https://doi.org/10.29321/MAJ.10.A03625

Studies on Backcross Progenies of the Hybrid *Gossypium arboreum* × *G. anomalum*

by

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Introduction: Although the wild species is of little value as a source of genes for improving lint length, it is useful as a parent for imparting fineness and strength of lint. The first attempt at utilisation of the wild species to improve the fineness of lint of *G. arboreum* was that of Afzal *et al.* (1945). The results of subsequent work showed the possibility of transferring the desirable expression to the cultivated types (Kalyanaraman and Santhanam, 1954; 1957; Kesava Iyengar *et al.*, 1958 and Santhanam, 1958). The present study is aimed at an evaluation of the behaviour of the second back cross progeny of the hybrid *G. arboreum* × *G. anomalum*.

Materials and Methods: The following materials were drawn from the collection maintained at the Cotton Breeding Station, Coimbatore.

Selected cultures, 26–3, 29–4, 30–4, 31–4, 32–1 and 41–6 from the first backcross population (BC_1) *G. arboreum* × (*G. arboreum* × *G. anomalum*) (Marappan, 1960) were utilized. The first backcross hybrids were used as pollen parents, and *G. arboreum* as the female. If the BC_1 were pollen sterile, they were used as seed parents. Cross pollinations were effected after hand emasculation. The mean swollen hair diameter from two samples of about 70 cotton fibres, treated with 18% KOH was ascertained. The estimate was expressed in microns and values lower than 20μ were taken as indicating fineness (Nanjundayya, 1956). The strain Karunganni-6 was used as the recurrent parent in backcrosses.

Results: The number of bolls developed in crosses of *G. arboreum* with the BC_1s was greater than those in *G. arboreum* pollinated with pollen of the F_1 plants. *G. arboreum* recorded 67.5% germination within eight days after sowing, whereas in *G. anomalum* the percentage of germination was low. This characteristic of the wild species could be noticed in successive populations of the hybrid.

In the second back cross population 244 seedlings out of 545 seeds sown were secured. Observations were made in 66 plants. The mean number of seeds per capsule was 18.1 in *G. arboreum* whereas it was 14.4 in *G. anomalum* and 4.0 seeds in the F_1. Three out of eight plants in the first backcross population yielded bolls, their seed yield being 2.6, 2.7 and 6.3 per capsule.

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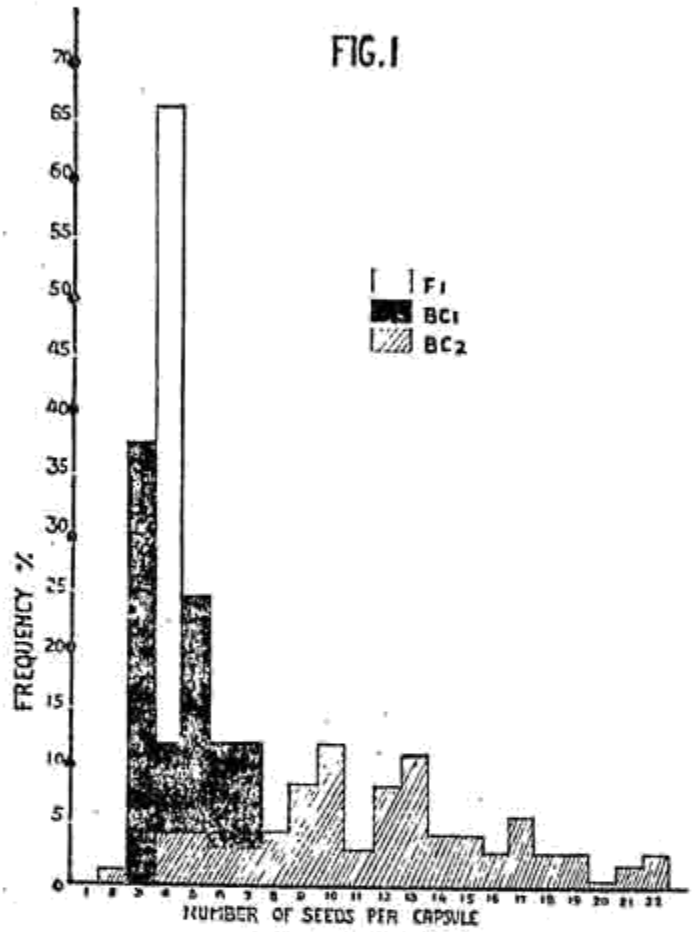
In the second back cross population the mean number of seeds per boll tended to increase, individual plants reaching the level of *G. arboreum*, or even exceeding it. It is noticed that the mean seed content per capsule in individual second back cross lines depends on the different plants used as male parent from the first backcross population (Fig. 1).



