

TABLE I

Associations of A and B-chromosomes at Diakinesis in non-desynaptic and desynaptic plants without and with B's

Plant	A-chromosome associations			B-chromosome associations				Total no. of cells
	Ring	Rod	Uni	Qua	Tri	Bi	Uni	
Desynaptic without B's	145 (1.45)	300 (3.00)	519 (5.10)	..	..	..	..	100
Desynaptic with 3 St. B's	210 (2.10)	318 (3.18)	344 (3.44)	..	..	3 (0.03)	295 (2.95)	100
Desynaptic with 2 St. + 2De.B's	233 (1.16)	488 (2.44)	1358 (6.79)	..	..	47 (0.235)	360 (3.3)	200
Non-desynaptic without B's	1116 (5.58)	284 (1.42)	..	..	..	..	..	200
Non-desynaptic with 3 St. B's	590 (5.90)	110 (1.10)	..	..	73 (0.73)	26 (0.26)	29 (0.29)	100
Non-desynaptic with 2 St. + 2 DeB's	1180 (5.90)	220 (1.10)	..	81 (0.405)	67 (0.335)	42 (0.21)	42 (0.225)	200

· () '—Numbers within brackets indicate the mean number of associations per cell.

St—Standard B's.

De—Deficient B's.

B's alone or when standard and deficient B's were present together in the desynaptic plant the B's did not form multivalents and the univalent frequency was much higher than that in the normal plants of corresponding B classes (Table I; Figs. 1 and 2). The absence of multivalent formation and the very low bivalent frequency in the desynaptic plants were the result of low B-chromosome chiasma frequencies. The mean B-chromosome chiasma frequencies in the desynaptic plants were significantly lower than those in the normal plants of corresponding B-classes. When three standard B's were present in the desynaptic plants their mean chiasma frequency per cell was 0.031 whereas in the normal plants it was 2.12. Similarly, in desynaptic plants with two standard and two deficient B's the mean chiasma frequency per cell was 0.162 and in normal plants of corresponding B class the value was 3.01. These results clearly show that the effect of the desynaptic gene on the association and chiasma frequency of B-chromosomes is similar to that on the A-chromosomes.

The effect of B chromosomes on A-chromosome associations was studied taking the desynaptic plant without B's as the control. When three standard B's were present in the desynaptic plant there was a significant increase in the A-chromosome bivalent frequency and decrease in univalent frequency. In plants with standard *plus* deficient B's there was a significant increase in the univalent frequency of

the A-chromosomes. In normal plants with three standard B's or two standard *plus* two deficient B's the B's had no effect on the A-chromosome associations or chiasma frequencies.

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ROLE OF COMPONENT COMPENSATION IN IMPARTING GENETIC HOMEOSTASIS FOR FRUIT PRODUCTION IN AUTOGAMOUS TOMATO CULTIVARS

RECENTLY, a number of theories have been advanced to explain the phenomenon of genetic homeostasis in heterozygote population^{1,3}. However, the precise information about the mechanics of homeostatic mechanism in stabilising the overall fruit production in homozygotes and particularly in tomato genotypes is rather inadequate. Such a

mechanism in tomato could be attributed to the component compensation and the mutual balance of a few or a number of characters with different rates of changes in building up overall fruit production. It may be likely that in stable cultivars, the characters influencing the overall fruit production might be compensating in such a way that the stability of total fruit production is not lost but is maintained regardless of the fluctuations in the environmental parameters. In the present work, this hypothesis was basically put to test and a detailed genetic analysis was conducted with 25 cream cultivars combed out from a tomato germplasm of 228 varieties maintained at this University. They were grown under four different environment conditions (Winter, 1972; Summer and Winter, 1975 and Summer, 1974) in a randomised block design with three replications. Observations were recorded on fruit yield and seven characters known to be influencing fruit production in tomato.

been given in Table I. Stability parameters were estimated as suggested by Eberhart and Russel (1966)². Stability of fruit yield has been related to stability of height of plant, days to first fruit set, and number of inflorescences per plant.

