X-RAY-INDUCED STRUCTURAL CHANGES IN THE CHROMOSOMES OF DROSOPHILA PSEUDO-OBSCURA

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(With One Text-figure)

INTRODUCTION

Drosophila pseudo-obscura differs fundamentally in its chromosome morphology from D. melanogaster. While the latter has a rod-shaped X, two V-shaped autosomes and a small dot chromosome, in D. pseudo-obscura the chromosome make-up consists of a V-shaped X, three rod-shaped autosomes of various sizes, and one small dot-chromosome. The Y-chromosome is similar in both species. Genetical analysis by Crew & Lamy (1935), Donald (1936), Sturtevant & Tan (1937), and Sturtevant & Novitski (1941) has shown that in spite of the profound morphological and genetical differences the various chromosomes, or arms of chromosomes, in these two species are related phylogenetically.

Several cytogenetical studies analysing the type and frequency of X-ray-induced chromosome rearrangements in the salivary gland nuclei have been carried out on D. melanogaster (Bauer, Demerec & Kaufmann, 1938; Catcheside, 1938; Bauer, 1939; Kaufmann, 1939). The information which has been collected on irradiated melanogaster has thrown light upon various problems concerning chromosome structure and behaviour. We can visualize now the possible mechanism by which structural changes are induced in the chromosomes when exposed to X-rays. In view of the fact that melanogaster and pseudo-obscura differ in their chromosome morphology and constitution it seemed desirable to carry out similar investigations in pseudo-obscura in order to ascertain how far the conclusions arrived at in melanogaster can be applied to a different organism.

While these experiments were in progress a paper was published by Helfer (1941) dealing with the X-ray-induced chromosomal variations in D. pseudo-obscura. His data give an opportunity of comparing two sets of data for D. pseudo-obscura and of relating them to those found in similar experiments in D. melanogaster.
Material and methods

A highly inbred *D. pseudo-obscura* Texas strain was used throughout the experiments. This strain belongs to race A, and its gene arrangement is designated as the 'standard' (Dobzhansky & Sturtevant, 1938). Two- to ten-day-old male flies were irradiated. The dosage was measured during the radiation by a Siemens integrating Dosimeter and it was kept constant (4500 r. units) throughout the experiments; the radiation was obtained by using 80 kV. 6 m.A., 0.5 mm. aluminium filter, 25 r./m. Treated males were mated, immediately after X-raying, to females of the same strain; fourteen males and fourteen females were placed together in the same vial. The average age of females at the time of mating was 10 days. The larvae were grown at about 15-16°C. In order to avoid overcrowding of the larvae the following procedure was followed: X-rayed males and untreated females were kept in vial cultures together for 2 days, afterwards being transferred into ½ pint culture bottles for 3 days. The females were then separated from the males and were transferred three times into new culture bottles at intervals of 3 days.

By raising three broods we were able also to obtain a larger number of female larvae for cytological analysis because these came to maturity in an appreciably shorter time than the males and were easy to select in cultures which are not overcrowded. This selection was necessitated by the fact that in the nuclei of the salivary glands an interchange between the Y and an autosome can readily be distinguished from one between two autosomes when one of the breaks in the latter has occurred in the heterochromatic region.

The structural changes were analysed in the chromosomes of the salivary gland nuclei of *F1* female larvae. The breakage points were determined within the limit of at least one subdivision of the map constructed by Dobzhansky & Sturtevant (1938) for the third chromosome; in the other chromosomes only the number of breaks and the type of rearrangement was studied.

Number of breaks

The salivary gland chromosomes of 154 *F1* larvae out of the total of 425 analysed have shown new rearrangements. The total number of breaks in 2125 chromosomes was found to be 518. This number represents only the residue of total breaks induced by X-raying; the initial number of breaks is probably much higher. It is known that many ionizations do not produce breaks because they do not occur in the proper atoms