Electronic Journal of Plant Breeding, 9 (3) : 1053 - 1059 (Sep 2018) DOI: 10.5958/0975-928X.2018.00131.X
ISSN 0975-928X

Research Article

Genetic variability and correlation studies in upland cotton (*Gossypium hirsutum* .L)

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Received:08 Aug 2018; Revised:12 Aug 2018; Accepted:17 Aug 2018)

Abstract

A total of fifty-four *Gosypium hirsutum* L F_1 synthesized using six lines (four compact and two non-compact) with nine non-compact testers in line x tester fashion were evaluated for seed cotton yield and fibre quality traits. Analysis of variance revealed significant differences among the genotypes for various characters studied indicating the presence of ample variation for effective selection. The phenotypic coefficient of variation (PCV) was slightly higher in magnitude than genotypic coefficient of variation (GCV) for all characters indicating the influence of environment over the expression of the traits studied. High phenotypic and genotypic coefficients of variation were obtained for number of monopodial branches per plant and single plant yield. High heritability coupled with high genetic advance (as per cent of mean) was observed for characters *viz*., number of monopodial branches per plant, number of sympodial branches per plant, number of bolls per plant, single plant yield and internode length. Correlation studies revealed that seed cotton yield exhibited positive and highly significant corrrelation with number of sympodial branches per plant, number of bolls per plant, boll weight, lint index, ginning out turn and 2.5 per cent span length.

Keywords

Compact and non-compact genotypes, Genetic variability, Heretability, Genetic advance and correlation.

Introduction

Cotton, the world's most important non-food agricultural commodity, is one of the first plant fibres used for textile purposes. Even today, it is an unchallenged natural textile fibre entering our daily life in a variety of ways and is valued the most amongst several hundreds of fibre yielding plants known to mankind. The production of cotton is greater than that of all other fibres put together.

The success of any breeding programme depends mainly upon the spectrum of genetic variability present in the population. In addition to genetic variability, knowledge on heritability and genetic advance helps the breeder to employ a suitable breeding strategy to achieve the objective. Selection for yield will be effective when it is based on its contributing components rather than relying on yield alone. Correlation study provides information on the nature and extent of relationships among characters. Understanding correlation facilitates simultaneous improvement of two or more characters and it aims at achieving the desirable combination of various yield components..

Materials and Methods

The present study was conducted in the experimental field of Department of Cotton, Centre for Plant Breeding and Genetics (CPBG), Tamil Nadu Agricultural University (TNAU), Coimbatore under irrigated condition during *kharif* 2017-18. The material consisted of fifty four F_1 s' obtained by crossing six lines and nine testers and the seeds were obtained from Department of Cotton, Tamil Nadu Agricultural University, Coimbatore.

The material was evaluated in the field in a randomized block design with two replications. The observations were recorded for 16 characters *viz*., days to first flowering, plant height (cm), number of sympodial branches per plant, number of monopodial branches per plant, number of bolls per plant, boll weight (g), internode length (cm), seed index (g), lint index,seed cotton yield per plant (g), ginning percentage (%), 2.5% span length (mm), fibre/bundle strength (g/tex), fibre fineness (mv), uniformity ratio and elongation percentage (%). The data was statistically analysed to estimate genetic variability and genotypic and phenotypic correlation coefficients.

Results and Discussion

The phenotypic co-efficient of variation which measures total variation was found to be greater than genotypic coefficient of variation for all the characters indicating some degree of environmental influence on the traits (Table 1).

In the present study, close correspondence observed between phenotypic and genotypic variances for days to first flowering, plant height, number of monopodial branches per plant, number of sympodial branches per plant, number of bolls per plant, single plant yield, internode length, seed index, ginning out turn, uniformity ratio, bundle strength and elongation percentage indicates less environmental variation. Boll weight, lint index, fibre fineness and 2.5 per cent span length showed higher differences indicating the influence of environment on these characters. Gite *et al.* (2006) observed a narrow variation between PCV and GCV though the magnitude of phenotypic co-efficient of variation was higher than that of genotypic co-efficient of variation.

