J. Farm Sci., 31(3): (258-263) 2018

RESEARCH PAPER

Studies on *per se* performance and component of genetic variation in recombinant inbred lines and testcross hybrids for yield, yield component and fiber quality traits in cotton

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(Received: December, 2017 ; Accepted: September, 2018)

Abstract: The present investigation was carried out to elucidate the information on *per se* performance and genetic variability from a set of 150 recombinant inbred lines (RILs) of interspecific hybrid DCH-32, along with their two testcross (TC) hybrids. Mean values of the TC hybrids were higher than corresponding values of the RILs for most of the traits. The phenotypic and genotypic coefficient of variation indicated the presence of wide variation for all most all the traits studied. Seed cotton yield, yield component and fibre quality traits had moderate to high heritability coupled with low to high genetic advance and genetic advance as per cent mean. Mean performance over two locations led to identification of two superior inbred lines and six TC hybrids for trait combinations. Two lines DRBH-70 (2,666.00 kg/ha) and DHBR-72 (2,600.00 kg/ha) possessed 42.33 and 38.78 per cent yield advantage over Sahana (1,873.00 kg/ha). A total of 13 hybrids, recorded significantly superior seed cotton yield. The TC hybrid, DRBH-83 x Sahana (3,490.00 kg/ha, 40.41 % yield advantage) was the top most performing in the study recorded significantly higher seed cotton yield than commercial hybrid checks DHH-11 (2,407.00 kg/ha) and DCH-32 (2407 kg/ha). The higher yields of this hybrid due to desirable trait combinations, suggested improving seed cotton yield even through intraspecific hybridization using *Gossypium hirsutum* as a donor parent.

Key words: Heritability, Recombinant inbred lines, Testcross hybrids, Variability

Introduction

The genus *Gossypium* consists of 45 diploid species divided into eight subgenomes (A-G and K) and five tetraploids (AD). Of all the *Gossypium* species, two tetraploids (*G. hirsutum* and *G. barbadense;* new world cotton, 2n=4x=52) and two diploid species (*G. arboreum* and *G. herbaceum;* old world or Asiatic cotton, 2n=2x=26) are commercially grown for natural fiber. The high yielding *G. hirsutum,* accounts for greater than 90 per cent of worldwide cotton production, while *G. barbadense*, known for its superior fibre quality also called "Extra Long Staple (ELS) cotton, is cultivated on limited area. In India, intra *hirsutum* and interspecific tetraploid cotton hybrids are cultivated in more than 90 per cent of cotton area. Intra *hirsutum* hybrids produce medium staple fibre suitable for spinning to 30-60s count and interspecific hybrids are known to produce extralong staple cotton for 60-120s counts. Whereas, *G. barbadense* cotton suitable for spinning more than 120s count is cultivated in less than 1 per cent area. Diploid (Desi) cottons (*G. arboreum* and *G. herbaceum*) suitable for 6-40s count are also under cultivation in an area of about 5 per cent. Selection is effective only when there is enough magnitude of variability in the breeding population. An understanding of precise magnitude of genetic variability would helps in selection of genotypes for trait improvement and important in formulating the most appropriate breeding technique for improvement of various characters. The magnitude of heritable variation is of utmost importance since it has relevance to selection response. Heritability refers to the extent of variability for a quantitative character that is transmitted to its progeny. However, the genetic gain from selection for a particular character is the function of its heritability, selection differential and phenotypic variance in the basal population (Burton and Devane, 1953). Therefore, the present investigation was undertaken to study the *per se* performance and genetic variability in 450 genotypes.

Material and methods

The materials used in this study included 150 Dharwad *Hirsutum Barbadense* Recombinant inbred (DHBR) lines of 11th advance generation derived by single seed decent from a cross between *G. hirsutum* var. DS 28 and *G. barbadense* var. SBYF 425 developed at the Agricutural Research Station, Dharwad Farm (Katageri *et al.,* 2007). In addition two testcross (TC) populations were generated by crossing RILs with testers, Sahana and Surabhi. The tester, Sahana, is widely adopted, pest tolerant, multiple cross derived *G. hirsutum* variety suited to both irrigated and rainfed situations, and it is identified as a good tester. Surabhi, which is high yielder, also identified as a good combiner and adapted to better conditions with fibre quality traits. The two testers were genetically unrelated. The experiment was laid out in augmented-II design (Federer, 1956) during 2015-16. The 150 RILs, 300 TCF_1 hybrids and six checks [Parents of the RILs (DS 28 and SBYF425), the F_1 hybrid (DCH-32), commercial intraspecific hybrid DHH-11 and two tester varieties Sahana and Surabhi] were sown in 15 compact blocks. Each block consisted of 42 entries including six checks. The RILs and TCF_1 hybrids were unreplicated while the six checks were repeated twice in each block. All the materials were sown in two rows in two different locations, one at Agricultural Research Station, Dharwad farm and another at Agricultural Research Station at Devihosur, Haveri, consecutively two rows of female RILs and two rows of each

