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Studies on 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, fifty *desi* cotton (*Gossypium arboreum* L.) genotypes including six checks *viz.*, AKA 7, AKA 8, JLA 794, JLA 505, PA 255 and PA 402 were studied to observe genetic variability, heritability and genetic advance for thirteen yield contributing and fiber quality characters. The analysis of variance revealed that the sufficient variability was present in the material for all the characters. The phenotypic coefficient of variation was higher than genotypic coefficient of variation. High estimates of GCV and PCV were observed for seed cotton yield per plant and moderate GCV and PCV for number of bolls per plant, plant height, lint index, seed index and boll weight. High heritability coupled with high genetic advance over mean was observed for the characters seed cotton yield per plant, number of bolls per plant, number of sympodia per plant, plant height and lint index indicating the presence of additive gene action in the inheritance of these traits. Whereas high heritability with moderate genetic advance was observed for fibre strength, fibre fineness, upper half mean length, seed index and boll weight.

Keywords: Desi cotton, genetic advance, *Gossypium arboreum*, heritability, variability

Introduction
Cotton is an important crop for sustainable economy of India and livelihood of the Indian Cotton Farming Community. Out of four cultivated genus *Gossypium*, only two species i.e., *G. hirsutum and G. arboreum* are being cultivated in Maharashtra. In last two decades, there has been a significant reduction in the area of *Gossypium arboreum* cotton across the country and particularly in Maharashtra, because of lower productivity and inferior fibre properties compared to tetraploid cotton in rainfed ecosystems.

Although, Indian cotton has a very wide quality spectrum, the right combination of fibre length, micronaire, and desirable fibre strength are however absent in many of the popular varieties and hybrids. The deficiency was particularly discernible in the staple length range of 27 to 30 mm combined with a micronair value of 4.0 to 4.5 ug/inch and 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. 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 long staple length with sustained yield in multiple environments. To achieve such desirable characteristics in a 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 a high degree of genetic variability among the individuals in the population. Hence, genetic variability present in a population is of prime importance to a plant breeder for starting a practical breeding programme.

Materials and Methods
The experiment was carried out during *kharif* 2020 at Cotton Research Station, Mehboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experimental material of present investigation comparised of fifty genotypes of *desi* cotton (*Gossypium arboreum* L.) including six checks namely AKA 7, AKA 8, JLA 505, JLA 794, PA 402 and PA 255. The experimental material was sown by dibbling 2-3 seeds / hill. Recommended agronomical and plant protection practices were followed. 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 eight yield and yield contributing characters *viz*., days to 50 percent flowering, plant height, number of sympodia per plant, number of bolls per plant, boll weight, seed index, lint index and seed cotton yield / plant, five fiber quality characters *viz*., ginning per cent, upper half mean length, fiber strength, micronnaire and uniformity ratio. The data were collected and analyzed for genotypic and phenotypic coefficients of variation, heritability (broad sense) and expected genetic advance as per cent of mean. The genotypic and phenotypic coefficient of variation (GCV and PCV) was calculated according to method suggested by Burton (1952) [3]. Heritability (broad sense) was calculated according to the method suggested by Allard (1960) [1]. The genetic advance (at 5 per cent selection intensity) was calculated for each character using the formula suggested by Johnson *et al.*, (1955) [11].

Results and Discussion

A 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 (123.10-149.30 cm), seed cotton yield per plant (31.29-56.44 g), number of bolls per plant (12.90-26.20),uniformity ratio (73.00-84.00), fibre strength (21.50-31.80 g tex^{-1}), days to 50 percent flowering (66.50-76.50 days), upper half mean length (21.90-31.50 mm), ginning percent (34.88-41.95%), number of sympodia per plant (10.10-16.35), fibre fineness (4.70-6.30 µg/in), lint index (3.23-5.33 g), seed index (5.04-6.06 g) and boll weight (2.22-2.96 g). Similar results of wide range for yield contributing and fibre quality traits were reported by Vinodhana *et al.* (2013) [19], Dhivya *et al*. (2014) [5], Reddy *et al*. (2014) [18], Erande *et al*. (2014) [4], Dahiphale *et al.* (2015) [4], Latif *et al.* (2015) [14], Kumar *et al.* (2017) [13] and Joshi *et al*. (2018) [12].

The highest estimate of phenotypic coefficient of variation and genotypic coefficient of variation was observed for seed cotton yield per plants (23.013 and 21.718%). These findings are in agreement with the results reported by Pujer *et al.* (2014) [17], Kumar *et al.* (2017) [13] and Joshi *et al.* (2018) [12].

The moderate estimate of phenotypic coefficient and genotypic coefficient of variation was observed for number of bolls per plant (19.006 and 17.451 per cent) followed by plant height (18.354 and 13.895 per cent), seed index (13.261 and 10.865 per cent), lint index (11.902 and 11.226 per cent) and boll weight (11.472 and 10.503 per cent). The moderate value for GCV and PCV was observed for number of bolls per plant, plant height, seed index, lint index and boll weight. Similar findings were also reported by Pujer *et al.* (2014) [17], Vinodhana *et al.* (2013) [19], Dahiphale *et al.* (2015) [4] and Kumar *et al*. (2017) [13]

The lowest PCV and GCV were observed for number of sympodia per plant (9.387 and 9.303 per cent), fibre strength (8.706 and 8.229 per cent), fibre fineness (8.635 and 8.531 percent), upper half mean length (8.265 and 8.236 per cent), days to 50 percent of flowering (3.887 and 3.772 per cent), ginning percentage (5.332 and 3.756 percent) and uniformity ratio (3.013 and 2.115 percent). The lowest genotypic and phenotypic coefficient of variation were observed for fibre strength, fibre fineness, upper half mean length, days to 50% flowering, ginning percent and uniformity ratio. The similar results were reported by Gumber *et al*. (2005) [9], Vinodhana *et al.* (2013) [19] and Jangid *et al.* (2019) [10].

