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EFFECT OF RECURRENT SELFING AND SELECTION ON PLANT-TYPE IN INDUCED MUTANTS FROM DESI COTTON (*GOSSYPIUM ARBOREUM* L.)

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The germinating seeds of gaorani - 46 (*Gossypium arboreum* L., race indicum) were subjected to 5000 r/ min of Co^{60} gamma-rays and 0.001 to 0.007M solutions of DES treatments separately. Some mutant lines for earliness, higher number of fruiting branches, higher number of bolls per fruiting branch and higher percentage of fruiting branches with more than two bolls each per plant were isolated by M_2 generation after recurrent selfing and selection.

Naturally occuring variations and induced mutations in plant type, are of considerable interest in plant breeding and they have been utilised effectively in improving the plant type and yield in self pollinated crops Hence alteration of plant type in *Gossypium hirsutum* L., and *G. barbadense* L, has received considerable emphasis in cotton breeding programmes quite for some time, but this aspect did not receive adequate attention in the breeding of diploid Asiatic Cottons so far. Breeding for improvement in plant structure in gaorani cotton (*G. arboreum* L., race indicum) was first attempted by Qureshi and Rao (1974). Later, making use of naturally occuring variations in different populations of gaorani, Qureshi (1980) attempted to improve its plant type through inter-crossing followed by selection in successive cycles.

It is well-known that polyploids are more suitable for mutation breeding than the diploids. Still it was though worth-while to induce mutations in gaorani-46-a disease, pest and drought resistant variety with much stronger and finer staple like other arboreums, and breed it in successive generations to isolate mutant lines of stabilised improved plant types.

MATERIALS AND METHODS

Five hundred germinating pure seeds of gaorani-46, obtained from Indian Agricultural Research Institute (IARI), Regional Station, Rajendranagar, Hyderabad, were irradiated with 5000 r/min of CO^{60} gamma-rays at the Department of Genetics, Osmania University Simultaneously three hundred and fifty two-days-old seedlings were treated with 0.001 to 0.007M solutions of diethyl sulphate (DES) separately in lots of fifty seedlings in each treatment lasting for 6h.

The surviving seedlings were planted in separate well prepared and

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labelled plots along with control, in the research fields at the Department of Botany, Osmania, University, during Kharif, 1972. The normal spacing of 60 cms, between lines and 30 cms between plants was maintained The crop was raised under irrigated condition.

The M_1 plants were studied for the following characters :

(a) Days to flower
(b) Fruiting branches / plant
(c) Bolls/fruiting branch
(d) Precentage of fruiting branches/plant

with more than two bolls each on a plant.

The better performing M_1 plants in one or the other character than the control, were selfed and their M_2 seeds were produced.

The M_2 generation along with the control, was raised in plant to progeny rows with thirty plants in each row during Kharif, 1974. The data of twenty randomly taken plants, for each character, in each line was statistically analysed The best performing plants in the better performing lines were selfed and their M_3 seeds were produced.

The M_3 generation was raised in R.B.D. with three replicates of thirty plants each of the selected mutant lines and control in each replicate during Kharif, 1975. After statistical analysis of the data of each character, the best performing plants in the better performing mutant lines were selfed and M_4 seeds were produced The process was repeated in raising M_4 to M_6 generations from 1976 to 1978.

The M_2 to M_6 generations were raised in the research field at the Department of Botany, Kakatiya University, Warangal, A.P.

RESULTS AND DISCUSSION

(a) *Days to flower :* The number of days taken by a plant from the day of its planting to the day of opening of its first flower was taken as number of days taken by the plant to flower.

The mean number of days taken by the different selected mutant lines from M_3 to M_6 generations, is given in Table 1. The mutant lines SRC-525 ($\bar{x}=72.36 \pm 1.127$, range 59—104) and SRD - 305 ($\bar{x} = 74.28 \pm 1.608$, range 52 - 102) flowered significantly earlier than the control ($\bar{x}=82.50 \pm 1.180$, range - 60 - 100) ($P<0.01$), flowering 10.14 and 8.22 days earlier respectively than the control. SRC-525 got stabilized for this character at M_4 generation, but SRC 305 did not, even at M^5 generation.

(b) *Number of fruiting branches / plant :* The data of mean number of fruiting branches / plant in different mutant lines in M - M_6 generations, is given in table 2. It shows that while the control had the mean of 18.55 (range 5 - 53) fruiting branches plant in all generations together, SRC - 536, 538 and 562 had 30.53 (range 11 - 67), 24.80 (range 11 - 55) and 33.68 (range 13 - 161) fruiting