In the present study, PCV was greater than GCV irrespective of characters and crosses. It is in accordance with the report of Sakthi *et al.* (2007). Low PCV and GCV were observed for days to first flowering (4.69 and 3.95), seed index (9.03 and 8.68), ginning out turn (6.95 and 5.49), 2.5 per cent span length (7.78 and 5.31), uniformity ratio (4.63 and 3.94), elongation percentage (5.41 and 4.08), fibre fineness (6.67 and 4.24) and bundle strength (7.12 and 6.71). Moderate PCV and GCV were recorded for plant height (12.32 and 11.00), number of sympodial branches per plant (11.09 and 10.96), number of bolls per plant (17.21 and 16.99), boll weight (13.21 and 10.97) and internode length (11.42 and 11.15). High PCV and GCV was observed for number of monopodial branches per plant (47.31 and 47.20) and single plant yield (24.42 and 24.25) and moderate PCV and low GCV for lint index (13.43 and 7.80). Moderate PCV and GCV for plant height was reported by Vinodhana *et al.* (2013), Vineela **(**2013), Ranganatha *et al.* (2013) and Dhivya *et al.* (2014).

Moderate PCV and GCV for number of sympodial branches per plant was reported by Dhivya *et al.* (2014) and Dahiphale *et al.* (2015). Moderate PCV and GCV for boll weight was observed by Murthy and Chamundeswari (2006), Vineela **(**2013**)**, Ahsan *et al.* (2015) and Chaudhari (2017). Moderate PCV and GCV for number of bolls per plant was reported by Dhamayanathi *et al.* (2010), Vineela **(**2013**),** Dhivya *et al.* (2014), Dahiphale *et al.*(2015) and Reddy *et al.* (2015).

Low PCV and GCV for ginning out turn, fibre fineness, 2.5 per cent span length, uniformity ratio and bundle strength were reported by Sakthi *et al.* (2007) and Neelima and Reddy, (2008). High PCV and GCV for seed cotton yield was reported by Dinakaran *et al.* (2012), Vinodhana *et al.* (2013), Ranganatha *et al*, (2013), Dahiphale *et al.* (2015) , Shakeel *et al.* (2015) and Chaudhari (2017).

Estimates of heritability along with genetic advance provides an idea about the gene action involved in the expression of various polygenic traits and provides a reliable criterion in selection programme. High heritability coupled with high genetic advance (as % mean) was observed for characters *viz*., number of monopodial branches per plant (97.53 % and 47.00 %), number of sympodial branches per plant (97.5 % and 22.29 %), number of bolls per plant (97.36 % and 34.53 %), single plant yield (98.65 % and 49.62 %) and internode length (95.44 % and 22.44 %) rendering the probability of selecting genotypes for these traits which would behave with fidelity. High heritability coupled with low genetic advance was noticed for characters *viz*., days to first flowering (71.09 % and 6.86 %) and ginning out turn (62.26 % and 8.92 %). High heritability coupled with moderate genetic advance was observed for characters *viz*., boll weight (68.97 % and 18.77 %), seed index (92.56 % and 17.21 %) and bundle strength (88.77 % and 13.03 %).

High heritability coupled with high genetic advance as per cent of mean was reported for number of bolls by Abbas *et al.* (2013), Vinodhana *et al.* (2013), Dahiphale *et al.* (2015) and Reddy *et al.* (2015) and Patil *et al.* (2011). High heritability coupled with high genetic advance as per cent of mean was reported for number of sympodial branches per plant by Vineela **(**2013**)**, Abbas *et al.* (2013), Dhivya *et al.* (2014) and Chaudhari (2017). Medium heritability coupled with medium genetic advance as per cent of mean for boll weight was reported by Preetha and Raveendran (2007) and Ranganatha *et al.* (2013). Low heritability coupled with low genetic advance as per cent of mean for fibre fineness was reported by Abbas *et al.* (2013) .

