INCREASED INCIDENCE OF MELANOTIC TUMORS IN TWO STRAINS OF DROSOPHILA MELANOGASTER FOLLOWING TREATMENT WITH SODIUM FLUORIDE[1]

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Received December 14, 1962

IN *Drosophila melanogaster*, the frequency of adults with melanotic tumors increases both when larvae from genetically normal (SANG and MCDONALD 1954) and genetically melanotic tumor strains (GOLDSCHMIDT 1962) are exposed to nutrient containing silver nitrate. Larval nutrient containing sodium fluoride also has this effect on genetically normal individuals (RAPOPORT 1947). The present work was performed to test simultaneously the melanotic tumorigenic capacity of sodium fluoride in two different genetic lines, in which such tumors normally occur or do not occur with appreciable frequency.

MATERIALS AND METHODS

The wild-type Oregon-R and the melanotic tumor, tu^{50j}, strains of *D. melanogaster* were used. Within three hours of hatching from the egg, 100 larvae from the same strain were placed in a vial containing a standard amount of an ordinary culture medium containing carragar, cornmeal, molasses, and brewer's yeast, which was seeded with live yeast. The nutrient medium also contained NaF (Merck reagent grade) in one of the following molar concentrations: 0 (control), .0010, .0015, .0020, .0025, .0030, .0035, .0040, .0045. A total of 1000 larvae from each strain were exposed to each of these molarities, except for the controls in each of which 1500 larvae were tested. The adult stage was scored for sex and presence of melanotic tumors.

The temperature was 25 ± 1 °C throughout.

RESULTS AND DISCUSSION

Other, preliminary experiments (each involving 1000 larvae of Oregon-R and of tu^{50j}) gave 100 percent lethality before adulthood after treatment with .0200, .0150, .0100, or .0050 M NaF. In the present experiment (most of the results are summarized in Table 1), .0045 M NaF also was completely lethal to both strains, as were .0040 or .0035 M to tu^{50j}. Apparently the Oregon-R strain can withstand higher concentrations of NaF during development than can the tu^{50j} strain. Since, despite inbreeding, there are probably many isoallelic differences within and between the two strains, it is not possible to attribute this difference, or any of the others to be mentioned, entirely or primarily to the presence or absence of the recessive gene for melanotic tumors, tu^{50j}.

[1] Supported by grant C4228 from the National Cancer Institute, Public Health Service.

TABLE 1

Effects on adult stage of raising genetically different larvae on medium containing different molar concentrations of sodium fluoride

M($\times 10^{-4}$) NaF in medium	Number larvae per series	Oregon-R strain				tu^{50j} strain				
		Percent reaching adulthood	Number tumorous	Percent tumorous (mean ± S.E. mean)	Induced percent tumorous†	Percent reaching adulthood	Number tumorous	Percent tumorous (mean ± S.E. mean)	* Induced percent tumorous	† Induced percent tumorous
0 (Control)	1500	81.2	0	0	.....	90.0	95	7.1 ± 1.0	.....	.....
10	1000	83.7	5	0.6 ± 0.1	0.6 ± 0.1	84.4	106	12.7 ± 1.3	5.6 ± 1.6	6.0 ± 1.6
15	1000	67.3	14	2.1 ± 0.4	1.5 ± 0.4	85.8	193	22.5 ± 1.4	15.4 ± 1.7	11.2 ± 1.9
20	1000	68.5	167	24.4 ± 4.3	22.8 ± 4.3	61.5	421	68.5 ± 3.8	61.4 ± 3.9	59.5 ± 4.0
25	1000	38.0	231	60.7 ± 3.6	48.1 ± 5.6	9.1	89	97.8 ± 1.2	90.7 ± 1.6	93.0 ± 4.0
30	1000	6.2	49	79.0 ± 7.8	46.2 ± 8.6	0.9	9	100	92.9	.....
35	1000	3.1	22	71.0	.....	0.1	1	.....	.....	.....
40	1000	0.3	3	100	.....	0	0	.....	.....	.....

* Relative to Control, calculated by: $\frac{\%\ \text{Treated} - \%\ \text{Control}}{100 - \%\ \text{Control}} \times 100.$

† Relative to next lower concentration of NaF, calculated by: $\frac{\%\ \text{Treated}_2 - \%\ \text{Treated}_1}{100 - \%\ \text{Treated}_1} \times 100.$

No tumors were found among the 1218 adult survivors in the Oregon-R control. It is common experience, however, to occasionally find melanotic tumors in Oregon-R under ordinary culture conditions. When this phenotype occurs in Oregon-R, it usually does not seem to be due to a newly arisen mutant, so that such melanotic individuals are probably homozygotes for the normal allele of tu^{50j}. Apparently the gene pool in Oregon-R produces genotypes which, under ordinary nutrient conditions, result in a penetrance for the melanotic tumor phenotype which is near zero.

In the tu^{50j} control, about 7.1 percent of adults had melanotic tumors. Approximately equal numbers of male and female control tu^{50j} individuals had tumors, and this was true among the tumor-bearing individuals of either strain appearing after exposure to different amounts of NaF in the culture medium. In both strains, the frequency of tumorous adults increased with increasing concentration of NaF. A comparison of the tumorigenic response of Oregon-R and tu^{50j} can be made by means of the frequency of induced tumors determined for those NaF concentrations which gave appreciable numbers of survivors in both strains. It can be seen in Table 1 and Figure 1, that the induced tumor rate, relative both to the control rate and to the rate obtained from the next lower concentration of NaF, was always significantly greater for the tu^{50j} strain than it was for the Oregon-R strain.

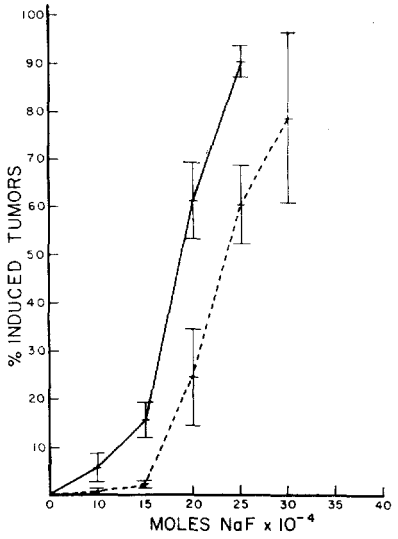

FIGURE 1.—Relationship between concentration of NaF in nutrient medium of larvae and percentage of tu^{50j} (continuous line) and of Oregon-R wild type (interrupted line) adults having melanotic tumors. Vertical bars show 95 percent confidence limits.

SUMMARY

In *D. melanogaster*, when larvae are grown in nutrient containing different concentrations of NaF, the tu^{5oj} strain, which normally has a relatively strong genetic predisposition for the formation of melanotic tumors, demonstrates a significantly higher rate of induced melanotic tumors in the adult stage than does the wild-type Oregon-R strain, which normally has a relatively weak genetic predisposition in this respect.

LITERATURE CITED

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