Rasmuson, B. and I. Montell. University of Umea, Sweden. Genetic instability and the production of transposing elements in Drosophila melanogaster.

In males with the genetic constitution z Dp (1:1) (w^{sp}) (w^{a}) kept against attached females, we have on several occasions (6 separate times) found premeiotic eliminations of the duplication with a simultaneous elimination of the w^{sp} in the left and a w^{a} in the right duplication. This duplication-eliminated chromosome gives a wild type eye color phenotype, characteristic for z w^{+} males. But the chromosome region remains genetically unstable, generating deletions (i.e. white mutants) in high frequency, as well as shifts in the white-locus activity, giving z w^{+} (zeste) and z w^{+} (red) eye color phenotypes (Rasmuson et al.). Recombination experiments have indicated that the unstable DNA possibly is associated with the orientation of the inserted segment, which is localized to the right of the white-locus, and thus regulates the white-locus activity.

The localized unstable DNA is also a part of a transposing element. It can be spontaneously excised from the original position in the X-chromosome and integrated into non-homologous positions. In this transposing process the white-locus can be co-transposed into the new positions, where the locus is completely active.

The following positions have been mapped. The two first mentioned are spontaneous in origin. The first is a transposon into the heterochromatin of the fourth chromosome, in which position it has been shown to retain its instability. The phenotypic expression is associated with the number of Y-chromosomes. The second transposon is inserted into the third chromosome, but its position is still not well known. The last three transposons have appeared after mutagen treatment, and they have all been found to be inserted into the second chromosome. Transposon w^{+II}(78c28) is mapped to about 74, transposon w^{+II}78e01 to about 57, and transposon w^{+II}78h24 to about 59 in the second chromosome.

They are all very short transposons; no one covers the rst or the vt loci to the right of white-locus nor one of the closest localized lethals to the left of the locus, i.e., Judd's 1(1) 63k18, localized 0.022 map units to the left of the white-locus. They are all characterized by wild type pigmented males in association with z in the X-chromosome, except for the transposon T w^{+II}78c28, the males of which have a halo-pigmented margin of the eye. The T w^{+} 78h24 is of particular interest, since simultaneously with the transposon the corresponding deletion of the white-locus was isolated as a premeiotic z Df(1) w^{-}78h24 deletion.

Preliminary hybridizing experiments together with Gvozdev show this unstable DNA to be identical with the intercalary heterochromatic DNA, cloned in the Dm 225 plasmid (Ilyin et al.), since the male salivary chromosomes from the z w^{+} (zeste) phenotype as well as the z w^{+} (red) phenotype show hybridization with this cloned DNA, whereas the Df(1) w^{-} deletion, which is a white eyed deletion from this unstable X-chromosome, does not.

References: Rasmuson, B. and M. Green 1974, Genetic instability in Drosophila melanogaster. A mutable tandem duplication, Mol. Gen. Genet. 133:249-260; Ilyin, Y.V., N.A. Tchurikov, E.V. Ananiev, A.P. Ryskov, G.N. Yenikolopov, S.A. Limborska, N.E. Maleeva, V.A. Gvozdev and G.P. Georgiev 1978, Studies on the DNA fragments of mammals and Drosophila containing structural genes and adjacent sequences, Cold Spring Harbor Symposia on Quantitative Biology, Vol. XLII:959-969.

Richmond, R.C. Indiana University, Bloomington, Indiana. Temperature and dessication tolerance in four species of the affinis subgroup.

D. affinis, algonquin, athabasca and narragansett occur sympatrically in a subset of their ranges. The relative abundance of these species varies within any one locality over time and over a latitudinal gradient between localities (Miller, Amer. Midl. Natur. 60:52; Richmond, unpub. data). Fig. 1 shows the average relative frequency of the four species in a single locality near Bloomington, Indiana for the months of March through September in 1972, 1973 and 1974. We tested the hypothesis that the temperature and dessication tolerance of the four species might account for the pronounced shifts in relative frequency by determining the time required for 50% of a group of flies to die when subjected to combined temperature and dessication stress. A group of 20 flies of one sex was placed into a 71 cc glass vial which was immersed in a water bath. Dry air obtained by passing the stream through a 4:1 mixture of anhydrous calcium chloride and "indicating" Dryrite was routed through each vial at a rate of

0.2 liters per minute. Air temperature was that of the water bath. Twenty individuals of each sex of the four species were tested at 31, 32, 33, 34, 35 and 36°C. At any one temperature, individuals of one sex of all species were tested simultaneously. The results are summarized in Figs. 2 and 3. D. athabasca is the least tolerant of the four species at temperatures below 34°C. At temperatures from 31-34°C, D. affinis, algonquin and narragansett have approximately equal tolerances to the stress conditions. However, at temperatures above 34°C, there are consistent differences between the four species such that the species tolerance to high temperature and dessication can be summarized as affinis > narragansett > athabasca > algonquin. A three-way, fixed factor analysis of variance of these data is given below.