Days to 50 percent flowering, plant height, number of sympodia per plant, number of bolls per plant, boll weight, seed index, lint index, ginning percentage, upper half mean length, fibre fineness, fibre strength, and uniformity were found to have high heritability in the current study. High heritability indicates that the traits high value is due to positive environmental impacts, qualities were under genotypic control, selection was simple, and that improvement was achievable using selective breeding procedures for these traits. High heritability suggests that genotypic variance accounts for the majority of phenotypic variance, and accurate selection for these traits should be made based on phenotypic performance.

High value of heritability for all characters under study, were also reported by Elango *et al.* (2012) [6] for number of bolls per plant, seed cotton yield per plant, micronaire value, uniformity ratio, Vinodhana *et al.* (2013) [19] for seed cotton yield, fibre length, fibre strength, plant height, number of bolls per plant, Erande *et al.* (2014) [7] for number of sympodia per plant, plant height, number of boll, boll weight, harvest index, seed cotton yield per plant and micronaire value, Amanu *et al.* (2018) [2] for fibre strength, upper half mean length, boll weight, ginning percent, boll number per plant and Monisha *et al.* (2018) [15] for number of sympodia per plant and number of boll per plant.

Genetic advance as per cent of mean ranged from 5.06 to 43.03. Seed cotton yield per plant, number of bolls per plant, lint index, and plant height recorded high genetic advance as a percent of mean, while number of sympodia per plant, fibre strength, upper half mean length, fibre fineness, seed index, and boll weight recorded moderate genetic advance as a percent of mean. In this study, the low value of genetic advance as a percentage of mean was found for days to 50% flowering, ginning percentage and uniformity ratio.

These results are in conformity with the studies of Gnanasekaran *et al.* (2020) [8] for number of bolls per plant and seed cotton yield per plant, Jangid *et al.* (2019) [10] recorded high genetic advance as per cent of mean for seed cotton yield per plant, lint index and number of bolls per plant, Amanu *et al.* (2018) [2] for number of bolls per plants, Pujer *et al.*, (2014) [17] for seed cotton yield per plant, plant height and number of bolls per plant, Elango *et al.* (2012) [6] for fibre fineness/micronaire value and uniformity ratio, Dhivya *et al.* (2014) [5] for boll weight, Patil *et al.* (2014) [16] for fibre strength and Dahiphale *et al.* (2015) [4] for seed index.

The traits seed cotton yield per plant, number of bolls per plant, lint index and plant height indicate high estimates of heritability accompanied with high genetic advance as per cent of mean indicating additive gene action and thus selection for these characters in genetically diverse material would be effective for desired genetic improvement. Similar results were reported by Gnanasakeran *et al.* (2020) [8] for number of bolls per plant and seed cotton yield per plant, Pujer *et al.* (2014) [17] for plant height, Erande *et al.* (2014) for plant height, number of bolls per plant and seed cotton yield per plant and Dahiphale *et al.* (2015) [4] for seed cotton yield per plant.

The high heritability with moderate genetic advance as a per cent of mean indicating the presence of non-additive gene action. The characters, number of sympodia per plant, fibre strength, upper half mean length, fibre fineness, seed index

and boll weight showed high heritability with moderate genetic advance. Similar results were reported by Dhivya *et al.* (2014) for boll weight, Pujer *et al.* (2014) [17] for uniformity ratio, Patil *et al.* (2014) for fibre strength and Dahifhale *et al.* (2015) [4] for seed index. The high heritability with low genetic advance as per cent of mean indicates the presence of non-additive gene action. The traits, days to 50 percent flowering, ginning percentage and uniformity ratio shows high heritability accompanied with low genetic advance as per cent mean. Similar result was reported by Elango *et al.* (2012) [6].

Table 1: Parameters of genetic variability for morphological, yield contributing and fibre characters

Sr. No.	Characters	Range	Mean	GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM
1	Days to 50 percent flowering	66.50-76.50	70.60	7.05	7.49	3.77	3.89	94.2	5.31	7.55
2	Plant height (cm)	123.10-155.00	132.72	258.47	450.99	13.89	18.35	65.3	25.07	21.67
3	No. of sympodia /plant	11.10-16.80	13.36	1.59	1.62	9.30	9.39	98.2	2.57	20.99
4	No. of bolls/plant	12.90-26.20	19.34	10.89	12.92	17.45	19.01	84.3	6.24	33.07
5	Boll weight (g)	2.16-.2.96	2.59	0.03	0.08	10.50	11.47	68.4	0.26	12.11
6	Seed index (g)	5.03-6.09	5.26	0.28	0.38	10.86	13.26	74.6	0.94	15.78
7	Lint index (g)	3.23-5.33	4.39	0.24	0.27	11.23	11.90	89.0	0.96	21.81
8	Ginning percent (%)	34.88-41.95	37.77	2.01	4.36	3.76	5.53	61.0	1.98	7.25
9	UHML (mm)	21.90-31.50	26.37	4.72	4.75	8.24	8.26	92.3	4.46	16.91
10	Fibre fineness (µg/in)	4.70-6.30	25.97	0.19	0.22	8.23	8.71	89.3	0.86	16.02
11	Fibre strength (g tex^{-1})	21.50-31.80	5.35	4.88	5.00	8.53	8.64	90.5	4.49	17.39
12	Uniformity ratio (%)	73.00-84.00	80.62	2.91	5.90	2.11	3.01	63.2	2.46	5.06
13	Seed cotton yield/plant (g)	31.29-56.44	40.48	29.59	42.72	21.72	22.01	96.1	9.33	43.03

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