Plant Archives Vol. 18, Special Issue (ICAAAS-2018), 2018 pp. 347-349 *ISSN 0972-5210*

STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE FOR CERTAIN ECONOMIC TRAITS IN COTTON (*GOSSYPIUM* SPP.) F_2 POPULATION

J.L. Joshi, K. R. Saravanan*, Darling B. Suji and Ajish Muraleedharan

Department of Genetics and Plant Breeding,
Faculty of Agriculture, Annamalai University, Annamalainagar, Tamilnadu-608002

Abstract

A study was conducted to find the *per se* performance, variability, heritability and Genetic advance for seven quantitative characters *viz*. Days to first flower, number of bolls per plant, boll weight, number of seeds per boll, seed cotton yield per plant, 100 seed weight and ginning percent in four parents *viz*. SVPR-2, Paiyur-1, MCU-5, Suvin, F_1 and F_2 generations. The mean performance revealed that parent Suvin was relatively good combiner with high per se for number of bolls per plant and MCU-5 for boll weight and seed cotton yield per plant. The cross MCU-5/ Suvin recorded high percentage of PCV, GCV, heritability and Genetic advance as per cent of mean for number of bolls per plant, seed cotton yield per plant and ginning per cent.

Introduction

Cotton (*Gossypium* spp.) is one of the most important commercial crop in India, plays a vital role in national economy and sustain million of people engaged in its cultivation, processing and marketing. It provides fibre for the textile industry, cellulose from its lint, oil and protein rich meal from its seed. Cotton being the "king of fibres" in preparing human apparel, has played a key role in the development of civilization. Due to its importance in agriculture as well as industrial economy, it is known as "White Gold". In India, cotton contributes 80 percent of the raw material for textile industry and still maintaining its prime position. Significant achievement has been made in the production of cotton during the past three decades by cultivating improved verities of hybrids. Success in hybrid programs and of selection of superior variety would be effective only when high genetic variability exists in the material. Robinson *et al*. (1949) emphasized that heritability of characters is the main concern to the breeder since it indicates the possibility and extend to which improvement is feasible through selection on phenotypic basis. Johnson *et al.* (1955) suggested that heritability together with genetic advance would bring out the advance expected from selection. The variation present in the population can be assessed by measuring the magnitude of phenotypic coefficient and genotypic coefficient of variability, heritability and genetic advance in the segregating populations. These statistical analysis will help the breeder in selection of elite genotypes.

Materials and methods

The present study was carried out at the plant breeding farm, faculty of Agriculture, Annamalai University.during. The genetic materials used for the study consists of four genotypes, among them, SVPR-2, Paiyur -1 and MCU-5 were Gossypium hirsutum and the remaining Suvin was Gossypium barbadense. The parental materials were raised on the sides of ridges with a spacing of 75 cm and between rows and 45 cm between plants and were crossed in direct and reciprocal fashion and produced four F_1 hybrids. Seeds of four F_1 hybrids were raised in same spacing along with their parents simultaneously in next season. Selected F_1 parents were selfed to obtain F_2 generation seeds in the following season. Four F_2 populations along with their parents were raised in randomized block design (RBD) with three replications. Around eight plants were maintained for each F_2 segregating populations in eight rows per replication. Around ten plant per parents and F_1 hybrids were maintained in two rows per replication. Recommended agronomic practices were provided. Davis (1978) also reported to keep the crop free from pests and diseases. In all the three replications, observations were recorded on individual plant basis for character of economic importance *viz*. Days to first flower, number of bolls per plant, boll weight, number of seeds per boll, seed cotton yield per plant, 100 seed weight and ginning percent. The mean and variance were analysed based on the formula given by Singh and Chaudhary (1977). The genotypic and phenotypic coefficient of variations were computed according to method suggested by Burton and Devane (1953). The range of phenotypic coefficient of variation and genotypic coefficient of variation as suggested by Sivasubramanian and Madhava menon (1973), Heritability (in broad sense an categorized by Robinson (1949) and Genetic advances as per cent of mean by Johnson *et al*.(1955).