Source	df	Mean Squares	F
Temperatures	5	43416.9	199.5***
Species	3	8049.9	37.0***
Sex	1	5355.2	24.6***
Temperature x Species	15	913.2	4.2**
Temperature x Sex	5	263.4	1.2
Species x Sex	3	1262.0	5.8*
Temperature x Species x Sex	15	217.6	
Total	47		

***p<0.001 **p<0.005 *p<0.01

Each of the principal factors tested had a strongly significant effect on the tolerance of these species. As is suggested by Figs. 2 and 3, there are significant interactions between temperature and species and between species and sex. However, the relative tolerances of the sexes over the temperatures used remain fairly constant, thus the temperature x sex interaction is not significant. The significant differences in tolerance to combined dessication and temperature stress especially at higher temperatures suggest that the physiological tolerances of these species may well be a significant factor affecting their distributions and abundances in time and space. Supported by NIH Grant GM23706.

FIG. 1

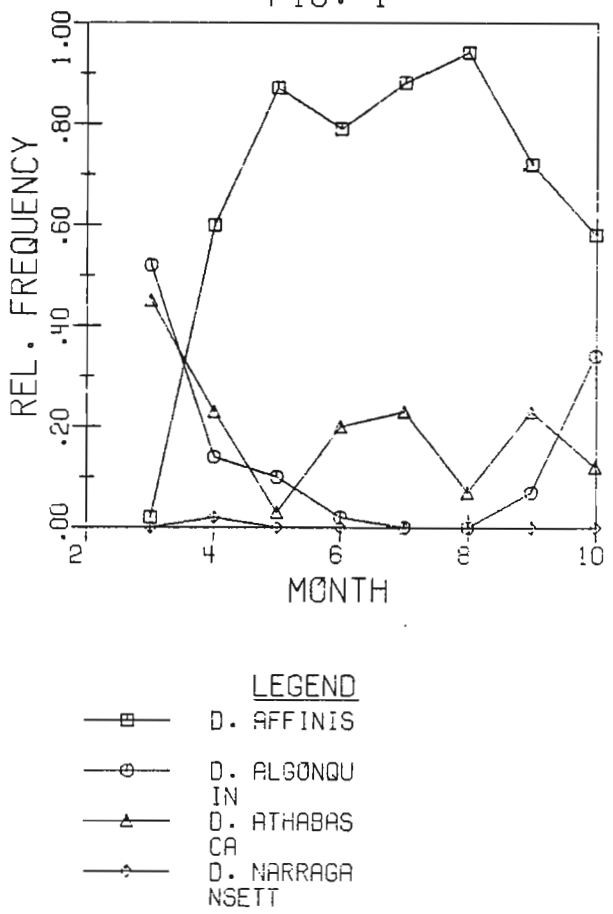


FIG. 2 **(MALES)**

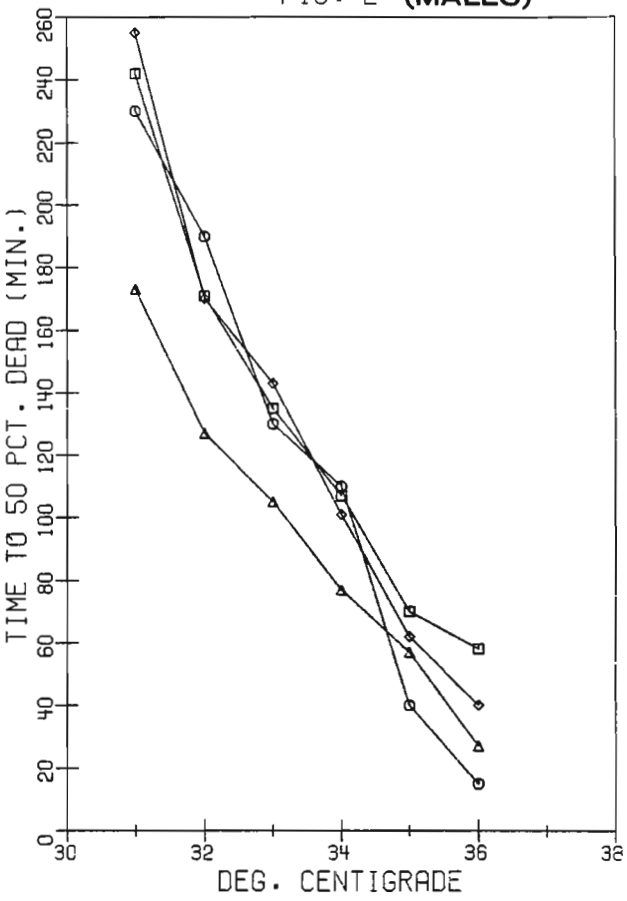
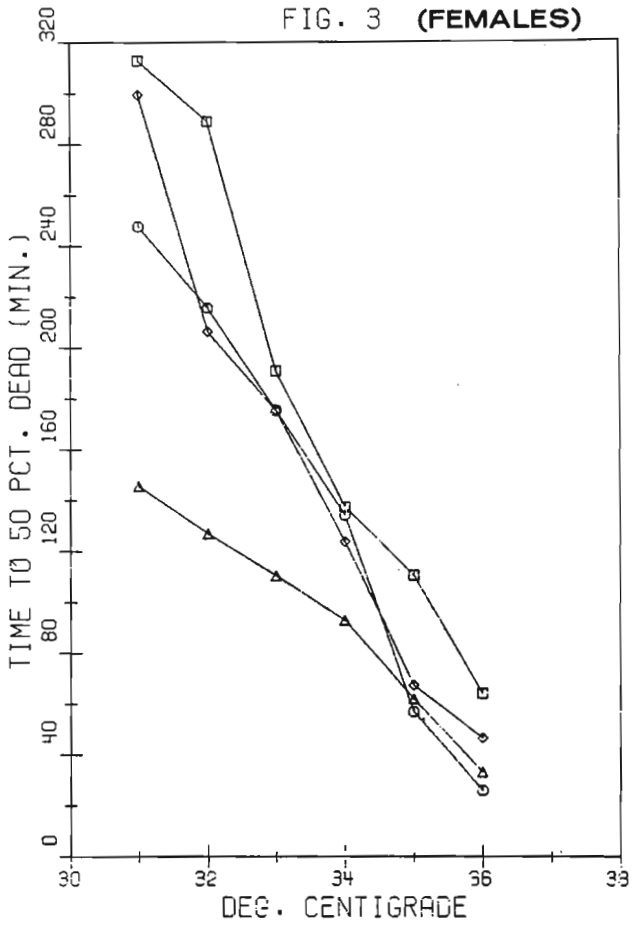


FIG. 3 **(FEMALES)**



Richmond, R. C. Indiana University, Bloomington, Indiana. Effects of temperature and humidity stress on genotype distribution at six allozyme loci.