Table. 1. Days to flower in Selected mutant lines in M_3-M_6 generations
N=20

Mutant Line	M_3		M_4		M_5		M_6		Total N=240	
	$\bar{X} \pm$ SE	Range	$\bar{X} \pm$ SE	Range	$\bar{X}$ SE	Range	$\bar{X} \pm$ SE	Range	$\bar{X} \pm$ SE	Range
Control	86.75±3.072	60—100	80.95±2.304	62—98	81.00±2 280	63—96	81.30±1.862	62—100	82.50±1.180	60—100
SRC—301	97.70±2.568	81—107	84.70±1.937	75—106	91.05±0.878	82—102	92.25±1.640	84—104	91.43±1.049	75—107
SRC—302	97.70±2.578	81—107	76.45±1.219	65—87	76 25±0.714	66—88	78.50±3.321	67—90	82.83±1.484	65—107
SRC—305	96.15±1.590	90—109	65.30±0.974	63—78	74.75±0.652	72—81	60.90±0.523	52—90	74.28±1.608	52—109
SRC—307	96.15±1.590	90—109	70.60±2.506	63—98	75.40±2.849	72—81	78.25±1.490	68—85	80.10±1.527	63—109
SRC—357	98.65±2 075	82—110	78.05±2.027	70—100	76 25±0 903	73—84	79 30±1.795	78—96	83.06±0 354	70—110
SRC—362	89.05±0.343	80—98	84.90±1.933	75—102	84.35±1.079	79—80	77.60±3.779	76—92	83.98±1.212	75—102
SRC—420	93.90±1.617	73—109	81.10±1.168	70—98	80 95±0.601	75—88	79.55±2.791	74—86	83.88±0.470	70—106
SRC—525	82.75±0.744	73—104	67.60±1.787	59—81	68.75±0 852	63—73	70.35±2.173	61—93	72.36±1.127	59—104
SRC—538	76.05±0.510	75—83	82.45±1.324	76—112	74.75±1.506	60—80	78.05±2.158	65—100	77 83±0 787	60—112
SRC—550	75.25±2.408	67—107	90.00±2.757	87—107	77.35±3.838	70—102	70.50±2.211	72—94	80.28±1.550	56—107
SRC—555	87.90±1.965	80—109	93.30±1.764	80—98	92.40±1.840	80—98	89.50±1.634	76—102	90.78±0 918	76—109
SRC—562	93.75±2.242	82—109	74.50±1.087	64—82	79.75±1.397	72—91	81.65±1.482	70—94	82.44±1.119	64—109
SRC—603	94.00±0.711	90—97	85.55±1.394	78—96	84.95±2.590	64—98	84.85±1.954	68—94	87.31±0.984	64—98

C.D. at 5% level = 5. 142.

Table 2 Mean number of fruiting branches/plant in the selected mutant lines in M_3-M_6 generations
N=60

Mutant Line	M_3		M_4		M_5		M_6		Mean of all generations	Range differ-	Range differ-ence/grand
	$\bar{X}$	Range	$\bar{X}$	Range	$\bar{X}$	Range	$\bar{X}$	Range	together	ence	mean
									N=240		
Control	19.20	10-13	14.70	5-32	20.30	9-53	20.00	12-33	18.55	48	2.59
SRC-307	25.10	15-32	15.80	8-28	21.90	11-40	13.20	3-18	21.50	37	1.72
SRC-312	15.10	7-28	19.60	8-31	14.10	6-25	13.80	5-26	15.68	26	1.66
SRC-340	13.60	6-34	11.50	7-18	12.80	7-19	7.90	4-11	11.50	28	2.43
SRC-358	25.80	11-39	26.90	19-34	25.40	11-54	20.40	11-55	24.73	43	1.75
SRC-361	25.80	11-39	22.90	13-31	18.10	8-31	15.20	6-24	20.50	33	1.61
SRC-365	18.70	10-30	35.90	21-57	19.30	6-47	21.60	12-35	23.90	44	1.84
SRC-423	18.70	10-30	19.90	8-38	26.10	13-52	12.70	7-20	19.39	45	2.35
SRC-435	25.10	15-32	31.60	21-58	11.90	7-20	12.70	5-27	22.78	53	2.33
SRC-489	20.70	7-33	26.30	9-45	28.10	8-47	10.10	7-33	23.55	40	1.70
SRC-518	11.50	4-22	24.70	13-44	21.10	13-35	26.60	18-47	20.98	43	2.05
SRC-536	23.90	16-15	41.46	17-67	21.30	11-33	35.50	20-59	30.53	56	1.83
SRC-538	23.90	16-51	30.50	19-55	22.40	11-52	22.40	14-57	24.80	44	1.77
SRC-562	26.10	16-40	29.40	13-56	23.20	27-67	55.00	40-161	33.68	148	4.39

branches/plant respectively. The ratio between mean and the difference in range was 1 : 1.83, 1 : 1.77 and 1 : 4.39 in SRC - 536, 538 and 562 respectively, while it was 1 : 2.59 in control. SRC - 361 recorded lowest ratio (1 : 1.61) between these two parameters among all mutant lines, but it's mean ($\bar{x}$ = 20 50, range 6-39) was not much different from that of control. On the other hand, the ratio 1 : 4.39 in SRC - 562 suggests that it was still seggregating for this character. It is possible that one may get stabilised mutant lines in it with much higher mean after selfing and careful selection in later generations.

These observations suggest that SRC - 536 and 538 were the better stabilised mutant lines for this improved character.

