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Studies of genetic parameters for yield, yield contributing and fiber quality characters in desi cotton (*Gossypium arboreum* L.)

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Abstract

In the present investigation, 39 desi (*Gossypium arboreum* L.) genotypes along with three checks viz., AKA-7, PA-08 and JLA-794 were studied to observe genetic variability, heritability and genetic advance for fifteen yield contributing and fiber quality characters. Analysis of variance showed significant differences for all the characters among genotypes indicating the presence of wide range of genetic variability in the experimental materials. The high GCV and PCV were observed for number of boll per plant, seed cotton yield per plant, number of sympodia per plant, lint index and plant height. High heritability estimates coupled with high expected genetic advance were observed for the characters number of boll per plant, seed cotton yield per plant, number of sympodia per plant, lint index, plant height and micronaire. It indicates the presence of additive gene action and phenotypic selection may be more fruitful and effective for desired genetic improvement.

Keywords: Genetic advance, *Gossypium arboreum*, heritability, seed cotton yield, variability

Introduction

Cotton is one of the most important fiber and cash crop of India and plays a dominant role in the industrial and agricultural economy of the country. It provides the basic raw material (cotton fiber) to cotton textile industry. Cotton in India provides direct livelihood to 6 million farmers and about 40 -50 million people are employed in cotton trade and its processing. In India, there are ten major cotton growing states which are divided into three zones, viz. north zone, central zone and south zone. Cotton is also cultivated in small areas of non-traditional states such as Uttar Pradesh, West Bengal and Tripura. Although, Indian cotton have very wide quality spectrum, the right combination of fiber length, micronaire and desirable fiber strength is however absent in many of the popular varieties and hybrids. The deficiency particularly discernable in the staple length range of 27 to 30 mm combined with micronaire value of 4.0 to 4.5 ug/inch and a strength of 22 to 25 g/tex. Indian cotton confirming to long and extra-long staple group are too fine coupled with weak strength. There is an urgent need to promote those cotton that could come closer in quality to the most sought by modern textile mills. It is well known that diploid species has inherent ability to resist pest and disease as compared to tetraploid cotton. They are also synchronous in maturity and possess consistent fiber qualities, especially strength. Considering these beneficial features, it is emphasized that if fiber qualities of desi cotton improved then it can compete with *hirsutum* cotton under rainfed ecology.

Therefore, more emphasis should be given to increase the seed cotton yield per unit area of *desi* cotton, by developing varieties with short stature, big boll size and medium to longer staple length with sustained yield in multiple environments. To achieve such desirable characteristics in new variety, proper breeding strategies should be followed. The existence of variability is essential for resistance to biotic and abiotic factors as well as for varietal adaptability. Selection is also effective when there is high degree of genetic variability among the individuals in the populations. Hence, genetic variability present in a population is of prime importance to a plant breeder for starting a judicious breeding programme.

Material and Methods

The experiment was carried out during kharif, 2018 at Cotton Research Station, Mehboob Baugh Farm, Vasanttrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experimental material consisted of 42 diverse elite genotypes of desi cotton (*Gossypium arboreum* L.) including three checks viz., AKA 7, PA 08 and JLA 794.

The experimental material was sown by dibbling 2-3 seeds / hill. Recommended agronomical and plant protection practices were followed regularly. Fertilizer dose of 50:25:25 kg NPK/ha was applied to the crop, out of which 25:25:25 kg NPK/ha was given at the time of sowing and remaining 25 kg N/ha was applied 45 days after sowing. Observations were recorded on ten yield and yield contributing characters *viz.*, days to 50 per cent flowering, days to 50 per cent boll bursting, plant height, sympodia / plant, bolls / plant, boll weight, seed index, lint index, harvest index and seed cotton yield / plant, five fibre quality characters *viz.*, ginning per cent, upper half mean length, fiber strength, micronaire and uniformity ratio. The data were collected and analysed for genotypic and phenotypic coefficients of variation, heritability (broad sense) and expected genetic advance as percent of mean.

