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Genetic Variability Studies in American Cotton (*Gossypium hirsutum L.*)*

P. W. KHORGADE[1] and A. P. EKBOTE[2]

In general, the studies revealed low genetic coefficient of variation for all the traits under study. The traits viz., plant height, number of sympodia per plant, number of bolls per plant and lint index showed comparatively high estimates of genetic advance accompanied with high estimates of heritability. The highest expected genetic advance of 55.99 percent accompanied by 72.50 percent of heritability estimate in respect of number of bolls per plant was encouraging as it indicated possibilities of improvement through judicious selection for this most important yield determiner.

Cotton is the main economic and industrial crop of Maharashtra accounting for nearly 36 per cent of the total cotton area in the country. The improvement in yield per plant should be the ultimate aim of every breeder in cotton improvement programme. Because of the fact that expression of most of the quantitative characters is greatly influenced by environmental fluctuations, the phenotypic variability among a collection of genetic stocks does not give a true indication of the potential genotype variability. Therefore, it is necessary to determine the exact magnitude and nature of heritable and non-heritable components of variation present in yield and its important components which will enable the breeder to know which traits respond to selection and how much improvement can be expected by basing selection on a particular trait and thus help him to plan his breeding programme accordingly.

MATERIAL AND METHODS

With the above abjectives in view, thirty three genotypes of *Gossypium hirsutum* L., comprising of indigenous strains collected from several cotton growing states of India were selected for study.

The genotypes were sown in a randomised block design, replicated four times, net plot size being 1.20 mx 4.80 m, the distance between rows and plants being 0.60 m and 0.30 m respectively.

The experiment was conducted at experimental area of cotton scheme, Punjabrao Krishi Vidyapeeth, Akola during 1973-74 and 1974-75, with identical details.

The observations were recorded, at maturity, on each of the five randomlyr selected plants, per genotype in each replication during both the years of

Punjabrao Krishi Vidyapeeth, Akola 444104 (Maharashtra)

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1 Assistant Professor of Botany, 2 Senior Research Scientist (Oilseeds).

study on the following traits: 1) Plant height in centimeter (2) Number of sympodia per plant (3) Number of bolls per plant (4) Boll weight in gramme (5) Halo length in millimeter (6) Ginning percentage (7) Lint index (8) Seed index and (9) Yield of seed cotton (*Kapas*) per plant in gramme.

The data obtained for both the years were subjected to the analysis of variance and covariance as per standard method (Panse and Sukhatme, 1954), pooled analysis was carried out (Panse and Sukhatme, 1954 and Cochran and Cox, 1957) and the total variance and covariance was partitioned into heritable and nonheritable components as per the method suggested by Fisher (1950). Various genetic parameters, viz., the genetic coefficient of variation, heritability estimates in broad sense and the expected genetic advance were estimated by the standard formulae (Burton, 1952; Hanson, Johnson *et al*., 1955· 1956 and Johnson *et al*., 1956, respectively).

RESULTS AND DISCUSSiON

Pooled analysis of the data presented in table 1 indicated that strains differed significantly among themselves for all the character studied. Range, general mean and various genetic parameters for all the nine characters, under study, are presented in table 2.

It is seen from table 2 that the genetic coefficient of variation ranged from 1.29 per cent for boll weight to 18.64 per cent in case of plant height, indicating, thereby, that the material, in general, possessed low amount of genetic variation for all the traits studied. These characters,Therefore appear to be considerably affected by environmental fluctuations. the character influenced to the maximum being boll weight and the trait which appeared to have been comparatively less influenced being plant height. Similar results were recorded, in hirsutum cotton, by Naidu and Katarki (1968).

Genetic coefficient of variation does not give the idea of total variation that is heritable. The relative amount of heritable portion of variation can be assessed through heritability estimates (Comstock *et al*., 1958). Heritability indicates the effectiveness with which selection for genotype can be based on the basis of its phenotypic performance. The heritability estimates worked out in broad sense, includes (i) additive gene effects, (ii) allelic interaction due to dominance and (iii) non-allelic interaction due to epistatis.