TC hybrids of Sahana and Surabhi with 16 plants in each row of 6 m length. The spacing was 40 cm between plants within each row and 90 cm between rows. All the cultural and production practices were used as recommended for each location. All the materials were measured for yield and fibre traits. Yield characters included plant height (cm), number of monopodia per plant, number of sympodia per plant, number of fruiting bodies, number of bolls per plant, boll weight (g), seed index (g), lint index (g), ginning outturn (%), seed cotton yield (kg/ha) and fibre quality parameters included fibre length (2.5% span length, mm), fibre strength (g/tex), fibre fineness (micronaire value,µg/in), uniformity ratio (%), maturity coefficient and fibre elongation (%). All fibre properties were analyzed at Belur, Cotton Testing Services 337-D, KIADB Industrial Area Belur, Dharwad-580 011, using High volume instrument (HVI). SAS Proc. GML and CORR (SAS Institute, 1996) were used to obtain the basic statistics of the traits. The genotypic and phenotypic variability were computed according to Burton and Devane (1953). Heritability, expected genetic advance and genetic gain in the broad sense was calculated according to the formula suggested by Johanson *et al.* (1955).

Results and discussion

The Augmented-II analysis was carried out for sixteen traits across 450 genotypes along with parents, testers and hybrid checks across two environments. The Analyses of variance revealed that the variability generated in the experimental material across all the traits was significant (Table 1). The significant differences observed between locations for most of the traits except number of bolls, seed index and ginning out-turn which indicated the differential response of genotypes across different environments. The interaction between genotypes and location was significant for eleven traits except number of monopodia, boll weight, seed index, lint index and ginning outturn. The considerable differences among genotypes and locations and their interaction, showed substantial environmental variation during cotton growing seasons across Dharwad and Devihosur locations during 2015-16.

The mean performance and components of genetic variation of DS 28 x SBYF 425 recombinant inbred lines and two testcross (TC) F_1 populations for 16 yield, yield component and fibre quality traits across two environments are furnished in Table 2. The mean values of the two test hybrid cross populations were higher than the RILs for all traits except fibre length in Sahana and micronaire value and maturity ratio in Surabhi. Out of 150 RILs studied, the lowest plant height of 74.22 cm was recorded in DHBR-76. None of the RILs failed to record significantly reduced number of monopodia over lowest check variety SBYF 425 (1.33). In general inbred lines with more than 17 sympodia per plant exhibited significantly high yields, interestingly present study identified a inbred line DRBH-84 (10.36) had less number of sympodia but exhibited significantly high yield (2551 kg/ha). An inbred line, DHBR-62 (45.88) noticed highest number of bolls than Surabhi and also recorded significantly high yield (2243 kg/ha). Only two inbred lines recorded more seed index than superior check SBYF 425 and highest was noticed in DHBR-34 (13.37 g) but it exhibited low yields (932 kg/ha), which may be attributed to less number of bolls (18.03) and seed index (4.91 g). The inbred line, DHBR-23 (7.01) was superior for lint index and possessed more than 35 per cent of lint index than DS 28 check. Totally 16 inbred lines recorded significantly higher ginning out-turn than superior varietal check Sahana, among them, DHBR-60 was the top most by recording 42.25 per cent of ginning out-turn. A total of five inbred lines recorded significantly high seed cotton yield and exhibited more than 19 per cent yield advantage than superior varietal check Sahana. Two lines DRBH-70 (2,666 kg/ha) and DHBR-72 (2,600 kg/ha) possessed 42.33 and 38.78 per cent yield advantage than Sahana (1,873 kg/ha). The high yielding ability of these two lines are attributed by desirable combinations of yield component traits like plant height (> 111.00 cm), monopodia (> 2.33), sympodia (18.00 to 20.00), number of bolls (36.00 to 38.00) and seed index (9.00 to 11.00 g).

