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Effects of inversions on viabilities in a local population of D. melanogaster.

It has been reported that the frequency of inversion-carrying chromosomes in natural populations, which are presumably near equilibrium, is fairly high (e.g. Oshima, Watanabe and Watanabe 1964; Watanabe 1967). The effects of these inversions on viabilities of individuals were examined, using experimental materials obtained from a Raleigh, North Carolina, population.

Six hundred ninety-one second chromosomes were extracted in the summer of 1970 and their salivary gland chromosomes were examined. One hundred and thirty chromosomes were shown to carry inversions, among which there were two polymorphic inversions (40 In(2L)Cy and 66 In (2R)NS). The homozygous viabilities of these chromosome lines and the viabilities of heterozygotes constructed by random combinations of these chromosome lines were estimated by the Cy method (cf. Wallace 1956). The experiment was conducted at 9 different times. The viabilities were standardized by the average heterozygote viabilities of their respective replications. The main conclusions were as follows:

1. The frequency of lethal-carrying chromosomes (Q) is much higher in the inversion-carrying chromosomes than in the inversion-free chromosomes ($\hat{Q}$= 0.54 vs. 0.37, $\chi^2_{df.=1}$ = 13.19 $P < 0.0005$).

2. Among the lethal-free chromosomes, the average homozygous viability of inversion-carrying chromosomes does not differ significantly from that of inversion-free chromosomes [Inversion-carrying chromosomes: 0.7253 ± 0.0296 (N=60); Inversion-free chromosomes: 0.7159 ± 0.0117 (N=356) where N is the number of chromosome lines].

3. The average viabilities and genotypic variance among random heterozygotes are shown in the following table:

	N	Average viability	Genotypic variance
All heterozygotes	688	1.0000 ± 0.0038	0.005691 ± 0.000546
Inversion-free heterozygotes	458	0.9957 ± 0.0047	0.005847 ± 0.000674
Inversion heterozygotes	230	1.0083 ± 0.0064	0.005294 ± 0.000921

The average viability of inversion heterozygotes is slightly higher than that of inversion-free heterozygotes but not significantly so ($t = 1.59$, $P > 0.05$). No significant difference was found in genotyic variance between inversion-carrying and inversion-free heterozygotes.

4. The average viability of lethal heterozygotes was estimated as follows:

	N	Inversion-carrying	N	Inversion-free
Normal/Normal′	68	1.0118 ± 0.0115 (1.0000 ± 0.0114)*	173	1.0124 ± 0.0076 (1.0000 ± 0.0075)
Normal/Lethal	118	1.0059 ± 0.0090 (0.9941 ± 0.0089)	232	0.9865 ± 0.0065 (0.9744 ± 0.0065)
Lethal/Lethal′	44	1.0098 ± 0.0151 (0.9980 ± 0.0149)	53	0.9821 ± 0.0116 (0.9701 ± 0.0115)

* The figures in parentheses are the standardized values.

The average degrees of dominance on a locus basis are 0.003 in the inversion-carrying individuals and 0.018 in the inversion-free individuals. The latter is significantly larger than 0. (Supported by PHS grants GM-11546 and FR-00011).

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First Multiple seven: now contains sn^{x2} for better balancing.

The construction of FM7 containing lz^{sp} has been previously described (DIS 44:101). Because males bearing this chromosome have poor viability, it is not useful for balancing sex linked lethals. We have subsequently replaced lz^{sp} with sn^{x2} as the female sterilizing mutant and males bearing the new FM7 chromosome are normally viable. The FM7 chromosome now contains the markers y^{31d}, sc^8, w^a, sn^{x2}, v, and B. We maintain it in two ways, over the y f attached-X and in females against un Bx^2, and will be glad to send cultures on request.