The detailed statistical analysis (Table I) revealed that the stability of a number of primary branches had a negative influence on the stability mechanism, its direct effect on the stability of the fruit yield being -0.554 . Days to fruit set and height of plant had the maximum direct effect (0.419 and 0.401 respectively) on the stability of the yield expression. The tomato cultivars, namely, Sanmar-sano, Roma and 2152-14 were observed to be most stable and possess a balanced homeostatic genetic system. Invariably, these varieties were highly stable for the characters days to first fruit set and height of the plant. These were, however, highly unstable for the character, number of primary branches. Varieties S_5 First, Marglobe, HS101,

TABLE I
Direct and indirect effects of the component characters to induce genetic homeostasis in tomato

Sl. No.	Characters	1	2	3	4	5	6	7	Correlation with genetic homeostasis of fruit production
1.	No. of days to first fruit set	<u>0.419</u>	0.034	0.020	-0.126	-0.107	-0.006	-0.014	0.221
2.	No. of days to first fruit ripening	-0.185	<u>-0.077</u>	0.019	0.184	0.104	-0.017	0.039	0.068
3.	Height of plant (cm)	0.021	-0.004	<u>0.401</u>	0.264	-0.086	-0.067	-0.041	0.488*
4.	No. of primary branches per plant	0.095	0.026	-0.191	<u>-0.554</u>	0.113	-0.030	-0.00	-0.582**
5.	No. of inflorescences per plant	0.109	0.019	0.084	0.152	<u>-0.410</u>	0.184	0.022	0.159
6.	No. of fruits per plant	0.006	-0.003	0.069	-0.043	0.196	<u>-0.386</u>	0.023	-0.185
7.	No. of locules per fruit	0.041	0.021	0.114	-0.076	0.061	-0.061	<u>-0.146</u>	-0.047

*, ** Significant at 5% and 1% level of probability respectively.

The underlined figures indicate the direct effect, the remaining ones (1 to 7) are the indirect effects.

As a first step towards identifying marker characters whose stability leads to the homeostasis in the total fruit production, correlation coefficients were worked out between the various stability parameters (bi's) among the yield and the components of the yield. The results obtained have

Momor and Best Of All were observed to be highly unstable varieties. In these cultivars, days to first fruit set and height of plant were highly unstable. However, these were stable for the character, primary branches per plant. From these observations, it could be deduced that in a homeo-

static genotype of tomato, the component characters like days to first fruit set, plant height and number of primary branches act in a compensating manner with each other in the changing environments and provide the tomato cultivar the ability to give a buffering mechanism and the consistent performance. On the other hand, in the unstable varieties, the above-mentioned characters do not compensate each other to adapt them to the changed environmental parameters and hence the cultivars exhibit a lower expression of fruit production under stress conditions.