Several investigators have studied the effects of short term temperature stress on allozyme loci in D. melanogaster (Johnson and Powell, PNAS 71: 1783; Milkman, DIS 52:58). Flies collected from an established population cage were subjected to 36°C and 0% humidity until approximately 50% were dead (about 45 minutes). Both dead and living flies were removed and their genotypes at 3-6 diallelic, allozyme loci were determined. Since there were no significant differences between genotype distributions in the two sexes, the data for both sexes have been combined.

	Dead Flies					Living Flies				
	Genotype numbers					Genotype numbers				
Locus	SS	SF	FF	F	χ^2	SS	SF	FF	F	χ^2
Mdh	184	21	1	-0.054	0.60	133	13	0	-0.047	0.32
Adh	74	74	27	+0.089	1.37	49	40	8	-0.004	0
Odh	4	6	68	+0.529	21.84*	1	18	98	+0.016	0.03
Est 6	38	110	55	-0.091	1.70	32	77	36	-0.063	0.57
αGpdh	2	25	182	+0.074	1.13	0	22	124	-0.082	0.97
Pgm	99	61	16	+0.109	2.07	36	50	8	-0.167	2.63

* $p < 0.005$

In the table above, the genotype distributions at each locus are given as is Wright's inbreeding coefficient, F, which measures deviations from Hardy-Weinberg expectations (+ = deficiency of heterozygotes; - = excess of heterozygotes). Only the Odh locus among dead flies shows a significant deviation from Hardy-Weinberg expectations. However a comparison of the