



Genetic variability studies for seed cotton yield and fibre quality traits in *desi* cotton [*Gossypium arboreum* (L).]

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Abstract

The variability studies indicated that the high estimate of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was observed for seed cotton yield per plant. High phenotypic coefficient of variation and moderate genotypic coefficient of variation was observed for the number of monopodia per plant. High heritability observed for the plant height, upper half mean length, fiber strength, and uniformity ratio, the number of bolls per plant, micronaire and seed cotton yield per plant. The plant height, the number of bolls per plant and seed cotton yield per plant shows high heritability coupled with high genetic advance over mean indicating the preponderance of additive gene action in the inheritance of these traits. Genetic variability parameters were studied in forty-two cotton genotypes raised during *kharif* 2025-2026 at Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in randomised block design with two replications. The high degree of variability observed among genotypes for different yield contributing traits could be utilized in the breeding program for the improvement of *desi* cotton.

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

Introduction

It is referred to as “White Gold” or King of fibre crop for its global importance and industrial utility (Romeu-Dalmau *et al.*, 2015) ^[18]. Cotton is a versatile fiber crop, primarily cultivated for its soft, fluffy cellulose fibers used in textiles. It's a significant cash crop, especially in India, where it supports millions of farmers and workers in related industries. Cotton is a warm-season crop, requiring high temperatures and rainfall, and is grown in tropical and subtropical regions worldwide. Cotton is an important crop for sustainable economy of India and livelihood of the Indian Cotton Farming Community. As it is the world's most important non-food agricultural commodity, cotton is essential for textile production, provides basic raw material to cotton textile industries, at present nearly 60 million people depend on cotton cultivation, marketing, processing, and export for their livelihood (Wendel *et al.*, 2012) ^[24].

Among the 50 species of cotton, which are the world's most important crop for fiber, 44 are diploid ($2n=2x=26$) and remaining species are allotetraploids ($2n=4x=52$). There is total four cultivated species of cotton. Cotton seed had gained the additional economic importance as a major contributor to edible oil, protein and other by-products (Hasan & Latha, 2017) ^[8].

Genetic variability, combined with heritability, provides insights into the potential and scope for improvement in crop breeding programs. High heritability, when accompanied by substantial genetic advance, indicates the likely progress achievable through selection (Deguang *et al.*, 2018) ^[15].

Material and Method

Thirty two genotypes of *desi* cotton were used for characterization, genetic variability in randomized block design with two replications during *kharif* 2025-2026. Plot size of *desi* cotton was 1.2×6.0 m² with spacing of 60 cm $\times$ 30 cm. recommended package of practices were followed as suitable for the climate conditions of Parbhani. Data were recorded on five randomly tagged plants for viz., days to 50 per cent flowering, number of monopodia, number of sympodia, plant height, number of bolls per plant, boll weight, ginning percentage, uniformity ratio, fiber strength, upper half mean length, micronaire, and seed cotton yield per plant. Genetic variability parameters were assessed based on the formula given by Burton (1952) ^[2]. Heritability and genetic advance parameters were calculated according to Allard (1940) and Johnson *et al.* (1955) ^[3].

Result and Discussion

The values of genotypic and phenotypic coefficient of variation for days to 50 % flowering were recorded 3.24 and 3.67 per cent respectively. The values for genotypic and phenotypic coefficient of variation for plant height were recorded 4.08 and 4.92 per cent respectively. The values for genotypic and phenotypic coefficient of variation for number of sympodia were recorded 21.58 and 25.02 per cent respectively.

The values for genotypic and phenotypic coefficient of variation for number of bolls per plant were recorded 24.53 and 25.83 per cent respectively. The values for genotypic and phenotypic coefficient of variation for boll weight were

recorded 8.72 and 8.85 per cent respectively. The values for genotypic and phenotypic coefficient of variation for seed cotton yield per plant were recorded 23.31 and 24.01 per cent respectively.

The values for genotypic and phenotypic coefficient of variation for upper half mean length were recorded 4.23 and 4.40 per cent respectively. The values for genotypic and phenotypic coefficient of variation for fiber fineness were recorded 4.86 and 5.61 per cent respectively. The values for genotypic and phenotypic coefficient of variation for fiber strength were recorded 5.01 and 5.17 per cent respectively. The values for genotypic and phenotypic coefficient of variation for uniformity ratio were recorded 1.16 and 1.51 per cent respectively.

The highest estimate of phenotypic coefficient of variation and genotypic coefficient of variation was observed for number of sympodia (21.58 and 25.02 %), number of bolls per plant (24.53 and 25.83 %) and seed cotton yield per plant (23.31 and 24.01 %) respectively. These findings are in agreement with the results reported by Jangid *et al.*, (2019) ^[9] in American cotton. Similar findings were also reported Pinki *et al.*, (2018) ^[17] in American cotton, Nawaz *et al.*, (2019) ^[14] in American cotton, Bhatti *et al.*, (2020) ^[4] in American cotton and Jangid *et al.*, (2019) ^[9] in American cotton.