All the traits, under study, exhibited high estimates of heritability, the range being 52.07 per cent for seed cotton yield per plant to 96.24 percent for halo length. The traits, viz., number of bolls per plant and yield of seed cotton per plant exhibited comparatively low estimates of heritability, it being minimum for the latter. This is to be expected as both these traits are highly influenced by environmental fluctuations Thus the material, under study, appears to be promising because high heritability values for the quantitative characters are always preferred by the breeder, as characters with high heritability estimates are generally comparatively less affected by the environment and

these estimates, thus, enable him to base his selection reliably on the phenotypic expression of these characters in individual plants. High estimates of heritability for these traits were also observed by Singh *et al.* (1968) in hirsutum cotton.

The heritability values, however, merely indicate the total amount of genotypic variation that is heritable. They do not provide an indication of genetic gain that can be expected by basing selection on a particular character. Burton (1952) has suggested that genetic coefficient of variation together with the heritability estimates gives the best picture of the amount of advance to be expected from selection. However, heritability estimates alone are not of much use in predicting the effects of selecting the best individuals. According to Johnson *et al.* (1955) this purpose is better achieved by combining heritability estimates with expected genetic advance. This aspect was further dealt in detail by Panse (1957), who stated that high genetic advance estimates are indicative of additive gene effects and such variation can be effectively exploited by rigorous selection for character improvement.

In the present material the traits, viz., number of bolls per plant, plant height, number of sympodia per plant and lint index possessed higher estimates of genetic advance accompanied by high estimates of heritability which is very encouraging since selection based on these characters being of additive nature is likely to be more efficient for their improvement. As such phenotypic selection for these traits is likely to be effective for their improvement. However, the remaining traits possessed nonadditive type of heritability. Though these characters may not respond reliably to selection, their improvement can be brought about by taking advantage of their high heritability estimates in a judiciously planned selection programme.

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TABLE 1 Pooled analysis of variance for nine characters

Source	D. F.	Characters (M. S.)								
		Plant height	No. of sympodia/ plant	No. of bolls/ plant	Boll weight	Halo length	Ginning percentage	Lint Index	Seed index	Yield/ plant
Block	6	718.24	13.15	12.56	0.078	0.18	0.22	0.14	0,36	17.60
Season	1	1917.76**	65.40**	283.97**	0.029	8.69**	4.64**	0.23	3.13**	150.91**
Treatment	32	230.26**	5.53**	6.29*	0.074**	6,84**	8 77**	0.89**	0.88**	14.52**
Pooled error (Revised)	224	30.24	0.98	1.73	0.014	0.26	0.52	0.08	0.17	6.96
S. E.		1.944	0.349	0.470	0.042	0.179	0.255	0.098	0.145	0.932
C. D.		5.388	0.968	1,300	0.118	0.497	0.707	0.271	0.401	2.584

* Significant at 5% ** Significant at 1%

TABLE 2 Range, mean and various genetic parameters for nine characters

Characters	Range	Mean	Genetic Coefficient of variation (Percent)	Heritability in broad sence (Percent)	Expected genetic advance expressed as percentage of mean
Plant height in (cm)	41.72-90.98	57.54	18.64	86.87	47.19
No. of sympodia/plant	5 -13	8.78	7.20	82.34	45.42
No. of bolls/plant	3 -11	6.69	8.26	72.50	55.99
Boll weight in (g)	3.262-4.001	3.605	1.29	80.95	12.58
Halo length in (mm)	25.50-31.40	27 86	4.86	96.24	18.61
Ginning percentage	34.00-40.00	36.43	4.76	94.07	15.76
Lint index	4.63- 7.33	5 62	3.81	91.40	31.64
Seed index	8 600-11.650	9.801	2.71	81.14	16.05
Yield/plant in (g)	10.480-25 400	15.983	6.88	52.07	25.57