PROCEEDINGS
OF THE
NATIONAL ACADEMY OF SCIENCES
Volume 32 March 15, 1946 Number 3

EXPERIMENTS ON SEXUAL ISOLATION IN DROSOPHILA. VI. ISOLATION BETWEEN DROSOPHILA PSEUDOOBSCURA AND DROSOPHILA PERSIMILIS AND THEIR HYBRIDS

BY ERNST MAYR

THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK

Communicated January 24, 1946

If males of either of the closely related species *Drosophila pseudoobscura* and *D. persimilis* have simultaneous access to females of both species, they inseminate a higher percentage of their own females. Particularly the males of *D. pseudoobscura* inseminate only a very small percentage of the available females of *D. persimilis*. Although the degree of preference can be altered slightly through conditioning, as is shown by the behavior of males previously associated with different kinds of females, there is little doubt that it is mainly controlled by genetic factors. It appeared therefore desirable to test the hybrids between the two species in regard to their position in the mating preference scale.[1]

Material and Method.—The same two stocks were used in this experiment, which have been described in an earlier paper in this series,[1] an orange-eyed strain of *Drosophila pseudoobscura* and a wild type strain of *D. persimilis*. The experimental procedure previously described was modified as follows: Males and females of the two species were segregated immediately after hatching and aged in food vials for a period of six to eight days. For each experiment ten or fewer males of one of the species were placed in a vial with food together with ten females of each of the two species or strains. The females were killed and examined for sperm, as described in an earlier paper,[1] after the number of hours necessary to insure the insemination of about fifty per cent of them had passed. The "experimental" and "aging" vials were kept in incubators at $24^1/_2$°C.

Hybrid Females.—The female offspring of the cross of *D. pseudoobscura* with *D. persimilis* (formerly called *D. pseudoobscura B*) are fertile, while male hybrids are sterile.[2] Hybrid females of the two reciprocal crosses were tested with males and females of the two parental species. The results of these tests are summarized in table 1. It can be seen that males

of *D. persimilis* inseminate more hybrid females than females of their own species. Males of *pseudoobscura*, on the other hand, show a slight preference for their own females as compared to hybrid females. A definite maternal effect is apparent in both crosses: female hybrids whose mother is conspecific with the tested males are inseminated more frequently than females of the reciprocal cross (table 1).

TABLE 1

NUMBER OF FEMALES DISSECTED (*n*) AND PER CENT CARRYING SPERM (%) IN WHICH MALES HAD THE CHOICE BETWEEN FEMALES OF THEIR OWN SPECIES AND ALIEN FEMALES

MALE AND HOMOGAMIC FEMALE	ALIEN FEMALE (HETEROGAMIC)	HOMOGAMIC *n*	HOMOGAMIC %	HETEROGAMIC *n*	HETEROGAMIC %	χ^2	ISOLATION INDEX
persimilis	persimilis × pseudoobscura^H	68	38.2	68	73.5	17.2	−0.32
persimilis	pseudoobscura × persimilis^H	142	33.8	143	45.5	4.04	−0.15
pseudoobscura	pseudoobscura × persimilis^H	142	69.0	145	54.5	5.76	+0.11
pseudoobscura	persimilis × pseudoobscura^H	80	67.5	84	27.4	29.7	+0.42
persimilis	pseudoobscura^C	107	72.0	97	41.3	19.5	+0.27
pseudoobscura	persimilis^C	202	77.3	205	6.8	207.7	+0.84

^{H} Hybrid females.

^{C} Control females.

In the first two experiments *persimilis* males are given the choice between their own (homogamic) and hybrid females. They inseminate more hybrid than own females. In the next two experiments *pseudoobscura* males are given a choice of their own and hybrid females. They show a slight preference for their own females. A maternal effect is apparent in both cases. In the two control experiments males are given a choice of females of their own and of the other species.

Discussion.—Direct observations of the mating behavior of *Drosophila* indicate that the "ratio of preference" in the main is controlled by three factors.[3] Species recognition or attraction is one of them, physical compatibility of the genitalia is the second and the degree of activity is the third. The more active a fly (of either sex), the more readily it will participate in a copulation. The factor of activity is particularly important in the case of hybrid females in which hybrid vigor may compensate for an adverse influence of the two other factors. In control tests (table 1, see also earlier paper[1]) it was shown that males of *D. persimilis* have a much lower ratio of preference for their own females than males of *D. pseudoobscura*. Males of *persimilis* inseminate about twice as many of their own as of alien females if equal numbers of both are available. Males of *pseudoobscura* inseminate more than ten times as many of their own females as of *persimilis*. This might mean that factors one, two or both are less important for the males of *D. persimilis* than for those of *pseudo-*

obscura. The results of the experiments with hybrids are consistent with this hypothesis (table 1). Males of *D. persimilis* inseminate a higher percentage of the hybrid than of their own females. The isolation index[1] is negative in both crosses (−0.15, −0.32). The greater activity of the hybrid females is apparently more than sufficient with males of *D. persimilis* to compensate for their genetic inferiority in regard to factors one and two. The greater activity of the hybrid females is not quite sufficient in tests with the males of *D. pseudoobscura* to overcome the adverse influence of factors one and two. The isolation index remains positive (+0.11, +0.42). Still, the discrimination of the *pseudoobscura* males against hybrid females is much slighter than against *persimilis* females. At best (with *persimilis* ♀ × *pseudoobscura* ♂ hybrids), only twice as many of their own females are inseminated as against ten times as many in the control experiment.

The relative desirability of the hybrid females is a puzzling fact, considering the wide overlap of the two species in nature. There would seem to be an apparent opportunity for a good deal of introgressive hybridization. The factors that keep this potential danger in check need further investigation.

[1] Mayr, E., and Dobzhansky, Th., these PROCEEDINGS, **31**, 75–82 (1945).
[2] Lancefield, D. E., *Zeits. ind. Abs. Vererbungsl.*, **52**, 287–317 (1929).
[3] Mayr, E., 1946 (unpublished).

---

*INHERITED DIFFERENCES IN SENSITIVITY TO RADIATION IN ESCHERICHIA COLI**

BY EVELYN M. WITKIN†

COLUMBIA UNIVERSITY AND CARNEGIE INSTITUTION, COLD SPRING HARBOR, N. Y.

Communicated February 11, 1946

The study of spontaneous and radiation-induced mutations is at present our best approach to the investigation of genetic mechanisms in bacteria. Mutations involving resistance to destructive agents (bacteriophage,[1] penicillin[2]) are especially suitable for genetic analysis, since resistant mutants can easily be detected in bacterial cultures. This preliminary report concerns a mutation in *Escherichia coli* leading to resistance to both ultraviolet radiation and x-rays, which was detected by exposing samples from normal cultures to high doses of radiation.

Most investigators of the effects of ultraviolet radiation on bacteria have considered the population within a strain to be fundamentally uniform in sensitivity. Most of the differences found seem to depend upon transient