Only one inbred line DRBH-75 (32.30 mm) categorized under extra long staple but it recorded non-significant value than superior check, SBYF 425. An inbred line DHBR-78 recorded significantly higher fibre strength (27.50 g/tex). DHBR- line possessed lowest micronaire value 17 (3.30 µg/in). Four inbred lines recorded significantly high uniformity ratio than superior varietal check Sahana, among them DHBR-119 (51.80 %) had highest. Eight inbred lines record significantly high maturity coefficient values than superior check SBYF 425, amongst which, DHBR-11 (0.83) was highest. Among the RILs, the highest fibre elongation was recorded in DHBR-127 (7.20 %) and lowest was recorded by DHBR-149 (5.40 %).

Totally 50 TCF_1s have recorded significantly reduced plant height than DHH-11, however, these hybrids failed to record significantly higher yields. A hybrid, DHBR-80 x Sahana was the shortest (61.62 cm) suitable for compact cultivation. In the present scenario looking to shortage of labour, identification and utilization of genotypes with lower monopodia or zero monopodia to develop variety for mechanical harvesting is necessary. Present study identified five hybrids,*viz.,* DHBR-72 x Sahana, DHBR-46 x Sahana, DHBR-53 x Surabhi, DHBR-35 x Surabhi and DHBR-39 x Surabhi with less than 1.25 monopodia and these hybrids can be suggested for machine harvesting. The hybrid, DHBR-13 x Sahana possessed significantly high number of sympodia (22.40).The hybrid, DHBR-9 x Sahana recorded highest fruiting bodies (74.13) alone with more number of bolls (48.70) but it had medium yield (2,000 kg/ha). Three hybrids of Sahana, DHBR-24 x Sahana (51.80), DHBR-9 x Sahana (48.70) and DHBR-144 x Sahana (46.42) had high number of bolls than superior check DCH-32 (39.00). The hybrid, DHBR-23 x Sahana has recorded more than 19 per cent of boll weight (6.09 g) than superior check DHH-11 (5.10 gm) and it also exhibited high seed cotton yield (2,825 kg/ha) with more number of bolls (38.18). DHBR-146 x Surabhi (46.00 %) TC hybrid, recorded more than 15 per cent high GOT than standard check DHH-11 (38.50 %) with high seed index of 11.25 g and lint index of 6.48 g. A total of 13 hybrids recorded significantly

Table 1. Analysis of variance in DS 28 x SBYF 425 recombinant inbred lines (RILs) and their two testcross F_1 hybrids and checks for sixteen yield, yield component and fibre quality traits across two environments

Source of variation	Degrees of freedom	Plant height (cm)			No. of monopodia			No. of sympodia			No. of fruiting bodies		
		Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F
Blocks	14	23.63	3282.34	0.00	0.21	0.23	0.63	2.52	0.03	0.86	12.01	46.73	0.00
Locations	01	35202.10	2.20	0.01	0.02	2.02	0.02	0.04	1.86	0.03	241.36	2.32	0.01
Checks	05	2376.90	221.63	0.00	7.19	68.05	0.00	419.63	309.94	0.00	2196.89	425.36	0.00
Genotypes	449	224.66	20.95	0.00	0.77	7.26	0.00	12.55	9.27	0.00	125.41	24.28	0.00
Locations x Genotypes	449	80.63	7.52	0.00	0.09	0.85	0.90	2.17	1.60	0.00	29.64	5.74	0.00
Error	159	10.72			0.12			1.35			5.16		

Source of variation	Degrees of freedom	No. of bolls/plant			Boll weight (g)			Seed index (g)			Lint index (g)		
		Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F
Blocks	14	4.92	30.95	0.00	0.30	5.92	0.02	0.55	0.07	0.79	0.61	13.86	0.00
Locations	01	113.41	1.34	0.19	0.82	2.20	0.01	0.03	1.56	0.10	3.13	2.69	0.00
Checks	05	1891.60	516.28	0.00	21.96	158.64	0.00	29.54	82.88	0.00	18.90	83.74	0.00
Genotypes	449	85.90	23.44	0.00	0.52	3.74	0.00	1.34	3.76	0.00	0.73	3.22	0.00
Locations x Genotypes	449	17.87	4.88	0.00	0.10	0.70	1.00	0.21	0.60	1.00	0.14	0.62	1.00
Error	159	3.66			0.14			0.36			0.23		

