MOSAICS IN *DROSOPHILA AMPELOPHILA*

ROSCOE R. HYDE AND HORACE M. POWELL

State Normal School, Terre Haute, Indiana

[Received June 6, 1916]

The accompanying plate shows a mosaic female that resulted from a cross between blood and eosin,—two mutant stocks of *Drosophila*. The right eye of this mosaic was typical of blood stock, the left was typical for males of eosin stock. Neither eye was of the color that characterized some five hundred of her sisters that hatched at the same time. In short the mosaic is a female with two male eyes.

Eosin shows bicolorism,—the eyes of the females are practically twice as red as those of the males. The stock breeds true to this condition. Many experiments carried out with this fly show the genotypical formula of the female to be $w^e w^e XX$, the male $w^e XY$. Blood is a new sex-linked mutation with eyes the color of a blood stain. The senior author has demonstrated that it is a member of the same allelomorphic system as eosin. Many experiments show consistently that the female formula is $w^b w^b XX$ and the male $w^b XY$ (HYDE 1916).

The mosaic female in question appeared in a cross between the blood ♀ and eosin ♂. The females produced by this cross are of the composition $w^e w^b XX$, the males $w^b XY$. This relation is shown by the following diagram:

$$\begin{array}{rcl} \text{Eggs from blood } \text{♀}, & w^b X & - & w^b X \\ \text{Sperm from eosin } \text{♂}, & w^e X & - & Y \\ \hline \text{F}_1 \text{ flies,} & w^e w^b XX, & w^b XY \end{array}$$

The females are eosin-blood compound with eyes much lighter than their blood brothers, but considerably darker than eosin females.

The egg that produced this mosaic was of the formula $w^b X$. Since this fly was a female the egg was evidently fertilized by a sperm of the formula $w^e X$. The eyes according to expectation should have been compounds,—lighter than blood but darker than the eyes of the eosin female, as were $500 \pm$ of her sisters. The fact that one eye was like the eosin male, the other like blood is explicable on the assumption that after fertilization the complex involving $w^e w^b XX$ became separated in

such a way that w^bX was carried to the cells of one eye, producing blood, w^eX being carried to the cells of the other eye, producing the eosin male eye. The result would seem to show that the eye color is not a result of the influence of some substance given off by the sex glands but is due to the chromatin complex carried to the cells of the eye itself.

This fly was under observation for about thirty days. Her eyes were compared many times with her brothers, sisters, eosin stock and blood stock. She proved infertile and no trace of a sex comb or other male characteristic could be found. This case would seem to lend strong support to the view that mosaics may arise through a mitotic disturbance in which the X chromosome is involved.

The second fly was a bilateral gynandromorph that appeared in a cross between the mutant stocks, truncate and white. These stocks had been inbred for many generations and no unusual forms had been found (HYDE 1914).

In a cross between a white-eyed, long-winged male and a red-eyed, truncate female the expectation is red-eyed, long-winged flies in the F_1 generation. Among several hundred offspring from this cross one fly appeared showing both eye colors and a long and a short wing. The white eye and the short wing were on the right side; the red eye and long wing were on the left side;—in short a bilateral gynandromorph, right side male, left side female. The short wing extended slightly beyond the tip of the abdomen and was rounded at the end instead of squared. The short wing in all probability has nothing to do with the truncate condition, but is small, characteristic of the wings of males. The right eye is male, inherited directly from the father through his X chromosome. The white eye has a small fleck of red apparently buried near its center. Two spurs of a sex comb were present on the male side.

The red eye on the left side is obviously female. The long wing would seem to be like the male but in reality its length is characteristically female. Females have larger bodies and correspondingly longer wings than the males. The difference that would result in a bilateral gynandromorph is obvious. We should expect the red eye on the female side of the gynandromorph to be larger than the white eye on the male side. As a matter of fact this eye is considerably smaller. The reduced size of the red eye was probably inherited from the mother since small eyes were characteristic of this truncate stock.

Cases of this kind, as MORGAN (1914) has pointed out, are readily interpreted on the assumption that a mitotic disturbance involving the sex chromosomes occurs in an early cleavage in such a way that the cells on one side of the body get one X chromosome which develops male

characters, those on the other side get two X chromosomes which develop female characters. The fact that a small amount of red occurs in the white eye shows that the disturbance occurred relatively late, possibly during the differentiation of the eye itself. This fly died before her breeding qualities could be determined.

The third mosaic arose from a cross between a red-eyed truncate male and a white-eyed long-winged female. The expectation from this cross is white-eyed, long-winged males and red-eyed, long-winged females. Among the children, however, there appeared a female with both eye colors and both kinds of wings. The white eye and the truncate wing were on the left side; the red eye and the long wing were on the right side. The short wing in this case was a typical truncate wing. The long wing was typical of wild stock with rounded ends. This female was mated to a long-winged white-eyed brother. The offspring were red-eyed long-winged males and females and white-eyed long-winged males and females in approximately equal numbers (table 1). It is to

TABLE I

Mosaic female by white-eyed brother.

Truncate	Truncate	Red long	White long	Red long	White long
♀ ♀	♂ ♂	♀ ♀	♀ ♀	♂ ♂	♂ ♂
0	0	75	70	65	65

The count as given in this table was not verified by the senior author.

be noted that no truncates appeared in this cross where the expectation is about seven longs to one truncate (HYDE 1914, page 210). With this exception this mosaic female is genotypically the same as her red-eyed sisters which were also tested.

Each side of this mosaic is both maternal and paternal with respect to eyes and wings. The sex chromosomes probably divided normally during the early cleavage stages for had one become separated at this time a gynandromorph would probably have resulted. The appearance of the white and red eye is explicable on the assumption of a later mitotic disturbance involving the X chromosome. No explanation is offered for the wings.

LITERATURE CITED

- MORGAN, T. H., 1914 Mosaics and gynandromorphs in *Drosophila*. Proc. Soc. Exp. Biol. and Med. **11**: 171-172.
 MORGAN, T. H., 1915 The infertility of rudimentary winged females of *Drosophila ampelophila*. Amer. Nat. **49**: 240-250.
 HYDE, R. R., 1914 Fertility and sterility in *Drosophila ampelophila*. Jour. Exp. Zool. **17**: 141-212, 343-372.
 HYDE, R. R., 1916 Two new members of a sex-linked multiple (sextuple) allelomorph system. Genetics **1**: 535-580.