Sharma, R. P. and M. S. Swaminathan.
Indian Agricultural Research Institute, New Delhi, India. Induced crossing over in Drosophila males by Ethylmethanesulphonate.

Ethylmethanesulphonate (EMS) a mono functional alkylating agent has been shown to be a potent mutagen in animal as well as plant systems. Besides testing its mutagenicity under different treatment conditions, we were interested in seeing whether it has any effect on meiotic crossing over. A significant increase in crossing over frequency restricted only to the centromeric region in IInd chromosome of Drosophila melanogaster females was noticed. The results will be published elsewhere. The present report deals with the effect of EMS on Drosophila males.

Approximately 24 hr old males heterozygous for IInd chromosome markers (dp b cn bw/ ++++) were injected intraabdominally with 0.3% EMS solution prepared in saline. Injected males were individually mated with four dp b cn bw/dp b cn bw homozygous virgin females. After every 6 days these males were provided with fresh virgin females. Three broods of 6 days each were sampled. The brood scheme is based on the findings of Olivieri and Olivieri (1965)[1]. These authors with the help of autoradiography, have studied time of DNA synthesis in spermatogenesis and fixed about 6 days time for the cells to reach to sperm stage from DNA synthesis time. By following this scheme the sperms sampled in Ist brood comes from post synthetic period whereas the 2nd and 3rd brood covers synthetic and presynthetic periods. Of course, if the chemical delays synthetic period, 2nd and 3rd brood can show a mixture of both the stages. The results obtained are given in Table 1.

Brood	No. of males tested	No. of offsprings scored	True crossovers: involving region I (dp-b)	involving region II (b-cn)	Longitudinally 1/2 normal & 1/2 dp b cn bw	dp	dp one wing	bw	brown One Eye	cn One Eye	dp-b	dp-b-cn	cn bw	b-cn-bw
ist Brood	47	2672	-	-	1	4	4	4	-	1	1	2	-	-
iind Brood	28	1814	1	2	-	8*	3	3	1	-	-	-	1	1
iiird Brood	27	1322	2	6	-	1	4	-	-	-	-	-	1	2

*One ♂ was showing clusters.

It is evident from the data that Ethylmethanesulphonate besides producing mosaics in all the three broods for approximately all the markers involved, induced some true cross-overs only in 2nd and 3rd broods. The frequency is always more in region II (b-cn) involving centromere. EMS has been shown to produce chromosome breaks and exchanges more frequently at the centric region or adjacent to it. It has been further shown to produce all types of symmetrical asymmetrical and incomplete exchanges in plant chromosomes[2], [3]. Thus, the crossovers obtained in this experiment involving the centromeric region may be the product of symmetrical centric exchanges involving homologous chromosomes. The cross-overs obtained in the dp-b region of the left arm of 2nd chromosome may be attributed to the iso-locus breaks in homologous chromosomes followed by the exchanges. The other classes showing more than one marker gene may result either from the deletion of some of the genes or by incomplete exchange. The reciprocal classes in these cases may be lost by either deficiency or duplication. The offsprings having single marker gene may be produced either by the deletion or by mutation of that gene. It is difficult to say which of these two processes is responsible. Since the crossovers were not produced in clusters it seems unlikely that they originated during early stages of spermatogenesis. On the other hand the high crossover frequency in 3rd brood, which covers the spermatogonial stages of development, suggest their occurrence during early stages of spermatogenesis.

References:

1. Olivieri, G. & Olivieri, A. Mutation Res. 2 (1965) 366-380.
2. Swaminathan, M.S; V.L. Chopra, & S. Bhaskaran. Ind. Jour. Gent. Plant Breeding. 22 (1962) 192-207.
3. Sharma, R.P. (Unpublished)