Source of variation	Degrees of freedom	Ginning out-turn (g)			Seed cotton yield (kg/ha)			Fibre length (mm)			Fibre strength (g/tex)		
		Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F
Blocks	14	1125.98	0.70	0.40	7074.77	15.94	0.00	0.97	34.11	0.00	1.20	2.72	0.00
Locations	01	750.44	1.05	0.40	71761	1.57	0.09	16.86	1.95	0.02	26.30	59.53	0.00
Checks	05	3386.31	3.17	0.01	15552564	3454.49	0.00	110.58	223.73	0.00	42.70	96.65	0.00
Genotypes	449	57.24	0.05	1.00	615009	136.60	0.00	4.29	8.68	0.00	5.39	12.20	0.00
Locations x Genotypes	449	6.95	0.01	1.00	46880	10.41	0.00	0.86	1.74	0.00	1.52	3.44	0.00
Error	159	1068.87			4502.13			0.49			0.44		

Source of variation	Degrees of freedom	Micronaire (µg/in)			Uniformity ratio (%)			Maturity coefficient			Fibre elongation (%)		
		Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F	Mean square	F Value	Pr > F
Blocks	14	0.06	1.54	0.10	1.90	3.14	0.00	0.0021	1.18	0.28	0.29	3.97	0.00
Locations	1	0.24	6.18	0.01	4.25	7.02	0.00	0.0003	8.11	0.00	1.67	22.31	0.00
Checks	5	4.49	117.39	0.00	22.86	37.69	0.00	0.0253	93.65	0.00	2.71	36.10	0.00
Genotypes	449	0.35	9.17	0.00	1.65	2.72	0.00	0.0040	14.68	0.00	0.16	2.10	0.00
Locations x Genotypes	449	0.05	1.40	0.00	0.46	0.76	0.00	0.0007	2.83	0.00	0.01	0.16	0.00
Error	159	0.04			0.60			0.0003			0.07		

superior seed cotton yield than hybrid check DHH-11, accounting from 17.87 to 40.15 per cent yield increment. The cross combinations like DRBH-83 x Sahana (3,490 kg/ha) which is the top most performing hybrid in this study followed by DRBH-56 x Sahana (3,318 kg/ha), DRBH-32 x Sahana (3,317 kg/ha) and DRBH-63 x Surabhi (3,198 kg/ha) which recorded significantly higher seed cotton yield than commercial hybrid checks DHH-11 (2,407 kg/ha) and DCH-32 (2,407 kg/ha) with a yield advantage of 40.41, 33.48, 33.44 and 28.64 per cent respectively.

Table 2. Mean performance and genetic variability in RILs and two testcross F_1 hybrids for sixteen yield, yield component and fibre quality traits across two environments

