genetic variability present in the breeding programme is responsible for the effective selection. Larger is the variability greater the scope of selection and improvement. The main objective of any breeding programme is to study the genetic variability in the material under study and utilization of suitable breeding procedure with the help of selection in the desired direction. The results revealed the presence of wide range of variability among the parental lines of *Gossypium*. The estimates of mean, range, phenotypic and genotypic coefficient of variance, heritability, genetic advance and expected genetic advance to all the characters are presented in Table 1 and 2.

The treatment mean squares were significant for all the characters studied, suggesting the presence of substantial variability for various characters studied in genotypes evaluated. On the basis of mean performance, the promising parental lines were RHBB-9714(chlorophyll stability index), RHCb-001 (adaxial stomata density),

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RHC-056 (abaxial stomata density), RHC-98034 (ginning out turn), RHBB-9714 (harvest index), RHC-2022 (seed cotton yield per plant and lint yield per plant). Less stomata density indicated less transpiration rate which indirectly reflects higher WUE. Therefore, genotypes with less stomata density coupled with higher yield are most appreciable. RHBB-9714, RHC-035, RHC-2004, RHC-2022, RHC-054 parental lines shown judicious combination of stomata density lower than the checks but yield higher than the checks and are, therefore, valuable. Lower CSI indicates tolerance of genotype to water stress condition and high temperature. The genotypes having CSI lower than the checks coupled with yield higher than or at least comparable with the checks *viz.*, LH-1556, RHC-2004 and RHBB-9923 will be useful for water stress condition. Similarly genotype LH-1556 recorded low abaxial stomata density and CSI simultaneously lower than the check indicating the best possible performance of the genotype under rainfed condition. Lower the number of leaves, lower will be the expected transpiration rate and thus higher WUE can be expected in such parental lines. Bichkar (2005) was also able to isolate four *Rabi* sorghum hybrids with leaf area (number of leaves) significantly lower but grain yield significantly higher than the checks. Greater leaf area indicates more surface available for the process of photosynthesis but at the same time it will cause higher transpiration losses and ultimately lower WUE.

On the other hand ideal combination of the lowest leaf area and the highest yield is available among the checks themselves (LRA-5166). In accordance with the above, parental lines RHC-2022 and RHBB-9923 having leaf area lower but yield higher than checks were sorted out. Low harvest index indicates production of

Table 1 : Mean performance of 26 parental lines of *Gossypium*

Sr. No.	Genotypes	Trichme density (No./ cm^2)	Adaxial stomata deisnty (No/ mm^2)	Abaxial stomata density (No/ mm^2)	CSI (nm)	No. of leaves/ plant	Leaf area (cm^2/1) leaves/plant)	Seed cotton yield (g/ plant)	Lint yield (g/ plant)	Harvest index (%)	Ginning outterm (%)
1.	RHC-054	218.09	120.50	142.13	0.758	171.86	620.00	113.13	41.53	36.16	36.67
2.	RHC-035	148.76	101.82	135.82	0.773	109.70	606.66	98.20	34.93	35.84	35.63
3.	RHC-056	230.45	78.44	100.78	0.640	114.36	627.00	85.60	30.80	25.52	36.03
4.	RHC-058	191.06	90.47	121.14	0.722	105.60	687.00	84.73	31.63	23.50	37.28
5.	RHC-003	192.46	137.18	161.45	0.670	105.56	665.00	79.26	30.53	22.02	38.41
6.	RHC-004	171.46	113.16	144.79	0.860	89.96	615.00	86.20	32.33	21.33	37.48
7.	RHC-006	154.81	139.47	166.11	0.633	95.00	488.33	94.73	35.06	38.34	37.01
8.	RHCb-001	246.78	68.45	102.78	0.838	98.10	692.00	74.33	26.33	20.47	35.36
9.	RHC-0688	238.45	82.78	113.80	0.742	105.46	677.00	86.33	31.93	38.46	36.97
10.	RHC-2022	245.44	119.78	142.14	0.880	93.33	470.00	127.66	45.86	38.83	35.94
11.	RHC-2004	183.43	113.16	131.80	0.630	119.33	690.66	114.93	41.40	37.32	36.04
12.	CPD-420	168.81	127.88	164.45	0.922	144.13	492.33	57.60	20.93	28.94	36.14
13.	DS-28	151.83	144.88	167.51	0.914	105.80	470.00	98.06	36.06	32.09	36.76
14.	LH-1556	166.50	130.09	152.80	0.629	146.53	635.00	114.83	42.08	27.01	37.33
15.	RHC-98034	165.96	98.46	122.51	0.822	114.56	647.33	97.20	38.33	33.13	39.39
16.	AKH-8801	115.18	125.42	146.80	0.811	125.80	660.33	108.00	40.40	37.61	38.03
17.	AKH-8649	126.20	127.68	158.73	0.698	139.63	642.00	87.56	34.00	32.40	38.82
18.	CNH-1009	165.91	132.57	174.74	0.648	122.03	720.00	100.40	37.60	20.02	37.38
19.	VRS-7	109.49	154.56	181.72	0.735	89.76	630.00	74.60	27.66	24.66	37.09
20.	RHBB-9712	117.39	107.87	129.38	0.629	78.83	675.00	60.06	21.66	25.98	36.01
21.	RHBB-9714	153.38	83.89	105.75	0.660	159.90	683.00	109.20	35.80	41.04	32.77
22.	RHBB-9923	163.40	138.37	177.53	0.636	91.46	427.00	112.33	40.60	31.51	36.10
23.	RHRGP-9945	205.71	160.63	186.95	0.683	138.63	615.00	109.33	40.06	36.86	36.64
24.	LRA-5166	176.69	141.79	169.51	0.657	166.26	417.00	116.73	41.80	41.00	35.78
25.	JLH-168	209.37	121.47	170.87	0.787	177.36	605.00	96.46	35.00	33.78	36.25
26.	PKV-Rajat	241.03	155.43	189.84	0.715	162.40	502.00	112.20	43.66	20.54	38.87
	Mean	178.96	119.85	148.53	0.746	121.97	602.29	96.14	35.33	30.94	36.77
	S.E. ±	9.53	10.81	12.14	0.008	10.11	14.22	5.98	2.30	4.82	0.98
	C.D. (P=0.05)	27.08	30.69	34.47	0.021	28.72	40.40	17.00	6.54	13.68	2.80

