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Reproductive fitness in exchange lines of a selected photonegative strain and its control.

During selection, fertility and vitality of the selected strains commonly decrease. One explanation for this is that during artificial selection such genotypes are necessarily considered which under the effect of natural selection would be neglected because of their lower fitness. For instance, Pyle (1976) investigated the reproductive fitness of positive and negative phototactic and geotactic strains of D.m., which he had selected in 15-unit classification mazes for over 40 generations. In the photopositive and photonegative strains he found a significant decrease in reproductive fitness (egg to adult survival). A possible explanation therefore is that genes which influence fitness are linked with those being directly selected.

This hypothesis we tried to investigate for a photonegative selected strain of D.m. The selection procedure took place in a 13-unit classification maze (Hadler, 1964). In generation 42 we started a synthesis of chromosome exchange lines out of the negative selected strain (NON) and its photopositive control (KOK), according to the design of Hirsch (1967). These exchange lines carried homozygous combinations of chromosomes from the negative strain (N) and its positive control (K), namely KKK, KNN, KKN, KNK, NNN, NKK, NNK, and NKN. Following a method of Nöthel (1967) the fecundities (eggs/female) of the synthesized lines and their two founder populations NON and KOK were investigated for 9 days (Table 1).

Table 1. Rates of fecundity and standard errors of the base populations NON and KOK and their exchange lines.

day line	1.	2.	3.	4.	5.	6.	7.	8.	9.
NKK	32.38 ±11.45	73.37 ± 8.98	86.56 ± 3.43	77.31 ± 1.31	73.87 ± 7.26	71.56 ± 2.97	74.81 ± 1.68	61.70 ± 1.74	60.27 ± 5.97
NNK	40.83 ± 6.44	64.38 ± 2.07	72.35 ± 3.21	70.18 ± 2.01	67.10 ± 5.31	70.08 ± 3.55	65.07 ± 5.11	55.65 ± 5.40	52.26 ± 5.00
NON	27.65 ± 2.11	51.19 ± 2.89	51.92 ± 7.09	49.50 ± 7.01	42.92 ±10.91	36.50 ± 7.30	36.76 ± 6.70	35.13 ± 9.44	32.94 ± 7.91
KNN	21.28 ± 7.28	50.22 ± 4.29	61.39 ± 5.24	63.91 ± 2.90	60.37 ± 4.41	49.02 ± 8.70	50.10 ± 1.89	51.13 ± 7.06	49.88 ± 9.54
KKN	21.85 ± 9.84	58.46 ± 7.58	65.89 ± 7.90	63.76 ± 4.92	62.07 ± 3.26	58.68 ± 3.89	58.43 ± 6.17	52.89 ± 6.05	50.87 ±11.93
KOK	31.70 ± 7.93	63.18 ± 3.71	68.23 ± 1.99	61.70 ± 4.01	53.65 ±11.08	50.36 ±12.81	45.68 ±10.94	41.18 ± 9.69	37.26 ±11.60
NKN	18.19 ± 5.45	65.61 ± 2.95	78.07 ± 5.83	67.77 ±10.17	71.23 ±12.65	72.23 ± 6.69	67.64 ± 8.13	67.63 ±12.04	57.15 ± 9.71
KNK	29.97 ± 4.54	53.59 ± 6.66	64.90 ± 8.59	64.66 ± 5.78	62.36 ± 8.22	50.79 ± 1.74	47.44 ± 5.30	53.60 ± 9.91	48.05 ± 7.59

There exist significant differences between the investigated lines ($P < 0.01$) according to the Friedman two-way analysis of variance by ranks (Siegel, 1956). We ranked these data in order of increasing size: KNN < KNK < KKN < NNK < NKN < NKK. The first strain KNN is significantly different from the last three lines (NNK, NKN, NKK); or alternatively the line with the highest fecundity NKK differs significantly from KNN, KNK, and KKN (Wilcoxon-Wilcox test).

But there is no clear-cut evidence in the data for the influence of the chromosomes of different origin. An analysis of variance according to the method of Hirsch (1967) leads to inconsistent results. Following our hypothesis we expected that those lines with unselected control chromosomes should show the highest fecundity. This is not the case. Our results show that there must exist interactions between all three chromosomes without considering their origin.

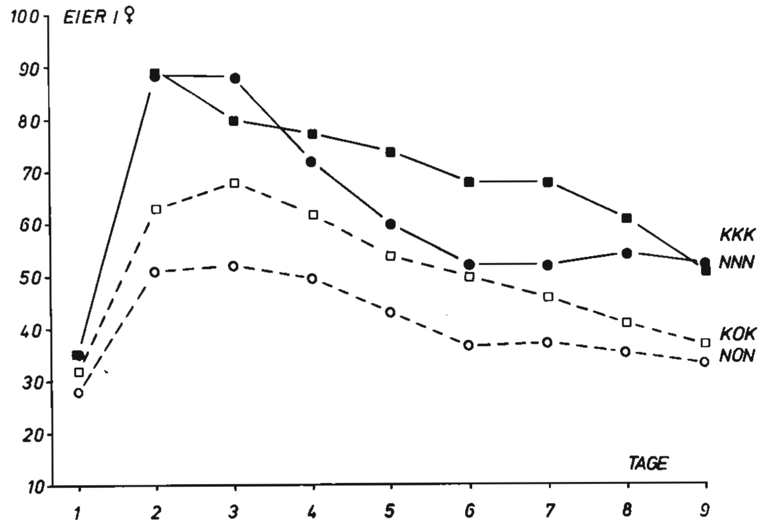

Figure 1. Fecundity (eggs/♀) of the base populations NON and KOK and the re-synthesized lines NNN and KKK until the ninth day.

Nevertheless it is interesting that each line with an X-chromosome from the selected photonegative strain leads to a higher fecundity in comparison with all the other exchange lines. This may support the conclusion that genes which increase fitness are linked with those being directly selected because the effect of the X-chromosome for negative phototactic behavior in D.m. is obvious (e.g. Köhler, 1977).

Similar results were obtained from the egg to adult survival rates. In this case the rank order is KNN < KNK < NKK < NNK < KKN < NKN. The first and second lines show significant differences as compared with the last three lines ($P < 0.01$).

Another interesting result came from the comparison of the fecundity of the populations NON and KOK with the strains NNN and KKK, which were again synthesized from the exchange lines. It is obvious (Fig. 1) that the fecundities of both lines (NNN, KKK) are higher than those of the base populations KOK and NON. This may be an effect of the exchange procedure which lasted 15 generations and must have brought a higher degree of heterozygosity.

References: Hadler, N.M. 1964, DIS 39:131; Hirsch, J. 1967, in Behavior-Genetic Analysis, McGraw Hill, New York; Köhler, W. 1977, Genetica 47:93-104; Nöthel, H. 1967, Strahlentherapie 134:609-624; Siegel, S. 1956, Nonparametric Statistics, McGraw Hill, Tokyo.

<u>Mikasa, K. and T. Narise.</u> Josai Dental University, Sakado, Saitama, Japan. The relation between dispersive behavior and temperature. II. Sex difference.

The experiments were conducted to examine the sex difference in dispersive behavior of D. melanogaster. The strains used were two wild strains, MS-1 and Oregon-R, and six mutant strains (cn bw, e, ss, ss^a, vg and w^a) of melanogaster. In addition, six wild strains (HD, AM, KZ, OD, AT and FO) newly collected in Japan were utilized. Fifty pairs of one to three day old flies of a strain were introduced in a Sakai's migration-tube (original tube) and kept for 24 hrs in it. Then, three new tubes having fresh food were connected with the tube