Traits	Populations	Mean	Range	PCV	GCV	h²BS (%)	GA	GAM (%)
Plant height	RILs	107.44	74.22 - 136.12	12.59	9.37	55.36	15.43	14.36
	TCF_1 (RILs x Sahana)	108.35	61.62 - 133.16	12.05	8.74	52.65	14.16	13.07
	TCF_1 (RILs x Surabhi)	109.24	74.13 - 134.93	11.03	7.40	45.03	11.17	10.23
No. of monopodia	RILs	2.46	1.05 - 4.18	27.00	24.17	80.15	1.10	44.58
	TCF_1 (RILs x Sahana)	2.56	1.13 - 4.02	25.31	22.39	78.30	1.04	40.82
	TCF_1 (RILs x Surabhi)	2.48	1.15 - 4.18	28.18	25.34	80.86	1.16	46.94
No. of sympodia	RILs	13.59	9.03- 20.79	18.99	15.96	70.65	3.76	27.64
	TCF_1 (RILs x Sahana)	16.61	8.61 - 22.40	17.56	15.24	75.28	4.52	27.24
	TCF_1 (RILs x Surabhi)	16.87	10.10 - 22.50	13.99	11.33	65.52	3.19	18.89
No. of fruiting	RILs	34.72	24.36 - 65.10	18.99	14.62	59.25	8.05	23.18
bodies	TCF_1 (RILs x Sahana)	44.10	25.63 - 74.13	19.70	15.44	61.40	10.99	24.92
	TCF_1 (RILs x Surabhi)	45.83	33.58 - 60.98	16.67	10.75	41.59	6.54	14.28
No. of bolls	RILs	23.61	13.56 - 45.88	21.13	16.95	64.34	6.61	28.01
	TCF_1 (RILs x Sahana)	32.13	17.33 - 51.80	20.66	16.70	65.39	8.94	27.82
	TCF_1 (RILs x Surabhi)	33.42	24.12 - 47.73	17.64	10.65	36.46	4.43	13.25
Boll weight	RILs	4.29	2.45 - 6.04	14.07	12.07	73.60	0.91	21.33
	TCF_1 (RILs x Sahana)	4.51	2.73 - 6.09	12.60	11.04	76.77	0.90	19.93
	TCF_1 (RILs x Surabhi)	4.63	3.64 - 5.76	11.11	8.39	57.04	0.60	13.05
Seed index	RILs	10.16	6.73 - 13.37	9.38	8.43	80.79	1.59	15.61
	TCF_1 (RILs x Sahana)	10.66	7.57 -12.98	7.72	6.48	70.43	1.19	11.21
	TCF_1 (RILs x Surabhi)	10.89	8.45 - 13.07	7.04	5.32	57.09	0.90	8.28
Lint index	RILs	5.17	3.20 - 7.01	12.91	11.11	74.14	1.02	19.71
	TCF_1 (RILs x Sahana)	5.58	3.48 - 7.17	11.73	9.78	69.43	0.94	16.78
	TCF_1 (RILs x Surabhi)	5.58	4.13 - 7.07	11.25	8.41	55.97	0.72	12.97
Ginning outturn	RILs	37.65	21.98 - 45.25	11.99	10.62	78.50	7.30	19.38
	TCF_1 (RILs x Sahana)	37.87	25.53 - 45.90	11.55	9.69	70.34	6.34	16.74
	TCF_1 (RILs x Surabhi)	38.32	26.64 - 46.00	10.39	8.62	68.89	5.65	14.75
Seed cotton yield	RILs	1443.64	684.14 - 2666.56	29.64	27.09	83.53	736.36	51.01
	TCF_1 (RILs x Sahana)	2098.98	882.87 - 3490.98	26.75	24.34	82.79	957.77	45.63
	TCF_1 (RILs x Surabhi)	2168.12	923.62 - 3198.39	21.81	19.04	76.16	741.94	34.22
2.5 % fibre length	RILs	28.59	24.35 - 32.30	6.27	5.27	70.66	2.61	9.13
	TCF_1 (RILs x Sahana)	28.50	24.55 - 33.95	5.50	4.55	68.45	2.21	7.75
	TCF_1 (RILs x Surabhi)	29.63	26.85 - 33.55	4.74	3.59	57.29	1.66	5.60
Fibre strength	RILs	23.38	18.55 - 27.50	8.68	7.02	65.44	2.74	11.70
	TCF_1 (RILs x Sahana)	23.45	19.20 - 27.80	8.14	6.62	66.04	2.6	11.08
	TCF_1 (RILs x Surabhi)	24.48	21.55 - 27.75	6.76	5.42	64.23	2.19	8.95
Micronaire	RILs	4.43	3.30 - 5.32	11.41	10.06	77.68	0.81	18.26
	TCF_1 (RILs x Sahana)	4.45	3.39 - 5.40	10.46	9.21	77.52	0.74	16.70
	TCF_1 (RILs x Surabhi)	4.32	3.33 - 5.32	8.75	7.14	66.67	0.52	12.02
Uniformity ratio	RILs	49.71	46.10 - 51.80	2.41	2.00	69.04	1.70	3.42
	TCF_1 (RILs x Sahana)	49.93	47.65 - 52.00	1.92	1.52	62.56	1.23	2.47
	TCF_1 (RILs x Surabhi)	49.74	46.95 - 51.25	1.90	1.36	51.58	1.00	2.02
Maturity ratio	RILs	0.74	0.62 - 0.83	7.07	6.00	72.05	0.08	10.49
	TCF_1 (RILs x Sahana)	0.74	0.62 - 0.83	6.94	5.75	68.70	0.07	9.82
	TCF_1 (RILs x Surabhi)	0.73	0.63 - 0.81	6.63	5.53	69.55	0.07	9.50
Fibre elongation	RILs	6.36	5.40 - 7.20	5.02	4.74	89.15	0.59	9.22
	TCF_1 (RILs x Sahana)	6.36	5.55 - 7.05	4.83	4.55	88.49	0.56	8.81
	TCF_1 (RILs x Surabhi)	6.38	5.70 - 7.05	4.46	4.2	88.82	0.52	8.16