The correlation studies (Table. 2, 3) revealed that single plant yield had highly positive significant association with six characters *viz*., number of sympodial branches per plant, number of bolls per plant, boll weight, lint index, ginning out turn and 2.5 % span length. Similar results for positive correlation between yield and fibre quality related traits were already reported by Agaudo *et al*. (2008), Do-Thi-Haan *et al*. (2008), Reddy and Reddy (2008), Salahuddin *et al*. (2010), Magadum *et al*. (2012) and Tamilselvam *et al*. (2013)..

Inter correlation among the traits also plays a vital role in selection. The inter correlation between the quantitative yield contributing traits *viz.,* number of sympodial branches per plant, number of bolls per plant and boll weight were positive and significant. Plant height showed positive and highly significant genotypic correlation with number of sympodial branches per plant, number of monopodial branches, internodal length and uniformity ratio. Number of monopodial branches per plant showed positive and highly significant genotypic correlation with internodal length. Number of sympodial branches per plant showed positive and highly significant genotypic correlation with number of bolls per plant, boll weight, lint index and ginning out turn. Number of bolls per plant showed positive and highly significant genotypic correlation with boll weight, lint index, seed index and ginning out turn. Boll weight showed highly significant positive genotypic correlation with lint index, seed index, ginning out turn and 2.5 per cent span length. Internode length showed positive and highly significant genotypic correlation with elongation percentage. Seed index showed positive and highly significant genotypic correlation with 2.5 per cent span length, elongation percentage and fibre strength. Lint index showed positive and highly significant genotypic correlation with seed index, ginning out turn and 2.5 per cent span length. 2.5 per cent span length showed positive and highly significant genotypic correlation with bundle strength and elongation percentage.

Similar results were reported by Agaudo *et al.* (2008), Do-Thi-Haan *et al.* (2008), Reddy and Reddy (2008), Salahuddin *et al.* (2010), Magadum *et al.* (2012), Tamilselvam *et al.* (2013), Rao and Gopinath (2013) and Reddy *et al.* (2015) and Nizamani (2017). On the contrary, Abdullah *et al.* (2016) reported negative inter correlation among various yield and fibre quality traits.

In the present investigation, it may be conclude that the analysis of variance highly significant differences between genotypes for the characters studied indicated the presence of considerable genetic variation in the experimental material.

High heritability coupled with high genetic advance for the characters *viz*., number of monopodial branches per plant, number of sympodial branches per plant, number of bolls per plant, single plant yield and internode length rendering the probability of selecting genotypes for these traits which would behave with fidelity

The Correlaion studies disclosed that number of sympodial branches per plant, number of bolls per plant, boll weight, lint index, ginning out turn and 2.5% span length are most important component traits for improving seed cotton yield in cotton (*Gossypium hirsutum* L).

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Electronic Journal of Plant Breeding, 9 (3) : 1053 - 1059 (Sep 2018) DOI: 10.5958/0975-928X.2018.00131.X
ISSN 0975-928X

Table 1. Components of variance for yield and fibre quality traits

Characters	PCV	GCV	Heritability	GAM
Days to first flowering	4.69	3.95	71.09	6.86
Plant height	12.32	11.00	79.61	20.21
Number of monopodial branches per plant	47.31	47.20	97.53	47.00
Number of sympodial branches per plant	11.09	10.96	97.50	22.29
Number of bolls per plant	17.21	16.99	97.36	34.53
Boll weight	13.21	10.97	68.97	18.77
Single plant yield	24.42	24.25	98.65	49.62
Internode length	11.42	11.15	95.44	22.44
Lint index	13.43	7.80	33.72	9.33
Seed index	9.03	8.68	92.56	17.21
Ginning out turn	6.95	5.49	62.26	8.92
2.5 per cent span length	7.78	5.31	46.62	7.47
Uniformity ratio	4.63	3.94	47.46	5.67
Bundle strength	7.12	6.71	88.77	13.03
Elongation percentage	5.41	4.08	20.01	5.99
Fibre fineness	6.67	4.24	40.00	5.55

