

Lawrence Berkeley National Laboratory

Recent Work

Title

THE PRODUCTION OF A NEW MUTANT IN DROSOPHILA MELANOGASTER BY LOW DOSES OF TRITIUM IRRADIATION

Permalink

<https://escholarship.org/uc/item/186672c2>

Authors

Hughes, Ann M.
Hildreth, Philip E.

Publication Date

1966-07-01

UCRL-17058

University of California
Ernest O. Lawrence
Radiation Laboratory

THE PRODUCTION OF A NEW MUTANT IN DROSOPHILA MELANOGASTER
BY LOW DOSES OF TRITIUM IRRADIATION

TWO-WEEK LOAN COPY

*This is a Library Circulating Copy
which may be borrowed for two weeks.
For a personal retention copy, call
Tech. Info. Division, Ext. 5545*

Berkeley, California

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

Submitted to Drosophila Information
Service

UCRL-17058
Preprint

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

AEC Contract No. W-7405-eng-48

THE PRODUCTION OF A NEW MUTANT IN DROSOPHILA MELANOGASTER
'BY LOW DOSES OF TRITIUM IRRADIATION

Ann M. Hughes and Philip E. Hildreth

August 11, 1966

THE PRODUCTION OF A NEW MUTANT IN DROSOPHILA MELANOGASTER
BY LOW DOSES OF TRITIUM IRRADIATION

Ann M. Hughes and Philip E. Hildreth

Lawrence Radiation Laboratory and Department of Zoology
University of California, Berkeley, California

August 11, 1966

On two separate occasions, during the course of an investigation in which D. melanogaster larvae were being raised on tritiated medium, apparently identical mutants affecting adult coloration were recovered. Since these mutants originated among only a few thousand flies and only in the treated series, it appeared that tritium might be repeatedly causing mutations at a specific locus. Therefore, further experiments were conducted in two series (1961-62, 1965-66) in order to test whether this one type of mutant could be routinely produced.

Homozygous yellow (y/y) females that had mated with y/B^SYy⁺ males oviposited on control or tritium-supplemented medium where the eggs hatched, the larvae and pupae developed. For the treated series, the standard cornmeal-molasses-agar-yeast medium contained either 0.1 or 1.0 $\mu\text{c } ^3\text{H}$ per gram. On the basis of the table of Tolbert (1960) and assumptions of rapid equilibration between the larval body water and that of the medium, the two concentrations of tritium used would give a maximum total body irradiation of 0.5 and 5.0 r per fly during the time from hatching through eclosion. The actual irradiation is probably less.

The F_1 males (y/B^SYy⁺) were then individually mated to virgin yellow nontreated females and the offspring raised on control medium. The expected offspring would again be yellow females and nonyellow Bar-eyed

(y/B^SYy⁺) males. Among the second-generation offspring exceptional males were recovered; they had bar-shaped eyes and wildtype-colored wings as in the expected class, but their bristles were yellow and bodies yellowish (but not as yellow as y/Y males) instead of wildtype. The mutant has been transmitted with the Y chromosome (B^SYy^{61d}) through many generations. The results are shown in Tables I and II.

In order to determine whether other types of irradiation would produce similar mutation, experiments involving the above mating procedure, but using Xrays as the irradiation source, were carried out. In the first experiment, virgin males were given 2800 r by use of a 250-kV X-ray machine with a 0.5-mm Cu and a 1.0-mm Al filter. The second experiment repeated the first except that a smaller dose of X ray was used. (A 150-kV machine with an inherent filtration of 1.5 mm Al was used to give the males 1000 r.) In the third experiment, prepupae were collected from culture bottles, irradiated with the 150-kV machine (735 r), and then allowed to pupate and eclose. In these experiments the expected offspring were the same as in the tritium experiments. Among 25,120 males from the control and 22,476 from the treated series, no mutants were recovered. Therefore it appears likely that it is not irradiation per se but some specific property of tritium that caused the mutations.

