

Krimbas, C. B. and E. Zouros. College of Agriculture, Dept. of Genetics, Athens, Greece. Crossing over suppression between linked but non overlapping inversions in *Drosophila subobscura*.

Sperlich (1963 DIS 37:130) observed a non random association of linked but non overlapping inversions in five Italian and one Austrian natural populations of *D. subobscura*. Five out of the seven cases he describes refer to inversions located in the chromosome 0. One of the

expected classes of chromosomes is either completely missing or at a much lower frequency than the one expected from random association. This is quite characteristic of *D. subobscura* (Krimbas 1964 Z. Vererb. 95:125, 1967 Mol. G. Gen. 99:133) but exceptions to this rule are sometimes recorded: for example in the Tarsus population the inversion types 0_{3+4+7} , 0_{3+4} , 0_7 , 0_{ST} seem to be at a linkage equilibrium (Götz 1967 Mol. G. Gen. 100:1). The non-random association of inversions can result from different mechanisms: either from a complete suppression of crossing over between the non-overlapping but linked inversions in double heterozygote females for the inversions, or from the interaction of linkage and selection (epistatic interaction in fitnesses) which would create a nearly absolute linkage disequilibrium.

As part of work on association of enzyme genetic polymorphisms and chromosomal types in *D. subobscura*, we have collected information, in several crosses, concerning the crossing over values between two independent but linked inversion systems of chromosome 0 in the gametes of the double heterozygote females. The data are reported in Table 1. The whole chromosome 0 is divided in 102 sections in the salivary gland chromosome map of Kunze-Mühlh & Müller (1958 Chromosoma 9:559) and its genetic length is estimated to be of 156 crossover units (Koske & Maynard Smith 1954 J. Genetics 52:536).

Table 1

Female's Genotype	Distance	Gametes				
		0_{3+4+1}	0_{ST}	0_{3+4}	0_1	Total
0_{3+4+1}	21 sections- > 50 units	59	80	0	0	139
0_{ST}						
		0_{3+4+7}	0_{ST}	0_{3+4}	0_7	Total
0_{3+4+7}	26 sections- > 50 units	61	41	0	0	102
0_{ST}						
		0_{3+4+12}	0_{ST}	0_{3+4}	0_{12}	Total
0_{3+4+12}	3 sections- \approx 15 units	26	23	0	0	49
0_{ST}						

In the first column of Table 1 we indicate the genotype of the female, in the second one the number of sections between the non overlapping inversions (corrected for inversion 0_7 according to Götz 1965 Z. Vererb. 96:285) and the estimated genetic length. This last one is estimated with the help of Est_1 and Lap genes. The sequence of the loci in chromosome 0 is the following:

T.B. (terminal break) of 0_{3+4} -----Lap-----F.B. (First break) of 0_{12} -----T.B. of 0_{12} -----F.B. of 0_{22} -----F.B. of 0_1 -----F.B. of 0_7 -----T.B. of 0_{22} -----T.B. of 0_1 -----T.B. of 0_7 ----- Est_1 -----centromere.

In females heterozygous $0_{3+4}/0_{ST}$ we found that the distance Lap-----T.B. 0_{3+4} is of 6 units. In females $0_{3+4+22}/0_{3+4}$ the distance of Lap-----F.B. 0_{22} is 45.5 units. Thus T.B. 0_{3+4} -----F.B. 0_{22} equals 51.5 units and T.B. 0_{3+4} -----F.B. 0_1 > 51.5 units. This is probably a serious underestimation. On the other hand Est_1 -----T.B. 0_{3+4+12} is 24 units (in females $0_{3+4+12}/0_{ST}$ and Est_1 -----T.B. 0_{3+4} is 39.3 units (in females $0_{3+4}/0_{ST}$). Thus T.B. 0_{3+4} -----F.B. 0_{12} is 15.3 units.

In the following columns of Table 1 the number and classes of gametes produced by the female as well as their total number are indicated. It is obvious that crossing over is nearly completely suppressed in double heterozygous females between the two independent inversion systems O_{3+4} and O_1 , O_{3+4} and O_7 , O_{3+4} and O_{12} .

This suppression is not due to suppressor genes because in O_{3+4+22}/O_{3+4} females the Lap gene at a distance of 6 units from T.B. O_{3+4} is at a distance of 45.5 units from the F.B. O_{22} (and O_{3+4+22} resembles O_{3+4+1} ; we never found O_{22} alone).

The cause of crossing over suppression is probably asynapsis of the whole region of the chromosome comprising the O_{3+4+1} , O_{3+4+7} , and O_{3+4+12} arrangements in heterozygote females with O_{ST} . Inversion system O_{3+4+8} (O_8 over O_{3+4}) probably restores some synapsis with O_{ST} as some data of Sperlich (1963) and Götz (1965) indicate.

This situation resembles the one described by Levitan in *D. robusta*, as well as the interpretation of the data of Terzaghi & Knapp in *D. pseudoobscura* (1960 Evolution 14:347).

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The genus *Drosophila* in New Guinea.

During 1967 the genus *Drosophila* was sampled at five stations in New Guinea from heaps of fermenting banana. The primary sorting of the flies yielded the results shown in Table 1. The results in

Table 2 were obtained from samples of *melanogaster* identified by their male progeny.

Cytogenetical studies and an investigation of isolating mechanisms in the species listed is proceeding.

Table 1

Primary Sorting

	<u>Port Moresby</u> (Bisianumu) (May)		<u>Rabaul</u> (May)		<u>Bulolo</u> (Aug.)		<u>Popondetta</u> (Sept.)		<u>Awala</u> (Sept.)	
	%		%		%		%		%	
<i>D. rubida</i>	12	1.4	116	7.6	59	3.6	18	1.1	91	10.7
<i>D. setifemur</i>	69	8.2	218	14.2	202	12.5	171	10.2	196	23.1
<i>D. pararubida</i>	26	3.1	258	16.8	226	14.0	57	3.4	12	1.4
<i>D. tetrachaeta</i>	2	0.2	30	2.0	62	3.8	22	1.4	1	0.1
<i>D. argentostriata</i>	8	1.0	-	-	-	-	-	-	-	-
<i>D. silvistriata</i>	9	1.1	-	-	-	-	18	1.1	39	4.6
<i>melanogaster</i> group	714	84.8	756	49.3	1062	65.9	1395	8.3	510	60.1
<i>Pholadoris</i>	2	0.2	155	10.1	-	-	-	-	-	-
	842		1533		1611		1681		849	

Table 2

Melanogaster group samples

	<u>Port Moresby</u> (Bisianumu) (May)		<u>Rabaul</u> (May)		<u>Bulolo</u> (Aug.)		<u>Popondetta</u> (Sept.)		<u>Awala</u> (Sept.)	
	%		%		%		%		%	
<i>D. ananassae</i>	22	7.4	21	17.5	53	19.0	31	14.4	18	12.3
" <i>Pseudoananassae</i> "	5	1.7	20	16.7	105	37.6	66	30.6	15	10.3
<i>D. szentivani</i>	1	0.3	1	0.8	7	2.5	8	3.7	11	7.5
<i>D. mayri</i>	1	0.3	1	0.8	25	9.0	56	25.9	36	24.7
<i>D. gracilis</i>	270	90.3	3	2.5	1	0.4	1	0.5	2	1.4
<i>D. serrata</i>	-	-	4	3.3	-	-	-	-	-	-
<i>D. birchii</i>	-	-	70	58.3	88	31.5	54	25.0	4	43.8
	299		120		279		216		146	