Results and Discussion

The analysis revealed that all the treatments exhibited significant differences for all the characters under study. The characters under investigation were analyzed for genotypic variance (σ^2_g), phenotypic variance (σ^2_p), genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (broad sense), genetic advance (GA) and expected genetic advance in percent mean (EGA) which were presented in Table. Wide range of variability was observed for majority of yield contributing characters. Range of variation on the basis of mean was more for the traits plant height (92.30 -150.26 cm), seed cotton yield / plant (22.00 - 45.50 g), upper half mean length (21-30.50 mm), sympodia / plant (10.00 - 19.75), bolls / plant (9.50 - 25.25), days to 50 per cent boll bursting (111.00 - 121.00 days), ginning percent (30.74 -39.08%), uniformity ratio (69.70 - 84.80), days to 50 per cent flowering (69.50 - 79.50 days) and fibre strength (18.40-28.60 g/tex) (Table 1). Similar results of wide ranged variability for yield contributing and fiber quality characters were reported by Naqib *et al.*, (2010) [4], Vinodhana *et al.*, (2013) [10], Dhivya *et al.*, (2014) [2], Reddy *et al.*, (2014) [7], Santosh Kumar *et al.*, (2014) [9], Dahiphale *et al.*, (2015) [1] and Latif *et al.*, (2015) [5].

The value of phenotypic variance (50.37) was higher than genotypic variance (37.07). The GCV values (18.18) were less than PCV values (21.19). Higher estimate of heritability (73.60%) coupled with high expected genetic advance (32.12%) were recorded for seed cotton yield per plant. The

values of genotypic variance and phenotypic variance for number of bolls per plant were 14.28 and 17.38, respectively. The phenotypic coefficient of variation (23.78) was higher than genotypic coefficient of variation (21.56). High estimate of heritability (82.20%) coupled with high value of expected genetic advance (40.28%) was observed for number of bolls per plant. The value of phenotypic variance (8.19) was higher than genotypic variance (5.29). High genotypic coefficient of variation (15.67) and phenotypic coefficient of variation (19.49) were observed. High heritability estimate (64.66%) coupled with high expected genetic advance (25.96%) was observed for this character. The character plant height exhibited high values of phenotypic and genotypic variance i.e. 7210.33 and 188.69 respectively. The values for GCV (11.54) and PCV (12.18) were observed. The higher estimate of heritability (89.71%) coupled with high value of expected genetic advance (22.51) was observed for plant height. Phenotypic variance (6.96) was higher than genotypic variance (5.27). The genotypic and phenotypic coefficients of variation were 1.96 and 2.25 respectively. Higher estimate of heritability (75.81%) coupled with low expected genetic advance (3.51%) was observed for days to 50 percent boll bursting.

The values of genotypic and phenotypic variance were 3.97 and 5.57 respectively for ginning percentage. The GCV (5.02) was less than PCV (6.66). Higher estimate of heritability (71.26%) coupled with low value of expected genetic advance (9.78) were recorded for ginning percentage. The values of genotypic and phenotypic variance for upper half mean length were 3.09 and 3.48 respectively. The values of GCV and PCV were 6.86 and 7.29 respectively. High value of PCV was observed than GCV for this character. Higher estimate of heritability (88.66%) coupled with medium expected genetic advance (13.31%) was recorded. The genotypic variance (6.37) was lower than phenotypic variance (6.83). The GCV (9.88) values were lower than PCV (10.23) were recorded. High estimate of heritability (93.24%) coupled with lower expected genetic advance (19.65%) was recorded for fiber strength. The values of phenotypic variance were more than the genotypic variance for all the characters. It means that the apparent variation is not only due to genotypes but also due to influence of environment. Similar results reported by Farooq *et al.*, (2014) [3], Patil *et al.*, (2014) [6], Rumesht *et al.*, (2014) [8], Reddy *et al.*, (2014) [7], and Santosh Kumar *et al.*, (2014) [9].