Result and Discussion

Among the four crosses taken for the study, cross 3 record highest mean performance for number of bolls per

Corresponding Author Email: j_l_joshi@yahoo.com

plant, seed cotton yield per plant, 100 seed weight and ginning per cent respectively, since the parents P_3 and P_4 had high mean performance for seed cotton yield per plant and number of bolls per plant. Also, cross 4 recorded the highest mean value for days to first flower and boll weight due to the highest mean performance of their parents for maximum boll weight and days to first flower. Information on the variability for yield and its components is essential for formulating an efficient breeding programme. Variability is the combined effect of genetic and environmental causes. A knowledge of genetic variability would provide realistic estimate and help to fix up characters in selection programme. The coefficients of variation indicated only the extent of variability existing for various traits and the heritable portion still stands as a question. In order to overcome that, heritability accompanied with estimates of genetic advance as per cent of mean was estimated. In the present study four crosses (cross 1, cross 2, cross 3, cross 4) in F_2 generation were subjected to Phenotypic coefficient of variation, Genotypic coefficient of variation , Heritability and Genetic advance as per cent of mean for all the seven traits viz., Days to first flower, number of bolls per plant, boll weight, number of seeds per boll, seed cotton yield per plant, 100 seed weight and ginning per cent.

The data for the trait Days to first flower indicated low phenotypic and genotypic coefficient of variation. The estimates of PCV were higher than GCV in all the crosses.the maximumGCV (3.03 per cent) was recorded in Cross 4. Moderate heritability coupled with low genetic advance as per cent of mean was observed in all crosses, except Cross 1 which had low heritability combined with low genetic advance as per cent of mean. Maximum heritability(53.4 per cent) combined with genetic advance as percent of mean (4.56 per cent) was recorded in cross 4 (Table 1). The number of bolls per plant exhibited low estimates of PCV and GCV in all crosses except Cross 3, which had moderate PCV (21.06 per cent) and low GCV (8.09 per cent). Moderate heritability coupled with low genetic advance as per cent of mean was recorded in all the crosses except Cross 3 which had moderate heritability (53.44 per cent) combined with moderate genetic advance (12.18 per cent) as per cent of mean (Table 1). In all the crosses high estimates of PCV and GCV were observed for boll weight. The Cross 3 recorded the maximum PCV(70.40 per cent) and Cross 1 observed the maximum GCV (55.47 per cent). In all the crosses high heritability coupled with high genetic advance as per cent of mean was recorded except for Cross 3 which has moderate heritability with high genetic advance. The Cross 3recorded maximum heritability (69.95 per cent) and genetic advance (98.73 per cent) as per cent of mean. (Table 1)

The estimates of PCV were higher than GCV in all the crosses for the trait number of seeds per boll. Moderate PCV and low GCV were recorded in all the crosses. The Cross 2 observed maximum PCV (18.08 per cent) and the Cross 4 exhibited maximum GCV (9.74 per cent). Moderate heritability coupled with moderategenetic advance as per cent of mean was observed in Cross 3 and moderate heritability combined with low genetic advance as per cent of mean is observed in the crosses 1 and 4. The Cross 2 recorded low heritability with low genetic advance. The maximum heritability (40.76 per cent) is exhibited in Cross 4. The maximum genetic advance as per cent of mean (10.25 per cent) is recorded in Cross 3 (Table 1).

The character seed cotton yield expressed low estimates of PCV and GCV. The PCV was higher than GCV in all the four crosses. The Cross 3 recorded the maximum PCV (4.78 per cent) and GCV (3.58 per cent). Moderate heritability coupled with low genetic advance is observed in all the four crosses. The maximum heritability (56.04 per cent) with genetic advance as per cent of mean (5.52) was observed in Cross 1 (Table:1). For the trait 100 seed weight high value of PCV and GCV was observed in all the crosses except in Cross 3which had moderate PCV and low GCV. Maximum PCV (40.95 per cent) was recorded in Cross 1 and maximum GCV (33.33 per cent) in Cross 4. High heritability coupled with high genetic advance as per cent of mean in Crosses 2 and 4. Maximum heritability (73.19 per cent) and maximum genetic advance as per cent of mean (58.66 per cent) is observed in Cross 4 (Table 1).

For the character Ginning per cent high PCV (28.36 per cent) and GCV (23.28 per cent) was recorded in Cross 3. High heritability(67.38 per cent) coupled with high genetic advance as per cent of mean (24.29 per cent) is recorded in Cross 3. From the present study, the estimates of GCV in comparison to their respective PCV showed wide variation present in the characters namely, number of bolls per plant, boll weight, ginning per cent, seed cotton yield per plant and 100 seed weight indicating that these characters are highly amenable for selection. Similar results were obtained by Krishnadoss and Kadam-bavanasundaram (1993). Among the crosses, the cross 3 recorded high values of PCV and GCV for number of bolls per plant, ginning per cent and seed cotton yield per plant.

