GENETICS

Homeostasis of the Sex Ratio in *Drosophila*

THE ability of 150 larvæ to emerge as adults under 6 different temperature regimes for 3 inbred lines, their hybrids and the F_2 generation has been studied in *Drosophila melanogaster*[1]. This work revealed that interactions between genotype and environment were smallest in the F_1 generation and largest in the inbred lines. The F_1's therefore show a higher degree of stability or homeostasis than the inbred lines. The F_2 gave a genotype × environment interaction intermediate between the F_1 and the inbred lines, as might intuitively be expected because of segregation in the F_2.

The temperature regimes were 15° C., 24° C. for 8 hr. and 15° C. for 16 hr., 24° C., 24° C. for 8 hr. and 31° C. for 16 hr., 31° C., and 31° C. for 16 hr. and 15° C. for 8 hr. At 10 a.m. and 6 p.m., the replicates under the fluctuating temperatures were changed from one temperature to the other, so that the 16-hr. period represented the night and the 8-hr. period the day. The three inbred lines were Oregon (*OR*) and Sacramento (*SAC*), which were highly inbred by sib-mating, and Bikini (*BIK*), which has been mass-inbred since 1947. The *BIK* mass-inbred line was almost equivalent in homeostatic ability to the F_1 hybrids. This is perhaps because mass inbreeding permits the unconscious selection of heterozygotes more readily than under sib-mating.

While the data were being collected, sex ratios were noted throughout, and only recently have these been analysed. In Table 1, the percentage of females for each inbred line, F_1, and F_2, is given with a heterogeneity χ^2_5 testing the heterogeneity of the 2 × 6 contingency tables made up of the two sexes and the six temperature regimes.

Table 1. PERCENTAGE OF FEMALES AND HETEROGENEITY χ^2 TESTS

Inbreds	Females (per cent)	χ^2_5 for heterogeneity	Probability
OR	45·25	29·99	$P < 0·001$
SAC	48·97	9·42	$0·05 < P < 0·1$
BIK	50·41	2·15	$P > 0·9$
F_1's			
OR × *SAC*	51·88	9·00	$0·1 < P < 0·2$
SAC × *OR*	50·68	1·26	$P > 0·8$
BIK × *OR*	52·47	7·39	$0·1 < P < 0·2$
OR × *BIK*	51·80	3·50	$0·5 < P < 0·7$
BIK × *SAC*	51·91	5·62	$0·3 < P < 0·5$
SAC × *BIK*	52·38	1·18	$P > 0·9$
F_2's			
OR × *SAC*	52·51	12·55	$0·02 < P < 0·05$
SAC × *OR*	50·95	4·62	$0·3 < P < 0·5$
BIK × *OR*	51·37	11·29	$0·02 < P < 0·05$
OR × *BIK*	54·30	5·59	$0·3 < P < 0·5$
BIK × *SAC*	51·36	6·22	$0·2 < P < 0·3$
SAC × *BIK*	51·74	7·65	$0·1 < P < 0·2$

The *OR* and *SAC* inbred lines, which were inbred by sib-mating, were deficient in females and were relatively heterogeneous between temperatures, whereas the *BIK* mass inbred line gave 50·41 per cent females with no significant heterogeneity. Usually in *Drosophila* somewhat more females than males are expected[2], hence the *BIK* line is closer to the normal sex ratio than the *OR* and *SAC* lines. Furthermore, the *BIK* line showed no significant heterogeneity between temperatures, which again suggests its greater homeostatic ability compared with the *OR* and *SAC* lines.

All the F_1 crosses gave about 51 per cent females with no significant heterogeneity, thus demonstrating their superior homeostatic ability. The F_2's showed an excess of females, but with rather more heterogeneity than for the F_1 data, but less than the inbred lines. Similarly, as pointed out earlier, the smallest genotype × environmental interaction was obtained for the F_1, the largest for the inbred lines, and the F_2 interaction occupied a position intermediate between the F_1 and the inbred lines. Hence it may be said that the sex ratio data in this experiment agree with the magnitude of the genotype × environmental interactions observed. The behaviour of the sex ratio in the various inbred lines and crosses over the six temperature regimes therefore agrees with recent theories on the possible relationship of homeostasis and heterozygosity[3]. It must of course be emphasized that homeostasis and heterozygosity are not necessarily related in all situations[4].

In order to explain the deficiency of females in the *OR* and *SAC* inbred lines, it may be postulated that the homozygous genes of the *XX* females depress the viability of the lines somewhat more than the hemizygous genes of the *XY* males. The F_1's between these inbred lines gave considerably more flies than the inbred lines[1], and as about 51 per cent females were produced in the F_1 compared with 46 per cent in the inbred lines, the increase is made up of rather more females than males. Possibly this occurs because the F_1 females are heterozygous for the *X* chromosome, whereas the F_1 males are hemizygous.

If heterozygosity is related to homeostasis or stability, as occurs in many situations[3], then it is possible that the *XX* females would exhibit a greater degree of homeostasis than the *XY* males. To test this, the significance of genotype × environmental interactions was tested for each sex separately for the inbred lines, and the F_1 and F_2 generations. However, there was no suggestion of any difference between sexes. Hence it may be said that within the limits of accuracy of the data, there is no difference in homeostatic ability between the sexes. Consequently the *X* chromosome may not be of great importance in determining homeostatic ability, unless the *Y* chromosome in the males has an effect similar to an *X* chromosome.

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Genetic Basis of Two Melanin Inhibitors in *Drosophila melanogaster*

MUTANTS such as ebony (*e*) and black (*b*) in *Drosophila* increase the melanin content of the integument of the adult fly. The ability of inbred and mass-bred larvæ of the genotypes $e''e''$, $e''+$, and $+ +$ to survive under various concentrations of the two melanin inhibitors phenyl-thio-carbamide and silver nitrate mixed in the food will be discussed briefly here, but complete details with additional information will be presented elsewhere.

Phenyl-thio-carbamide is an organic sulphur compound which inhibits melanin formation by combining with copper ions, which are necessary for the action of the enzyme, tyrosinase[1]. The inhibitory action of silver nitrate, a heavy-metal compound, is presumably due to its interaction with the enzyme