The percentage of good pollen is greatly reduced in the F_1 (24.3%), as compared to the parents, and the mean fertility of the first backcross was 36.1% while that of the second backcross progeny gets considerably increased (74.3%) (Fig. 2).

The swollen hair diameter in *G.arboreum* was 22.4μ whereas in *G.anomalum* it was 10.5 μ. The F_1 was intermediate (13.6 μ) with a dominant bias towards *G.anomalum*. In certain lines of the second backcross population all plants were coarse linted, in crosses involving *G.arboreum* and coarse linted first backcross hybrids.

One of the hybrids in the first backcross (26–3) which was used as the pollen parent to produce the second backcross, by itself produced no bolls. Nevertheless in the second backcross population five plants with low swollen hair values were obtained (Table.)

FIG.2

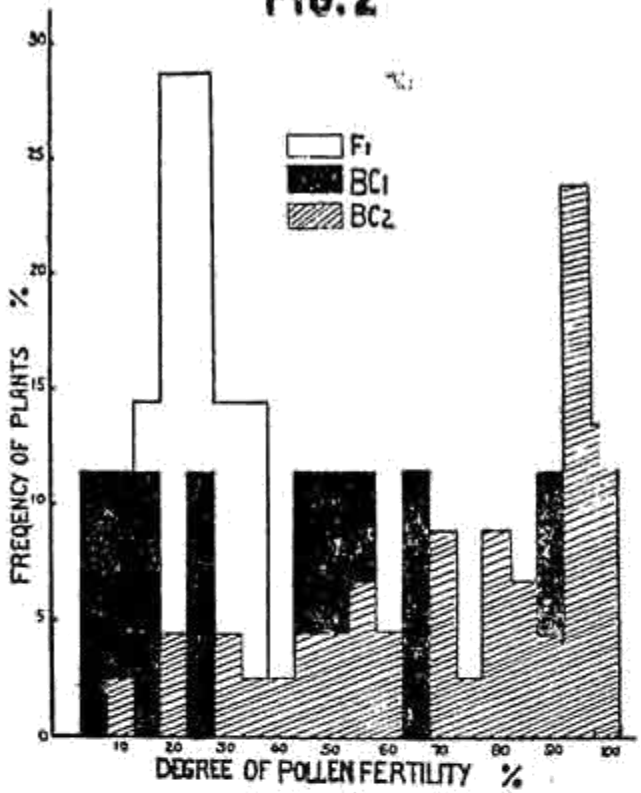

F1
BC1
BC2
FREQENCY OF PLANTS %
DEGREE OF POLLEN FERTILITY %

FIG.3

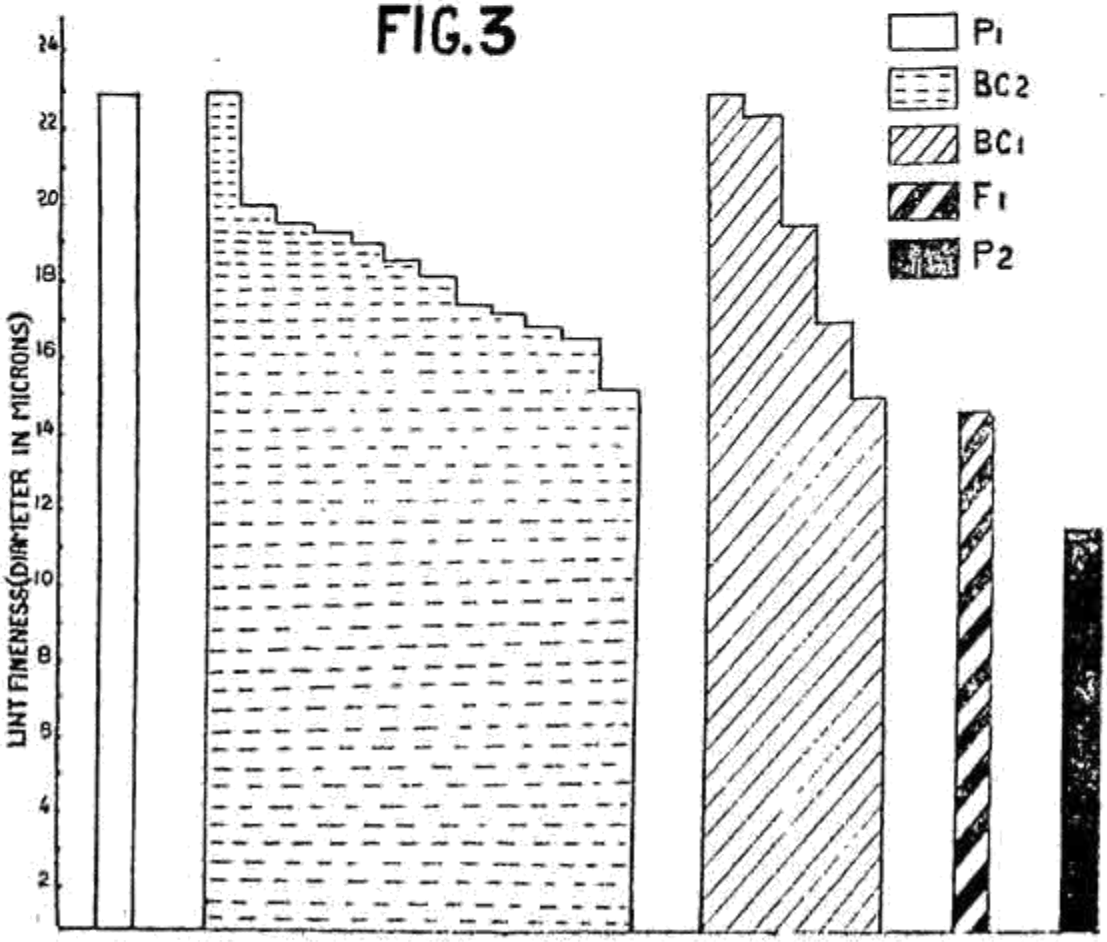

P1
BC2
BC1
F1
P2
LINT FINENESS(DIAMETER IN MICRONS)

TABLE. *Attributes of the parents and progenies of backcross derivatives of the hybrid G. arboreum × G. anomalum*

Culture	No. of bolls produced	No. of seeds per boll	Length of boll (cm)	Thickness of boll (cm)	Halo length (mm)	Ginning percentage	Lint index in (d.g)	Seed index in (d.g)	Swollen hair diameter (microns)	Pollen fertility %	Colour of lint
Plants selected for the present study											
G. arboreum (K 6) (Mean)	34.8	18.1	3.3	2.2	25.2	31.6	30.7	65.3	22.4	98.7	White
G. anomalum (Mean)	5.0	14.4	2.2	1.2	5.4	11.1	2.8	22.4	10.5	91.2	
F_1 hybrid (Mean)	20.1	3.9	2.7	1.4	18.2	22.1	8.9	38.0	13.6	24.3	Light brown