Heritability along with genetic advance as per cent of mean are normally more helpful in predicting the gain under selection than heritability estimates alone. The progress of selection among heritable variance can be obtained from the estimates of genetic advance (Burton, 1952; Johnson *et al.,* 1955). Heritability in broad sense included both additive and non additive genes. The character, days to first flower recorded moderate heritability and low genetic advance as per cent of mean, it indicated the presence of non- additive gene action, hence selection for such traits may not be rewarding. Moderate heritability accompanied with low genetic advance (except cross 3) was observed for number of bolls per plant and number of seeds per boll. It indicated the presence of non- additive gene action. Almost all the crosses recorded high to moderate heritability with very high genetic advance as per cent of mean for boll weight and 100 seed weight. It indicated that most likely the heritability is due to additive gene effects and selection may be effective for this character. Low genetic advance for seed cotton yield per plant was observed in all crosses. This is in accordance with the work of Jain *et al*. (1984). From the foregoing results on heritability and genetic advance, it is clear that the Cross 3was the best as it recorded considerable genetic advance for seed cotton yield indicating the possibility of improvement in the seed cotton yield.

Table: 1 Mean, Variability, Heritability and Genetic advance in F_2 generation

Parameters	Populations	PCV (%)	GCV (%)	h^2 (%)	GA as % of mean	Mean
Days to first flowering	Cross 1	4.78	2.38	25.00	2.45	59.12
	Cross 2	4.73	2.94	38.66	3.74	60.02
	Cross 3	5.22	2.99	32.96	3.52	67.72
	Cross 4	4.14	3.03	53.49	4.56	70.05
Number of bolls per plant	Cross 1	19.62	15.72	35.62	7.00	29.57
	Cross 2	16.82	14.61	45.31	6.39	40.12
	Cross 3	21.06	18.09	53.44	12.18	50.83
	Cross 4	14.02	12.28	32.16	2.66	45.66
Boll weight	Cross 1	67.10	55.47	68.12	94.34	3.21
	Cross 2	69.08	53.51	56.87	81.57	3.24
	Cross 3	70.40	54.23	69.65	98.73	3.14
	Cross 4	67.61	55.12	66.86	92.85	3.34
Number of seeds per boll	Cross 1	11.20	6.66	35.40	8.16	22.05
	Cross 2	18.08	9.04	25.00	8.14	24.57
	Cross 3	16.26	8.99	30.60	10.23	20.13
	Cross 4	15.25	9.74	40.76	9.87	21.71
Seed cotton yield per plant	Cross 1	14.66	12.66	32.62	3.13	127.02
	Cross 2	11.51	9.94	38.81	0.67	145.92
	Cross 3	16.78	13.58	56.09	5.52	161.08
	Cross 4	11.68	9.16	47.90	1.66	122.92
100 seed weight	Cross 1	40.95	29.62	52.22	43.97	9.55
	Cross 2	36.19	29.79	67.76	50.43	8.88
	Cross 3	14.12	9.11	41.67	12.05	10.62
	Cross 4	38.96	33.33	73.19	58.66	9.00
Ginning percentage	Cross 1	6.22	5.00	64.62	8.24	33.98
	Cross 2	6.78	3.95	38.28	4.72	32.03
	Cross 3	28.36	23.28	67.38	24.28	34.43
	Cross 4	22.08	16.42	44.45	20.18	32.41

References

Burton, G.W. (1952). Quantitative inheritance in grasses. Proc. *6th Intl.Grassland Cong.*, **1:** 227-283.

Davis , D.D. (1978). Hybrid cotton-specific problems and potentials. *Adv.Agron.,* **30:** 129-157.

Jain, D.K., B.R. Mom and S.S. Nehra (1984). Studies on Heritability and genetic advance in desi cotton (Gossypium arboretum L.). *J. Indian Soc. Cott. Improv.,* **9(9):** 1-4.

Johnson, H.W., H.F. Robinson and R.E. Comstock (1955). Estimates of genetic and environment variability in soybean. *Agron. J.,* **47:** 314-318.

Krishnadoss, D. and M. Kadambavanasundaram (1993). Genetic variability, heritability and genetic advance in tetraploid species of cotton. *Indian J. Genet.,* **53(1):** 55-59.

Robinson, H.F., R.E. Comstock and P.H. Harvey (1949). Estimates of heritability and the degree of dominance in corn. *Agron. J.,* **41:** 351-359.