The lowest PCV and GCV were observed for days to flowering (3.24 and 3.67 percent), days to maturity (1.30 and 1.78 percent), Uniformity ratio (1.16 and 1.78 percent). The similar results were reported by Chapepa *et al.*, (2020) in American cotton and Patankar (2021) ^[16] in American cotton.

High heritability (94.25 %) coupled with moderate genetic advance (20.56) as per cent of mean was recorded for seed cotton yield per plant followed by number of bolls per plant (90.21% and 13.93). High heritability coupled with low genetic advance was recorded for characters viz; boll weight (97.12 % and 0.61), ginning percentage (98.71 % and 6.4), fibre strength (93.91 % and 3.58) and upper half mean length (92.21 % and 3.11). High value of heritability for all characters under study, were also reported by Sahar *et al.*, (2021) in american cotton for number of bolls per plant, seed cotton yield per plant, micronaire value, uniformity ratio, Jangid *et al.*, (2019) ^[9] in american cotton for seed cotton yield, fiber length, fiber strength, plant height, number of bolls per plant, Sangwan *et al.*, (2023) ^[21] in desi cotton for fiber strength, upper half mean length, boll weight, ginning percent, boll number per plant and Nikhil *et al.*, (2023) in american cotton for number of sympodia per plant and number of boll per plant.

Genetic advance as percent of mean ranged from 2.37 to 45.83. Seed cotton yield per plant, number of bolls per plant and boll weight recorded high genetic advance as a percent of mean, while days to 50% flowering, plant height, ginning percentage, fiber strength, upper half mean length and fiber fineness 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 maturity and uniformity ratio.

These results are in conformity with the studies Jangid *et al.* (2019) ^[9] in american cotton recorded high genetic advance as per cent of mean for seed cotton yield per plant, lint index and number of bolls per plant, Valu *et al.*, (2021) ^[23] in desi cotton for number of bolls per plants, Kumar *et al.*, (2024) ^[12] in desi cotton for seed cotton yield per plant, plant height and number of bolls per plant, Nandhini *et al.*, (2019) ^[13] in american cotton for fiber fineness/micronaire value and uniformity ratio.

It was suggested that when calculating genetic progress may during by selection, it is important to evaluate both heritability and genetic advance as a percent mean of traits rather than considering each character individually. The heritability associated with genetic advance as per cent of mean is more useful for predicting yield under phenotypic selection than heritability estimations alone. High heritability coupled with high genetic advance as per cent mean suggests that most likely the heritability is due to additive gene action and selection may be successful. The traits seed cotton yield per plant, number of bolls per plant, boll weight, ginning percentage, fibre strength and upper half mean length recorded high estimates of heritability accompanied 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) in american cotton for number of bolls per plant and seed cotton yield per plant, Jogender *et al.*, (2023) ^[10] in desi cotton for plant height, number of bolls per plant and seed cotton yield per plant and Sangwan *et al.*, (2023) ^[21] in desi cotton for seed cotton yield per plant. The high heritability with moderate genetic advance as a per cent of mean indicating the presence of nonadditive gene action. The characters, plant height and number of bolls per plant showed high heritability with moderate genetic advance. Similar results were reported by Jogender *et al.*, (2023) ^[10] in desi cotton for uniformity ratio, Fatima *et al.*, (2021) ^[6] and Vaibhav Ujjainkar (2024) ^[22] in desi cotton for fiber strength.

The high heritability with low genetic advance as per cent of mean indicates the presence of non-additive gene action. The traits, boll weight ginning percentage, fibre strength and upper half mean length have recorded high heritability accompanied with low genetic advance as per cent mean. Similar result was reported by Sagar *et al.*, (2023) ^[15] in desi cotton.

Conclusion

The investigations conducted in this study unveiled that the characters boll weight, number of bolls and seed cotton yield per plant has high heritability high genetic advance as percent mean. The traits which exhibit high heritability coupled with high genetic advance indicating the role of additive genes and selection based on these traits like plant height, number of sympodia per plant and number of bolls per plant would be beneficial for further crop improvement.

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Author's contribution:

1. **Author 1:** She conducted the experiment as part of PG study.
2. **Author 2:** He guided the PG student for effective conduct of the experiment.
3. **Author 3:** He checked the manuscript.
4. **Author 4:** She provided technical help for conduct of the experiment.
5. **Author 5:** He finalized the objectives of the experiment.
6. **Author 6:** She helped the student for analysis of the data of the experiment.