Table 2 : Component of genetic variation in parental lines of *Gossypium*

Sr. No.	Characters	General mean	Range	Phenotypic variance	Genotypic variance	PCV (%)	GCV (%)	Heritability h^2 (bs) (%)	Genetic advance(actual)	GA (% of mean)
1.	Trichome density (No/cm^2)	178.96	109.49-246.78	1686.54	1595.55	22.94	22.31	94.60	80.09	44.71
2.	Adaxial stomata density (No/mm^2)	119.85	68.45-160.63	623.94	507.04	20.84	18.78	81.26	41.80	34.87
3.	Abaxial stomata density (No/mm^2)	148.53	100.78-189.84	708.29	560.79	17.91	15.94	79.17	43.40	29.22
4.	Chlophyll stability index (nm)	0.746	0.629-0.929	0.01	0.00994	13.40	13.36	99.40	0.204	27.34
5.	No. of leaves/ plant	121.97	78.83-177.36	824.13	721.77	23.53	22.02	87.57	51.78	42.45
6.	Leaf area (cm^2/ 10 leaves/ plant)	602.29	417.00-720.00	8139.44	7937.07	14.97	14.79	97.50	181.23	30.09
7.	Seed cotton yield (g/ plant)	96.14	57.60-127.66	318.58	282.76	18.56	17.49	88.80	32.63	33.94
8.	Lint yield (g/ plant)	35.33	20.93-45.86	42.35	37.04	18.41	17.22	87.50	11.72	33.18
9.	Harvest index (%)	30.94	20.47-41.04	49.69	26.44	22.78	16.62	53.22	11.80	38.15
10.	Ginning percentage (%)	36.77	32.77-39.39	1.80	1.58	3.65	3.42	87.60	2.42	6.59

unnecessary and unproductive vegetative biomass. Therefore, parental lines RHC-2022 and LRA-5166 were selected having high harvest index coupled with higher yield. Trichome density indicates non preference type of insect resistance which is the most useful criteria for resistance mechanism. In the present investigation, parental lines RHC-2022, RHC-054, RHRGP-9945 and RHC-2004 possessed high trichome density coupled with higher yield level. The genotypes RHC-2022, RHC-2004, RHBB-9714, PKV-Rajat, and RHCb-001 were superior for most of the traits which contribute towards lower water losses from plant surface and ultimately higher WUE and can, therefore, be used in breeding programme for rainfed situation.

The relative contribution of genotype and environment could be judged by computing phenotypic and genotypic coefficient of variation. The high magnitude of PCV and GCV was recorded in all the traits studied except ginning percentage suggesting the presence of wide variability for these traits. Continuous selection for high ginning percentage since long period might be responsible for low GCV and PCV for GP. The highest magnitude of PCV and GCV was recorded in the number of leaves per plant followed by trichome density, adaxial stomata density, seed cotton yield per plant, lint yield per plant abaxial stomata density, harvest index, leaf area per 10 leaves per plant and CSI suggesting the presence of wide variability for these traits. These results are in accordance with those obtained by Das (1986) and Krishnadoss and Vanasundaram (1993). The difference between GCV and PCV was of small magnitude indicating that the variability was mainly due to genetic factors while the same difference was higher for harvest index indicating greater role of environment in the expression of this trait.

Heritability is the measurement of transmission of an attribute from one generation to the other. The high heritability coupled with high genetic advance for particular characters indicates its suitability of being selected for further improvement. High heritability (bs) and high genetic advance was recorded for all the characters under study except harvest index and ginning outturn, respectively. The highest heritability (bs) was recorded for CSI followed by leaf area per 10 leaves per plant, trichome density, seed cotton yield per plant, ginning out turn, no of leaves per plant, lint yield per plant, adaxial stomata density, abaxial stomata density and harvest index. These results are in conformity with that reported by Krishnadoss and Vanasundaram (1993) and Das (1986). High heritability coupled with high genetic advance was recorded for all the characters except ginning outturn

indicting the possibility of additive gene action.

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