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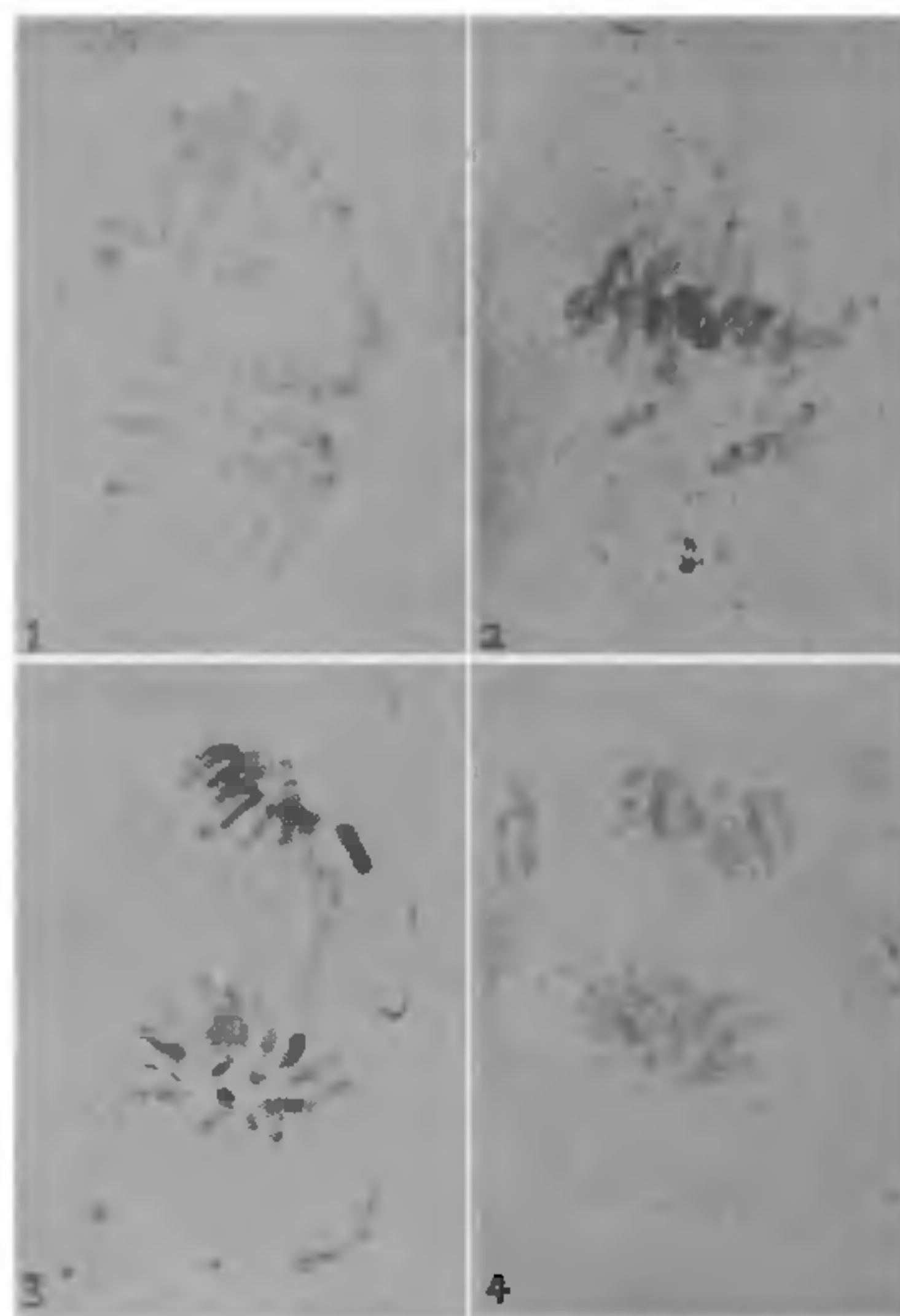
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EFFECT OF GAMMA-RADIATION ON MITOSIS

GAMMA-RADIATION has now been widely used for the artificial production of genetic variants in the plants. In the present study, the effect of gamma-irradiation on mitosis of barley (*Hordeum vulgare* L.) root tips was investigated.

Seeds of cultivated six rowed barley variety, K₁₂, were irradiated with four doses of gamma-rays from Co⁶⁰ source at Bhabha Atomic Research Centre, Trombay, Bombay. The different doses were 20 Kr, 30 Kr, 40 Kr and 50 Kr. The irradiated seed samples were germinated on different moist blotting papers and when the root tips attained a height of 1 to 1.5 cm., they were collected and fixed in 1:3 acetic-alcohol. After 24 hr interval, these root tips were transferred in permanent fixative of 70% alcohol and kept in a refrigerator. Before squashing, the root tips were hydrolysed in 1 N HCl at 60° C for 5 minutes and then squashed with 2 or 3 drops of aceto-orcein stain on clean slides under microscope. Observations were recorded on the number of dividing cells at different stages of mitosis and the various types of abnormalities produced by gamma-radiation are recorded in Table I.

Except with the 30 Kr dose, increase in radiation dose increases the number of cells in prophase stage and the relationship between radiation doses and cells in prophase stage was found linear. It can, therefore, be concluded that the radiation induces inhibition of mitosis. Relationship between the doses of radiation and cells in metaphase, anaphase and telophase was, however, not linear, and highest percentage of metaphase, anaphase and telophase cells were recorded at 30, 40 and 50 Kr doses respectively.



FIGS. 1-4. Fig. 1. Showing chromosomes with fragments. Fig. 2. Chromosomes clumping at metaphase with fragments. Fig. 3. A dicentric chromosome bridge at anaphase. Fig. 4. Dicentric chromosome bridge with lagging chromosomes at anaphase.

The different types of mitotic aberrations observed in the present study were: chromosome breaks (fragments), bridges, stickiness and micro-nuclei. Chromosome fragments were found in all the four doses of radiation and the highest frequency was recorded at 50 Kr followed by 40 Kr, 30 Kr and 20 Kr. The relationship between the frequency of radiation doses and chromosome fragments was found linear. This type of linear relationship between the frequencies of the two types of chromosomal aberrations (fragments and bridges) and X-ray doses was reported earlier in many plant materials by Sax and Brunfield (1943), Caldecoll *et al.* (1959) and Yagy and Morris