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Table 2. Genotypic correlation coefficients between single plant yield with yield components and fibre quality traits

	DFF	PLHT	NMP	NSP	NBP	BW	INL	LI	SI	GOT	SPL	STR	UR	EL	Mic	YLDP
DFF	1	-0.069	-0.246**	0.035	0.049	0.066	-0.003	-0.162	-0.073	-0.105	0.019	0.136	0.121	0.022	-0.083	-0.029
PLHT		1	0.389**	0.224**	0.318**	-0.059	0.459**	-0.014	0.177*	-0.232**	-0.114	0.012	0.184*	0.184*	0.240**	0.088
NMP			1	-0.014	0.106	-0.162	.333**	0.02	0.109	-0.114	-0.028	0.07	0.003	0.159	0.037	0.008
NSP				1	0.488**	0.227**	0.018	0.244**	0.062	.236**	0.153	0.054	-0.142	0.026	0.102	0.416**
NBP					1	0.277**	0.114	0.328**	0.162	.242**	0.118	0.058	-0.047	0.018	0.155	0.636**
BW						1	-0.018	0.526**	0.314**	0.333**	0.293**	0.208*	-0.176*	0.011	0.043	0.507**
INL							1	-0.181*	-0.065	-0.173*	0.025	0.123	0.121	0.135	0.027	-0.03
LI								1	.665**	0.553**	0.325**	0.185*	-0.211*	0.058	0.125	0.442**
SI									1	-0.246**	0.342**	0.322**	-0.096	0.226**	0.051	0.163
GOT										1	0.049	-0.124	-0.178*	-0.188*	0.113	0.381**
SPL											1	0.761**	-0.472**	0.385**	-0.194*	0.181*
STR												1	0.066	0.548**	-.290**	0.124
UR													1	0.181*	0.041	-0.061
EL														1	-.174*	-0.073
Mic															1	0.165
YLDP																1

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Table 3. Phenotypic correlation coefficients between single plant yield with yield components and fibre quality trait

	DFF	PLHT	NMP	NSP	NBP	BW	INL	LI	SI	GOT	SPL	STR	UR	EL	MIC	YLDP
DFF	1	-0.07	-0.215	0.04	0.061	0.09	-0.049	-0.184	-0.064	-0.136	0.013	0.089	0.104	-0.014	-0.029	-0.046
PLHT		1	0.374**	0.238*	0.339**	-0.058	0.632**	-0.02	0.205	-.241*	-0.119	0.055	0.246*	0.266*	0.296*	0.092
NMP			1	-0.054	0.163	-0.171	.357**	0.024	0.2	-0.172	-0.027	0.059	-0.009	0.213	0.096	0.009
NSP				1	0.501**	0.247*	0.045	.296*	0.068	0.271*	0.191	0.085	-0.182	0.045	0.122	0.420**
NBP					1	0.306*	0.124	0.463**	0.244*	0.310**	0.163	0.092	-0.056	0.038	0.221	0.668**
BW						1	-0.001	0.623**	0.365**	0.402**	0.327**	0.203	-.253*	-0.004	0.091	0.557**
INL							1	-0.05	0.17	-0.241*	0.007	0.149	0.191	.303*	0.097	-0.053
LI								1	0.591**	0.638**	0.363**	0.215	-0.292*	0.101	0.165	0.542**
SI									1	-0.237*	0.452**	0.510**	-0.129	0.390**	0.123	0.204
GOT										1	0.014	-0.221	-0.233	-0.257*	0.198	0.440**
SPL											1	.828**	-0.539**	0.389**	-.235*	0.211
STR												1	-0.105	0.543**	-0.226	0.152
UR													1	0.102	0.135	-0.076
EL														1	-0.154	-0.1
MIC															1	0.209
YLDP																1