Table 1: Parameters of genetic variability for yield, yield contributing and fiber quality characters

Sr. No.	Characters	Range	GM	GV (%)	PV (%)	GCV (%)	PCV (%)	Heritability (%)	Genetic advance	EGA (%)
1	Days to 50% flowering	69.5-79.5	74.23	7.64	9.16	3.72	4.07	83.51	5.20	7.01
2	Days to 50% boll bursting	111.0-121.0	117.17	5.27	6.96	1.96	2.25	75.81	4.12	3.51
3	Plant height (cm)	92.30-150.26	119.02	188.69	210.33	11.54	12.18	89.71	26.80	22.51
4	No. of sympodia per plant	10.60-19.75	14.68	5.29	8.19	15.67	19.49	64.66	3.81	25.96
5	No. of bolls per plant	9.50-25.25	17.52	14.28	17.38	21.56	23.78	82.20	7.05	40.28
6	Boll weight (g)	2.13-2.36	2.26	0.0021	0.0052	2.00	3.19	39.32	0.05	2.58
7	Seed index (g)	5.17-6.40	5.59	0.16	0.27	7.29	9.40	60.17	0.65	11.65
8	Lint index (g)	3.21-6.37	4.19	0.44	0.54	15.98	17.54	82.99	1.25	29.99
9	Harvest index	0.33-0.43	0.39	0.0005	0.0010	5.43	8.24	43.51	0.029	7.38
10	Ginning percent (%)	30.74-39.08	35.42	3.97	5.57	5.62	6.66	71.26	3.46	9.78
11	Upper half mean length (mm)	21-30.50	25.61	3.09	3.48	6.86	7.29	88.66	3.41	13.31
12	Fiber strength (g/tex)	18.40-28.60	25.54	6.37	6.83	9.88	10.23	93.24	5.02	19.65
13	Micronaire (ug/inch)	4.50-7.52	5.74	0.34	0.42	10.21	11.35	80.90	1.08	18.92
14	Uniformity ratio	69.70-84.80	77.95	9.61	11.23	3.97	4.30	85.56	5.90	7.58
15	Seed cotton yield per plant(g)	22.0-44.4	33.49	37.07	50.37	18.18	21.19	73.60	10.76	32.12

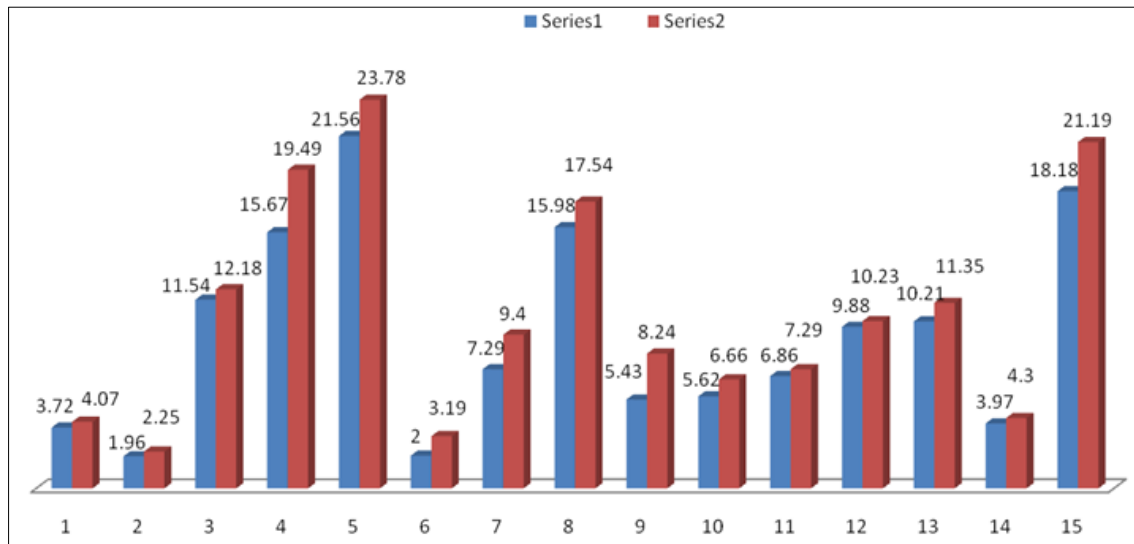


Fig 1: GCV and PCV for yield contributing and fiber traits

Characters

1. Days to 50% flowering 2. Days to 50% boll bursting 3. Plant height 4. No. of sympodia per plant 5. No. of bolls per plant 6. Boll weight 7. Seed index 8. Lint index 9. Harvest index 10. Ginning percent 11. Upper half mean length 12. Fiber strength 13. Micronaire 14. Uniformity ratio 15. Seed cotton yield per plant.

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