(c) Mean number of bolls/fruiting branch and

(d) Percentage of fruiting branches with more than two bolls each.

Table 3 gives the mean number of bolls/fruiting branches/plant and percentage of fruiting branches with more than two bolls each in the selected mutant lines from M_3 -M_6 generations. The table shows that SRC - 355 and 357 (range 1-8), 538 and 562 (range 1 - 10) had 2.23 bolls/fruiting branch each, and SRC-518, 2.35 (range 1-7) bolls/fruiting branch on an average, while the control had only 1.53 bolls/fruiting branch (range 1-4). Further SRC-518, 355, 357, 562, 560 and 538 had 34.45 (range 22.60 - 40.10), 32.80 (range 22.70 - 43.20), 32.73 (range 22.20 - 43 21), 30.25 (range 20.30 - 34.00), 27.68 (range 20.30 - 34.00) and 26.70 (range 24.10 - 29 50) percentage of fruiting branches with more than two bolls each respectively, while there were only 7.73 (range 6.27 - 10.00) percentage of fruiting branches with more than two bolls each in the control.

Mutations caused by X - and gamma rays and Chemical mutagens are due to changes in a few genes. Unless selfing and careful selection is made in successive generations, they are not expected to accumulate and give rise ro desired stable mutant lines (Richmond - 1955).

Bhute (1960) using gamma rays on var. AK-235 and 197-3, and Bahavandoss Menon (1970) using X - rays on var-K6 of *G. arboreum* L., obtained early types among the mutants. But both of them had studied the inheritance of this character in them upto M_2 only. In the present breeding experiment stabilised earliness was achieved in SRC - 525 in M_4, after selfing and careful selection.

Number of fruiting branches/plant, bolls/fruiting branch and percentage of fruiting branches with more than two bolls each/plant are three important components of plant type that play a significant role in improving the plant yield. Eventhough Qureshi (1980) had obtained lines with 3 - 4 bolls (range 2.5 - 6.1) on

Table - 3 Bolls/Fruiting Branch Plant and percentage of fruiting branches with more than two bolls each in selected mutant lines through M_3 - M_6 Generations

N=60

	M_3			M_4			M_5			M_6			Grand mean	% of fr. br.
	Bolls/ fr. br. — X	Range	%fr. br. with > 2 bolls each	Bolls fr. br. — X	Range	%fr. br. with > 2 bolls each	Bolls/ fr. br. — X	Range	%fr. br. with > 2 bolls each	Bolls/ fr. br. — X	Range	%fr. br. with > 2 bolls each	bolls/ fr. br. N=240	with > 2 eaah N=240
Control	1.70	1—4	7.69	1.40	1—3	6.80	1.30	1—4	6.27	1.70	1—4	10.00	1.50	7.73
SRC—307	1.60	1—8	6.80	1.70	1—5	13.30	1.60	1—4	15.10	1.80	0—6	26.50	1.52	13.66
SRC—355—435	1.90	1—7	24.00	2.50	1—7	41.10	1.90	1—8	22.70	2.60	1—8	43.20	2.23	32.80
SRC—357—499	1.90	1—7	24.00	2.50	1—7	41.10	1.90	1—8	22.20	2.60	1—8	43.21	2.23	32.73
SRC—365	1.50	1—5	11.80	1.60	1—8	21.50	1.70	1—6	17.60	1.90	1—9	19.40	1.70	18.32
SRC—369	1.90	1—8	—	2.30	1—7	—	2.20	1—7	—	1.45	1—5	11.76	1.96	—
SRC—518	1.80	1—5	22.70	2.50	1—7	40.10	2.80	1—7	38.40	2.30	1—7	31.20	2.35	34.45
SRC—536	2.10	1—8	28.50	1.60	1—10	16.90	1.90	1—6	23.50	2.00	1—7	24.80	1.90	20.75
SRC—538	2.10	1—8	28.50	2.20	1—9	24.60	2.40	1—10	24.10	2.30	1—9	29.50	2.23	26.70
SRC—560	1.90	1—9	20.30	2.30	1—7	28.60	2.20	1—7	27.20	2.47	1—10	34.00	2.22	27.68
SRC—561	1.90	81—9	20.30	2.30	1—7	28.60	2.20	1—7	27.20	2.34	1—7	14.29	2.19	22.77
SRC—552	1.90	1—8	20.30	2.30	1—7	28.60	2.20	1—7	27.20	2.50	1—10	34.00	2.23	30.25

an average, on the longest fruiting branches in this inter population breeding of gaorani-46 cotton yet these three attributes were not dealt with as separate aspects, hither-to in any species of cotton. In the present breeding work, the stabilised mutant lines SRC - 525 (for earliness) SRC - 536 and 538 (for higher number of fruiting branches/plant), SRC - 355, 357, 538, 562, and 518 (for higher number of bolls/fruiting branch) and SRC - 518, 355 and 357 (for higher percentage of fruiting branches with more than two bolls each/plant) were obtained. Hybridisation and selection among these four sets of lines is expected to to give early hybridlines with combination of all these improved characters.

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