PCV - Phenotypic coefficient of variation GCV - Genotypic coefficient of variation h²BS -Heritability in broad sense
GA - Genetics advance GAM - Genetics advance over mean

Three hybrids of Surabhi exhibited extra long fibre length. Among them, DHBR-81 x Surabhi (33.95 mm) recorded maximum. Fifteen hybrids of Surabhi, exhibited more fibre strength, among them the hybrid, DRBH-63 x Surabhi (3198 kg/ha) possessed significantly higher yield than DHH-11 along with very good fibre strength (27.20 g/tex) and therefore this is suitable for spinning higher count yarn. The hybrid, DRBH-83 x Sahana possessed 3.43 µg/in of micronaire with 3,490 kg/ha seed cotton yield among TCF_1 hybrids. Three hybrids DRBH-79 x Sahana, DRBH-86 x Sahana and DRBH-74 x Surabhi exhibited significantly high uniformity ratio (> 50.50 %) along with high maturity coefficient (> 0.79) and fibre elongation (> 6.75 %). It indicated the possibility of improving fibre quality using even intraspecific hybridization.

Mean performance over two locations led to the identification of two superior inbred lines *viz.,* DRBH-62 for number of fruiting bodies per plant (65.10), number of bolls per plant (45.88), ginning out-turn (43.94 %), seed cotton yield (2242 kg/ha) and maturity coefficient (0.80); DHBR-23 for boll weight (6.04 g) and lint index (7.01 g) and DHBR-27 for lint index (6.22 g) and ginning out-turn (44.60 %) and six superior hybrid combinations *viz.,* DHBR-149 x Sahana for short plant height (98.30 cm), boll weight (5.18 g), ginning out-turn (44.71 %), seed cotton yield (2988 kg/ha) and maturity coefficient (0.83); DHBR-63 x Surabhi for less number of monopodia (1.61), seed cotton yield (3,198 kg/ha), fibre strength (27.20 g/tex) and uniformity ratio (50.85 %); DHBR-19 x Sahana for number of fruiting bodies (63.58), boll weight (5.54 g) and seed cotton yield (2,944 kg/ha); DHBR-80 x Sahana for short plant height (61.62 cm), lint index (6.88 g) and ginning out-turn (45.00 %); DHBR-131 x Sahana for boll weight (5.23 g), seed cotton yield (2,993 kg/ha) and maturity coefficient (0.78); DHBR-144 x Sahana for number of fruiting bodies (68.56), lint index (6.91 g) and seed cotton yield (3,065 kg/ha) for trait combinations. The hybrid, DRBH-83 x Sahana (3,490 kg/ha, 40.41 % yield advantage) was the top most performing in the study followed by DRBH-56 x Sahana (3,318 kg/ha), DRBH-32 x Sahana (3,317 kg/ha) and DRBH-63 x Surabhi (3,198 kg/ha) which recorded significantly higher seed cotton yield than commercial hybrid checks DHH-11 (2,407 kg/ha) and DCH-32 (2,407 kg/ha). The higher yields of these hybrids were due to desirable combinations of yield components like number of sympodia (> 16.75), number of fruiting bodies (> 39.90), number of bolls (> 30.11), boll weight (> 4.03 g), seed index (> 10.26 g), lint index (> 5.11 g) and ginning out-turn (> 34.24 %) and suggested improving seed cotton yield even through intraspecific hybridization using *G. hirsutum* as a donor parent. The TCF_1s of Surabhi produced longer and stronger fibres indicating introgression of superior fibre quality alleles from donor parent, Surabhi. The hybrid, DRBH-63 x Surabhi had significantly higher seed cotton yield of 3198 kg/ha along with fibre length of 29.00 mm and fibre strength of 27.20 g/tex. It indicated simultaneous improvement in seed cotton yield and fibre quality possible through intraspecific hybridization.