Conflict of Interest

The authors have no conflict of interest

Characters	GCV (%)	PCV (%)	Heritability (BS) (%)	Genetic advance (GA)	Genetic advance as % of Mean (GAM)	Genotypic Variance (GV)	Phenotypic Variance (PV)
Days to 50 % flowering	3.24	3.67	77.80	4.93	7.54	4.48	5.76
Days to maturity	1.30	1.78	53.42	2.91	2.52	2.26	4.25
Number of sympodia	21.58	25.02	65.80	5.17	45.83	8.56	12.12
Plant height (cm)	4.08	4.92	69.00	13.47	8.96	37.74	54.72
Number of bolls/plant	24.53	25.83	90.21	13.93	61.53	30.87	34.21
Boll Weight (gm)	8.72	8.85	97.12	0.61	22.70	0.05	0.05
Ginning percentage (%)	6.58	6.63	98.71	6.40	17.28	5.96	6.04
Uniformity Ratio (%)	1.16	1.51	59.51	1.97	2.37	0.94	1.58
Fiber Strength (g/tex)	5.01	5.17	93.91	3.58	12.80	1.96	2.09
Upper half mean length (mm)	4.23	4.40	92.21	3.11	10.73	1.50	1.63
Micronaire (µg/inch)	4.86	5.61	75.31	0.63	11.15	0.07	0.10
Seed cotton yield per plant (gm)	23.31	24.01	94.25	20.56	59.71	64.41	68.38

Ethics Approval

The authors approve the research article for publication.

AI Tool Usage Declaration

No AI tool is used for conduct of the experiment.

Table 1: Analysis of variance for morphological, yield contributing and fibre characters in cotton

Sr. no.	Characters	Mean sum of squares		
		Replication (1)	Treatment (41)	Error (41)
1	Days to 50% flowering	0.01	10.25**	1.28
2	Days to maturity	5.76	6.51**	1.98
3	No. of sympodia	1.44	25.69**	4.56
4	Plant height (cm)	3.85	92.46**	16.97
5	No. of bolls (gm)	0.04	65.08**	3.34
6	Boll weight (gm)	0.01	0.11**	0.01
7	Ginning %	0.00	12.01**	0.08
8	Uniformity ratio	0.72	2.40**	0.19
9	Fibre strength (g tex ⁻¹)	0.30	4.06**	0.12
10	UHML (mm)	0.22	3.13**	0.13
11	Micronaire(µg/in)	0.01	0.18**	0.02
12	Seed cotton yield/plant	0.14	132.80**	3.96

*, ** significant at 5 and 1 percent level, respectively.

Table 2: Parameter of genetic variability for morphological, yield contributing and fibre characters in cotton

Abbreviation	Full Form
GV	Genotypic Variance
PV	Phenotypic Variance
PCV (%)	Phenotypic co-efficient of Variation (%)
GCV (%)	Genotypic co-efficient of Variation (%)
BS (%)	Heritability (%)
GAM (%)	Genetic Advance as Percentage of Mean (%)
GA	Genetic Advance

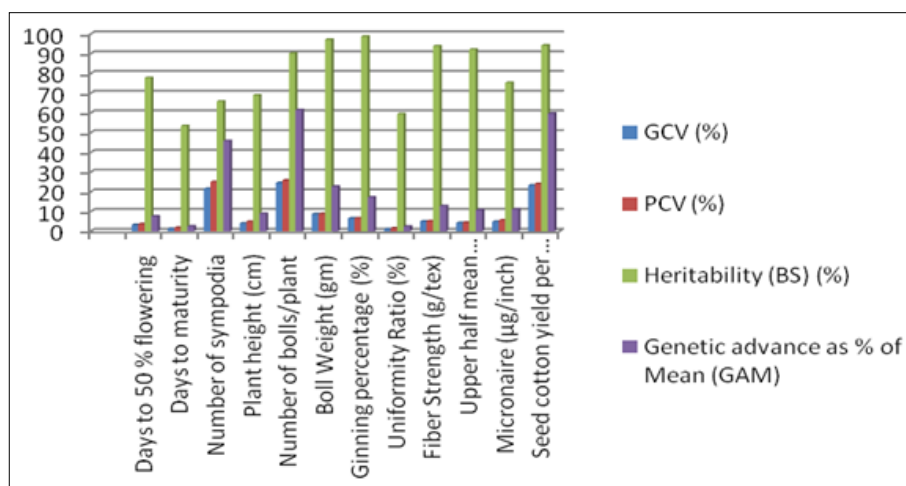


Fig 1: Graphical representation of genetic parameters for sixteen characters in desi cotton (*Gossypium arboreum* L.)

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