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Viability of lethal heterozygotes of D. melanogaster under fluctuating temperature.

In natural populations, Drosophila flies are living in variable environment. Effect of fluctuating temperature on the viabilities of heterozygous flies for normal and lethal second chromosomes was examined by an "Insectoron" having a programing controller. 323 second chromosomes were isolated from different male flies captured from natural populations of Kofu-Katsunuma, Japan in 1966. The viability of homozygous flies for each chromosome was estimated by Cy-Pm technique, and 9 D/D, 89 N/D and 225 N/N heterozygotes (D: lethal or semi-lethal chromosome, N: quasinormal chromosome) were obtained by random combinations of these chromosomes. Viabilities of these heterozygotes were estimated under constant (25°C) and fluctuating (20-30°C) environments simultaneously. The results are shown in Table 1. The viability of each heterozygote increased under fluctuating temperature while the number of emerged flies decreased. The most remarkable increase was observed in N/D heterozygotes of which viability became better than that of N/N heterozygotes. This suggests that different heterozygotes possess their own adaptive potentials in respect to the variable environment and the lethal heterozygotes tend to show the highest response to the fluctuating temperature.

Table 1. Viabilities of three fly genotypes under constant and fluctuating environments.

Genotype	No. of lines	Constant (25°C) No. of counted flies	Constant (25°C) Relative viability	Fluctuating (20 - 30°C) No. of counted flies	Fluctuating (20 - 30°C) Relative viability
N / N	225	59148	0.9940 ± 0.01395	46088	1.0137 ± 0.01245
N / D	89	22958	0.9794 ± 0.01844	18054	1.0431 ± 0.01616 **
D / D	9	2005	0.8775 ± 0.08520	1682	0.9884 ± 0.09371
Total	323	84111	0.9868 ± 0.01123	65824	1.0211 ± 0.01007 *

The mean viability of Cy/Pm, Cy and Pm flies is standard (1.0000).

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The effects of disruptive and stabilizing selection on body size in Drosophila melanogaster.

It was shown by several authors (Thoday 1963, Scharloo, Hoogmoed and ter Kuile 1967) that disruptive and stabilizing selection can influence the phenotypic variance of morphological characters. It seemed worth while to practise these modes of selection on characters with a different biological significance.

Therefore three selection systems were applied to thorax length during 18 generations.

Each selection line was replicated and consisted of four cultures. The cultures were started with a limited number of eggs to prevent effects of crowding on thorax length. From each culture 20♀♀ and 20♂♂ were measured.

Variances were computed as squared coefficients of variation ($c.v^2.$). The base population (Groningen-1967) was a cage population started from a large number of female flies caught in Groningen. The heritability of thorax length was 0.53; $c.v^2. = 8.53$.

Two control lines were maintained by selection of 4 flies at random from each culture.

Stabilizing selection was applied by selecting the 4 flies nearest to the mean value of the sample.

Both stabilizing lines showed a small decrease of variation in the first few generations (minimum $c.v^2. = 3.76$), but came back to control level. The mean thorax length was about 6% below the control level in both lines.

In the disruptive lines the two flies with the lowest value and the two flies with the highest value were selected from each sample. In the D^R lines the selected flies were mated at random. In the D^R_1 line $c.v^2.$ increased three times, but dropped to control level after every top. In D^R_2 there was only a single rise in the first few generations. The decrease after the first top (D^R_1 G 5, $c.v^2. = 14.29$) coincided with a considerable increase of 5% in thorax length in both lines. Probably larger reproduction of the large flies caused a direc-

tional component in the disruptive selection.

In the D^- lines (disruptive selection with negative assortative mating) high ♀♀ were mated with low ♂♂ separately from low ♀♀ and high ♂♂. After 24 hours the ♂♂ were discarded and the females were transferred to one culture for egglaying.

In both D^- lines $c.v^2$. increased considerable (D^-_1 G 16, $c.v^2$. = 20.80; D^-_2 G 16, $c.v^2$. = 22.18) without a change of mean thorax length.

The phenotypic variance in the selection lines will be analyzed.

Valentin, Jack. Institute of Genetics, University of Stockholm, Sweden. Inter-chromosomal effects of SM1 and SM5 on crossing-over.

The Cy inversions have a well-known characteristic interchromosomal effect, viz., the main increase in crossing-over in X is located distally instead of around the centromere (see e.g. Ramel and Valentin, Hereditas 54:307-313, 1966). SM1 is a derivative of In(2L+2R)Cy, carrying besides Cy a pericentric inversion obtained by irradiation. SM5 is a product of further repeated irradiation of SM1 and is yet more complex. However, they both carry the Cy gene and inversions. Now it is evident that if there is any difference in synaptic properties, SM1 and especially SM5 (which may show complete asynapsis in salivary glands) have a lower synaptic capability than the original Cy chromosome. Therefore, it seemed interesting to study how the interchromosomal effect in general and especially the Cy effect on distal X is influenced by increasing degree of complexity.

SM1 and SM5 were both tested by crossing to y ec ct^6 v f ♀♀, giving a series of full sib daughters carrying the X chromosome markers heterozygously and being heterozygous for the rearrangement in question or structurally homozygous normal (control). These daughters were crossed to stock males and crossing-over was measured. As can be seen from Table 1, the degree of increase in the rearrangement series is quite moderate compared to the results obtained with Cy (values from Ramel and Valentin 1966). SM5 shows only a slight distal increase of crossing-over while SM1 does not at all show this characteristic feature.

The latter result seemed so improbable that a second experiment was performed with SM1, this time with the markers w^a ct^6/sc cv v f. As Table 2 shows, a certain distal increase was obtained this time. On the other hand the total increase is still quite low, which confirms the earlier observation that the degree of asynapsis is not directly correlated to the interchromosomal effect. There is not yet any satisfactory explanation for the lack of pronounced distal effect observed with SM5 and perhaps also with SM1.

Table 1

Region	y-ec	% inc.	ec-ct	% inc.	ct-v	% inc.	v-f	% inc.	Total	% inc.	Number counted
SM1/+	6.08[2]	23.3	17.72[2]	13.9	15.85[2]	15.0	27.24[2]	12.7	66.89	14.3	8664
Contr.	4.93	-	15.56	-	13.78	-	24.17	-	58.49	-	8077
SM5/+	5.96[2]	54.0	17.48[2]	30.3	17.91[2]	25.6	31.42[2]	29.1	72.77	30.2	2317
Contr.	3.87	-	13.42	-	14.26	-	24.33	-	55.88	-	4053
Cy/+	10.0[2]	156.4	23.5[2]	43.3	16.4	7.2	26.4[2]	17.2	76.3	31.3	2719
Contr.	3.9	-	16.4	-	15.3	-	22.5	-	58.1	-	3447

Table 2

Region	sc-w^a	%inc.	w^a-cv	%inc.	cv-ct	%inc.	ct-v	%inc.	v-f	%inc.	Ttl	%inc.	N
SM1/+	3.8[2]	151.3	13.8[2]	38.6	10.6[2]	45.1	17.0	4.4	25.6[1]	13.9	70.8	23.1	2750
Contr.	1.5	-	9.9	-	7.3	-	16.3	-	22.5	-	57.5	-	3347

[1] = significant at the 1% level
[2] = significant at the 0.1% level (χ^2, 2x2 contingency tables)