First backcross plant	71	4.8	2.8	1.5	21.2	32.3	18.4	38.6	18.4	36.1 (Mean)	Light green
Second backcross (a) (K 6×26-3)											
Plant 8/4	36	10.4	3.0	1.8	20.4	28.6	13.8	34.4	18.5	84.1	White
Plant 8/9	25	11.2	2.3	2.3	21.4	26.3	18.2	51.2	19.1	—	Grey
Plant 10/2	46	8.0	2.5	1.6	19.0	17.7	8.0	37.4	17.2	10.7	White
Plant 11/2	15	8.6	2.7	1.8	22.4	20.8	10.4	59.5	17.5	28.8	White
Plant 14/4	34	4.2	2.4	1.5	21.8	21.0	9.1	34.3	15.8	—	White
(b) (K 6×29-4)											
Plant 15/7	122	11.9	3.2	1.9	22.8	32.2	25.0	52.6	22.1	95.7	White
(c) (31-4×K 6)											
Plant 22/1	5	8.0	2.9	1.9	19.4	22.6	14.3	49.0	14.2	6.4	White
Plant 22/2	13	9.8	3.0	1.9	21.6	17.3	10.9	52.1	16.2	59.4	White
Plant 22/3	13	6.0	2.2	1.4	17.4	23.9	18.1	57.5	18.2	70.3	White
Plant 22/4	21	5.0	2.3	1.4	20.2	19.4	10.1	42.3	16.4	51.6	White
Plant 23/2	16	10.0	3.4	1.8	23.8	22.1	15.2	53.7	18.6	41.1	White
(d) (41-6×K 6)											
Plant 32/2	36	7.0	3.0	1.8	20.6	20.5	10.9	42.5	15.6	32.6	Green

In a small second backcross population obtained by using a fine linted BC_1 plant (16.1 μ) as the male parent, five were fine linted (Table and Fig 3) besides being white linted. Two (22/2 and 22/4) showed as much fineness as the BC_1 seed parent (16.1 μ), one (22/1) recorded a lower swollen hair value (14.2 μ) similar to that of the primary hybrid (13.6 μ). The BC_2 (22/2) plant was superior to its BC_1 seed parent in having larger number of bolls and seeds per boll, increased pollen fertility and boll size, enhanced lint length, and a better seed index. Another BC_2 plant 32/2, derived from a fine linted BC_1 plant (13.9 μ) proved to be fine linted (15.6 μ).

