

Adaptation by Natural Selection in Populations of *Drosophila pseudoobscura*

Two experiments are reported here in which natural selection lead to an increase in the adaptedness of populations of *Drosophila pseudoobscura* to the experimental environment. In each experiment one population was monomorphic for the chromosomal arrangement (CH), another was monomorphic for the arrangement (AR), and a third population was polymorphic for CH and AR. The origin and culture technique of these populations has been described elsewhere¹.

During the first few weeks the populations increased sharply in numbers, and then decreased equally drastically. An equilibrium was reached around week 20, after which productivity and population size remained nearly constant. To ascertain whether there was any gradual change in the adaptedness of the populations to the experimental environment the regression coefficients of productivity and population size on time from week 20 until the end of the experiment were tabulated.

The regression coefficients of productivity and of population size on time are positive in all 6 populations. 9 out of 12 regression coefficients are significantly greater than zero, and the other 3 are nearly so ($P < 0.10$). The adaptedness of the populations to the experimental environment, as measured by their productivity and size, gradually increased as a result of natural selection. The size of the populations increased at a rate of about 3-4

flies per generation in the first experiment, and of about 8-9 flies per generation in the second experiment, or between 2 and 4% of the mean population size per generation. These rates of evolution are considerably higher than the rates usually observed in nature, although rapid evolutionary changes have been observed in natural populations of insects adapting to changing environments²⁻⁴. The high rates of evolution observed in the experiments are presumably due to strong selection pressure in a constant direction acting on populations with suitable genetic variability.

Increases in the adaptedness to the environment have been observed in experimental populations of several species of *Drosophila*⁵⁻⁹. It is interesting to compare the present experiments with the results obtained with *D. serrata*⁷⁻⁸ and *D. birchii*⁹ using a technique similar to the present one. In the populations of *D. serrata* and *D. birchii* there was a small or no increase in the productivity, but a large increase in the size of the populations, while in *D. pseudoobscura* the increase in size is not significantly greater than the increase in productivity. This difference is possibly due to a behavioral adaptation which occurred in the *D. serrata* and *D. birchii* populations, namely that the adult flies became gradually less active, thereby decreasing the probability of colliding with each other in the crowded cultures. No similar be-

Mean productivity per week (\bar{X}), mean population size (\bar{Y}), and coefficients of regression (b) of productivity and population size on time, in 6 experimental populations of *Drosophila pseudoobscura*

Population number	Genetic constitution	N	Productivity		Population size ^a	
			\bar{X}	b	\bar{Y}	b
First experiment:						
175	AR	51	167 ± 6	1.09 ± 0.40 ^c	183 ± 7	0.79 ± 0.47
177	CH	52	214 ± 8	1.22 ± 0.49 ^b	242 ± 8	1.10 ± 0.53 ^b
173	AR + CH	51	214 ± 9	1.56 ± 0.55 ^c	240 ± 9	1.15 ± 0.61
Second experiment:						
180	AR	60	149 ± 8	2.07 ± 0.40 ^c	157 ± 9	2.69 ± 0.40 ^c
182	CH	44	167 ± 8	1.09 ± 0.64	199 ± 10	2.92 ± 0.74 ^c
181	AR + CH	60	204 ± 10	2.13 ± 0.49 ^c	225 ± 11	2.83 ± 0.51 ^c

Time units for the regression are weeks. N, number of measurements. ^a Population size is measured before adding the young flies. ^b $P < 0.05$. ^c $P < 0.01$.

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havioral change occurred in the populations of *D. pseudoobscura*¹⁰.

Resumen. Seis poblaciones de *Drosophila pseudoobscura* han evolucionado, debido a la selección natural, hacia una mayor adaptación al ambiente. Durante 20 o 25 generaciones el número de individuos nacidos por unidad de comida y el tamaño de la población han aumentado gradualmente entre un dos y un cuatro por ciento por generación.

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