The phenotypic and genotypic coefficient of variation indicated the presence of wide variation for all most all the traits studied. Seed cotton yield, yield component and fibre quality traits had moderate to high heritability coupled with low to high genetic advance and genetic advance as per cent mean in RILs and two sets of TC hybrids.Tuteja *et al.* (2006), Vinodhana *et al*. (2013), Erande *et al*. (2014), Ahsan *et al.* (2015) and Nagaraju *et al.* (2017) reported high GCV and PCV with high heritability, genetic advance for these traits in their study. Guang and XiongMing (2008) and Ali *et al.* (2009) in their experiment recorded low to moderate variability with low heritability.

Conclusion

The phenotypic and genotypic coefficient of variation depicted presence of wide variation for all most all the traits studied. The hybrid, DRBH-83 x Sahana possessed highest seed cotton yield of 3,490 kg/ha which is 40 per cent higher than commercial check, DHH-11. The TCF_1s of Surabhi had longer and stronger fibers which were introgressed alleles from donor parent, Surabhi. The hybrid, DRBH-63 x Surabhi had significantly higher seed cotton yield of 3198 kg/ha along with fibre length of 29.00 mm and fibre strength of 27.20 g/tex. It indicated simultaneous improvement in seed cotton yield and fibre quality possible through intraspecific hybridization.

Acknowledgement

The first author acknowledge the financial support of Department of Science and Technology (DST), Ministry of Science and Technology, Government of India, New Delhi through INSPIRE Fellowship for this study.

References

Ahsan, M. Z., Majidano, M. S., Bhutto, H., Soomro, A. W., Panhwar, F. H., Channa, A. R. and Sial, K. B., 2015, Genetic variability, coefficient of variance, heritability and genetic advance of some *Gossypium hirsutum* L. accessions. *J. Agric. Sci.,* 7(2): 147-151.

Ali, M. A., Khan, I. A. and Nawab, N. N., 2009, Estimation of genetic divergence and linkage for fibre quality traits in upland cotton. *J. Agric. Res., Lahore,* 47(3): 229-236.

Burton, G. W. and Devane, E. M., 1953, Estimating heritability in fall fescue (Festecdcirunclindcede) from replicated clonal material. *Agron. J.,* 45: 478-481.

Erande, C. S., Kalpande, H. V., Doesarkar, D. B., Chavan, S. K., Patil, V. S., Deshmukh, J. D., Chinchane, V. N., Kumar, A., Dey, U. and Puttawar, M. R., 2014, Genetic variability, correlation and path analysis among dofferent traits in desi cotton (*Gossypium arboretum* L.) *African J. Biotechnol.,* 9(29): 2278-2286.

Federer, W. T., 1956, Augmented (or hoonuiaku) designs. *Hawaiian Planter's Record,* 55: 191-208.

Guang, C. and Xiong Ming, D., 2006, Genetic diversity of basal germplasm phenotypes in upland cotton in china. *Acta Botanica Boreali Occidentalia Sinica.* 26(8): 1649-1656.

Johanson, A. W, Robinson, H. F. and Comstock, R. F., 1955, Estimates of genetic and environmental variability in soybean. *Agric. J.,* 47: 314-318.

Katageri, I. S. Khadi, B. M., Vamadevaiah, H. M. and Narayanan, K., 2007, Genetic resource enhancement for fiber traits in cotton (*Gossypium* spp.) through inter-specific hybridization, Presented during *World – Cotton Research Conference* 4 at Lubbock, pp. 28-35.

Nagaraju, CH, Khadi, B. M. and Kategeri, I.S., 2017, Genetic analysis of diversity and variability for yield and yield attributingtraits in recombinant inbred lines of interspecific tetraploid cotton. *Res. Environ. Life Sci.,*10(4): 356-260.

Tuteja, O. P., Sunil Kumar and Mahender Singh, 2006, Selection parameters and yield enhancement of upland cotton (*G. hirsutum*) under irrigated ecosystems of north India. *Indian J. Agric. Sci.,* 76(2) : 77-80.

Vinodhana, N. K., Gunasekaran, M. and Vindhiyavarman, P., 2013, Genetic studies of variability, correlation and path coefficient analysis in cotton genotypes. *Int. J. Pure App. Biosci.* 1(5): 6-10.