Discussion: The results indicate that the female parent used for hybridization has an influence on the time taken for germination. With K 6 as the female parent, the hybrid seeds germinated earlier than when a backcross hybrid was used as the female parent. The delayed germination of the latter is probably due to the hard testa, charactertistic of *G.anomalum.*

The fertility of the backcross hybrids, as measured both by the number of seeds per capsule and by the percentage of good pollen, was greatly increased over that of the F_1. Thus by the second backcrossing, the low fertility of the F_1 was got over.

One plant (26–3) in the first backcross progeny which was used as the pollen parent, did not produce any boll. Still in the subsequent progeny, plants with low swollen hair diameter appeared. This is similar to the recovery of a very high boll yielding plant (15/7) in the progeny of the cross *G.arboreum* $\times BC_1$ plant 29–4 an apparently degenerate type. As the outcome of the cross can not be predicted it seems worthwhile to select as many plants as possible in early backcross populations for use in hybridisation.

All the plants in a line of the second backcross (*G.arboreum* $\times BC_1$— Plant No. 31–1 with no lint fineness) did not show lint fineness, though a few excelled in other qualities. One fine linted BC_1 plant, 30–4 with a swollen hair diameter of 11.8 μ could not yield plants with appreciable fineness in the second backcross population. It is obvious that a study of the larger population is necessary and plants in the backcross progeny with the highest possible expression of the characteristic desired, have to be selected as male parents.

A plant (22/2) in the second backcross generation has a swollen hair diameter of 16.1 μ with the same fineness as its male parent. It addition, it was superior in having white lint, heavier seeds as indicated by the larger seed index, larger number of bolls, increase in boll size, larger number of seeds and also higher fertility (Table). The lint index (weight of lint per 100 seeds) also remains the same as that of the BC_1 parent. The apparent decrease in the ginning outturn is due to the seed weight having increased without an increase

in the lint weight per 100 seeds. Further backcrossing would be helpful in recovering types possessing the same lint fineness and the vegetative characteristics of the recurrent parent.

Summary: The second backcross of a hybrid of *Gossypium arboreum* and the wild species, *G.anomalum*, to strain K 6 *G.arboreum* showed an increase in the mean fertility. Their performance is discussed with reference to the characteristics of the first backcross hybrids used as parents, in the second backcross. Plants with high production of bolls and fine linted individuals have been isolated. In addition, they possessed white lint, higher seed weight, larger number of bolls and seeds, increased boll-size and better fertility. Further backcrosses with selected derivatives are suggested to be helpful in improving the fineness of the strain K 6.

Acknowledgement: This investigation formed the subject of study for the dissertation submitted by the first autor in part fulfilment of the requirements of the M.Sc. (Ag.) degree of the Madras University.

REFERENCES

Afzal, M., S. M. Sikka and A. Rahman. 1945. Cytogenetic investigations in some *arboreum-anomalum* crosses. *Indian J. Genet.*, **5**: 82-91.

Kalyanaraman, S. M. and V. Santhanam. 1954. The role of wild species of *Gossypium* in the improvement of cultivated cottons. *Proc. 3rd Sci. Workrs. Conf.* Madras Agric. Dept.

——— and ———. 1957. A note on the performance of some interspecific hybrids involving wild species of *Gossypium arboreum – anomalum* crosses. *Indian Cott. Gr. Rev.*, **11**: 136-40.

Kesava Iyengar, N., V. Santhanam and H. Leela. 1958. Further studies in *arboreum – anomalum* crosses. *Indian Cott. Gr. Rev.*, **12**: 369-75.

Marappan, P. V. 1960. Cotton improvement through Interspecific Hybridization-Behaviour of *arboreum – anomalum* back crosses. Diss. M. Sc. (Ag.) Univ. Madras. (un-publ.)

Nanjundayya, C. 1956. Technological Research on cotton in India. *Bull. Technology Laboratory, Bombay.*

Santhanam, V. 1958. Some problems concerning *arboreum* improvement work in Madras. *Proc. 8th Conf. Cott. Gr. Probl. India.*, Indian Cent. Cott. Cttee., Bombay.