According to Dr. Irwin I. Oster, who kindly did salivary gland analyses, the B^SYy^{61d} chromosome was not different from the original B^SYy⁺ chromosome. Thus no gross chromosomal aberration was associated with the mutation. It is likely that the change was within the y⁺ locus, although an undetected alteration in some other region of the B^SYy⁺ chromosome cannot be ruled out.

To determine interactions with other alleles, males carrying $\underline{B}^S \underline{Y} \underline{y}^{61d}$ were crossed with the following stocks: \underline{y} , \underline{y}^{2S} , \underline{y}^{62a} \underline{sc} \underline{cv} and \underline{y} \underline{f} ; \underline{br} $\underline{ec}/\underline{y}^{3d}$; \underline{y}^2 \underline{cv} \underline{v} \underline{f} and $\underline{M}(1)n/\underline{FM6}$ \underline{y}^{31d} .

When heterozygous, \underline{y}^{61d} acted as a dominant gene over all alleles in regard to wing color, over \underline{y}^2 and \underline{y}^{3d} in regard to body color.

The alleles which normally produce dark bristles are dominant over \underline{y}^{61d} . In hemizygous condition, both \underline{y}^{3d} and \underline{y}^{61d} produce yellow bristles, yet $\underline{y}^{3d}/\underline{B}^S \underline{Y} \underline{y}^{61d}$ males have dark bristles.

Combining the control and the X-ray totals, the mutation rate is 0.016/1000. Since both mutants were found in the same culture, the minimum number of mutant events could be 0.008/1000. In the tritium-treated group, the total mutation rate is 0.148/1000, and the minimum mutant event rate 0.058/1000. In addition, in the tritium treatment, in one culture a gonosomal mosaic for this mutant was recovered, and in another culture one mutant in the third generation. At present there is no explanation for the lack of recovery of mutants in each experiment in the 1965-66 series, as was observed in 1961-62.

The work described in this paper was sponsored, in part, by the U. S. Atomic Energy Commission.

Tolbert, B. M.: Self-Destruction in Radioactive Compounds. Nucleonics, Aug. 1960, 74-75.

Table I. The occurrence of $E^S Yy^{61d}$ mutant in Drosophila grown on medium containing tritium (1961-62).

Experiment	Date	Treatment	Number cultures	Total males	Total mutants	Mutant events ^a
I	6/61	Control	199	6487	0	0
		0.5 r	189	6044	5	2
II	8/61	Control	385	15574	0	0
		0.5 r	388	15954	1	1
III	1/62	Control	240	7260	2	1
		0.5 r	263	8474	6	3
		5.0 r	246	7419	1	1
IV	4/62	Control	199	7817	0	0
		0.5 r	206	7673	0	0
		5.0 r	394	13903	10	2
Totals		Control	1023	37138	2	1
		0.5 r	1046	38145	12	6
		5.0 r	640	21322	11	3

a. In some cultures, more than one mutant was recovered. Thus, "mutant event" refers to the number of cultures in which one or more mutants were found.

Table II. The occurrence of $B^S Yy^{61d}$ mutant in Drosophila grown on medium containing tritium (1965-66).

Experiment	Date	Treatment	Number cultures	Total males	Total mutants	Mutant events ^a
V	10/65	Control	28	7941	0	0
		20 r ^b	69	18085	0	0 ^c
VI	11/65)	Control	200	15745	0	0
	12/65)	0.5 r	495	41178	0	0
VII	2/66	Control	117	9853	0	0
		0.5 r	338	26270	0	0
VIII	3/66	Control	100	2923	0	0
		1 r	319	10463	1 ^d	1

a. In some cultures, more than one mutant was recovered. Thus "mutant event" refers to the number of cultures in which one or more mutants were found.

b. Tritium solution was inadvertently contaminated with ^{14}C .

c. One mutant found in third generation.

d. Phenotypically like original mutant, but germ cells $B^S Yy^+$.

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

