Abedin, K., S. McNamara, D. Osterbur and W. W. M. Steiner. University of Illinois, Urbana. Studies on the effect of temperature on fitness and fecundity at the Esterase-6 locus in D. melanogaster.

Wright and MacIntyre (1965) found the presence of two alleles in D. melanogaster producing variants of esterase-6 (est-6) enzyme which had similar electrophoretic mobility. Allele est-6^{F}_{1} was found to control production of a heat labile form in which no activity of the enzyme remained after 5 minutes at 60°C while allele est-6^{F}_{2} was heat stable. An electrophoretically slow migrating third allele, est-6^{S}, was found to be heat stable also. Long (1970) has determined that temperature fluctuations may effect genetic responses in D. melanogaster populations but the specific response of the different est-6 alleles have remained uninvestigated in this regard. The in-vitro effects described by Wright and MacIntyre imply that under high temperature stress flies carrying the est-6 heat resistant allele may be at an advantage. In addition, the fecundity of each allelic type has remained uninvestigated under different temperature regimes, a point which is of interest with respect to the selective maintenance of the different alleles.

We have investigated these points using strains 3008 (homozygous for an est-6^{F} allele) and 3009 (homozygous for est-6^{S}) obtained from the University of Umea, Sweden. Heat denaturation tests were first conducted to determine if the allelic types differed in heat sensitivity. Homogenates of 10 males of each genotype were placed in a glass tube (Kimax, 6x50 mm) and subjected to incubation temperatures of 30°C or 60°C for 10 minutes, on a temp-bloc (Scientific Products). The test was repeated for flies raised at 18°C, 25°C, and 30°C and for a control raised at a varying room temperature of 20-23°C in order to determine if variation in developmental temperature might play a role in heat sensitivity. A second control raised at each of the above temperatures but not heat treated was also used. After the temperature exposure, the supernatants from each homogenized set of flies was electrophoresed on a tris-citrate gel (pH 8.45 containing 10% of electrode buffer) bridged across a set of electrode trays containing lithium hydroxide-boric acid (pH 8.2) solution. Gels were run for 8 hours at 200 volts. Allozyme bands were visualized using a standard esterase histochemical stain, and the presence or absence of bands was noted. The results shown in Table 1 clearly indicate that line 3008 carries a heat sensitive form of the est-6^{F} allele but we are not sure it is the same as that found by Wright and MacIntyre (1965). Although we must conclude that there is no effect on the expression of sensitivity due to various developmental temperature regimes, it is interesting to note that the sensitivity of est-6^{F} at 30°C in flies raised at a fluctuating (room) temperature and at a high (30°C) temperature is reduced. The est-6^{S} allozyme retains activity regardless of development temperature background or heat treatment.

Table 1. The results of heat-inactivation studies on est-6^{F} and est-6^{S} carrying flies raised at different temperatures. The presence of enzyme activity after a treatment is indicated by a + while a - indicates no activity.

Temperature raised at	Treatment	3008 est-6^{F}	3009 est-6^{S}
room	no denaturation	+	+
room	30°C	+	+
room	60°C	-	+
18°C	no denaturation	+	+
18°C	30°C	-	+
18°C	60°C	-	+
25°C	no denaturation	+	+
25°C	30°C	-	+
25°C	60°C	-	+
30°C	no denaturation	+	+
30°C	30°C	+	+
30°C	60°C	-	+

To investigate fecundity at different temperatures for the two allelic types, flies 24 hours of age were chosen for preconditioning on sugar media for two days at room temperature. These were then split into three groups for each line and were kept for two more days at 18°C, 25°C, and 30°C, respectively. They were then transferred onto a standard yeast and cornmeal media containing red food coloring to facilitate egg counting. These vials, which contained a moist folded Kimwipe to maintain humidity in each vial, were then kept at their respective temperatures for 48 hours longer. At the end of this period, the flies were removed and the eggs in each vial were counted under a dissecting microscope. Eggs were maintained at each temperature until adults emerged. These were counted daily over an 8 day period when it was ascertained that hatching was completed.

The results of this study are shown in Table 2 which also contains the fitness coefficients for egg to adult survival. For both lines, fecundity and egg to adult survival are maximized at what should be the near-optimal temperature of 25°C. Examining the data reveals that line 3008 has a higher egg to

adult survival rate (85.8% compared to 70.5%) at 25°C, and has a slightly higher survival at 18°C. At 30°C, however, the situation is reversed and not only are over twice as many flies surviving to the adult stage in line 3009, but line 3008 has a relative fecundity almost twice that of 3009 (the difference between strains for fecundity at 25°C and 30°C is significantly different, t = 3.59 and 3.03, p = 0.005). The fitness coefficients reflect the higher survival rates in line 3009 as well. Thus, it appears that the heat sensitive est-6^F allele in this study may be at an advantage with respect to individual survival and fecundity at temperatures around 25°C and lower but at a disadvantage in vivo at temperatures approaching 30°C. That this is an effect associated with the est-6^F heat sensitive allele is not entirely clear even though the study was initiated to determine if the ad hoc prediction would be met. The survey of additional lines fixed for est-6^S and the heat sensitive est-6^F alleles, which should differ in genetic background except at this locus, would aid in clarifying the relationship observed in this study. Examination of the relative allozyme activities in flies raised at different temperatures and delineation of the physiological role of esterase-6 would also help. Studies on certain aspects of these problems are continuing.

Table 2. Relative fecundity, survival and fitness within est-6 strains in flies kept at three different temperatures.

Line	Temperature °C	No. of eggs	No. of adults	Percent Relative Survival	Relative Fecundity	Fitness
3008 (est-6^F)	18	29	8	27.6	15.3	.32
	25	190	163	85.8	100.0	1.00
	30	155	42	27.1	81.6	.29
3009 (est-6^S)	18	40	10	25.0	14.5	.35
	25	275	194	70.5	100.0	1.00
	30	116	75	64.7	42.2	.96

References: Long, T. 1970, Genetics 66:401; Wright, T.R.F. and R.J. MacIntyre 1965, Elisha J. Mitchell Soc. -1:17.

Albornoz, J. and J. Rubio. University of Oviedo, Oviedo, Spain. Location of a region controlling the suppression of normal bristles in Drosophila melanogaster.

Repeated attempts to increase the number of missing dorsocentral and scutellar bristles (dc and sc) by selective crossing of the few deviant flies found in wild populations have failed. However, we found quite a number of missing dorsocentral and scutellar bristles in a population that had been intensively selected for increased number of bristles (dc and sc) and then let go without selection, where more than 95% of the flies had extra dc and sc bristles. The quick response to selection for increased number of missing bristles (line S) is shown in Figure 1 up to generation 11, when a plateau was reached; the 6 latest counts are included. Presently all the flies in the population lack some normal bristles in the dorsocentral and scutellar areas; other bristle systems, and occasionally some microchaetae, are also affected. The proportion of flies having extra bristles was drastically reduced from 95% to 6-8% at generation 11, but even now 4-8% of the flies in every generation have extra dc and sc bristles.

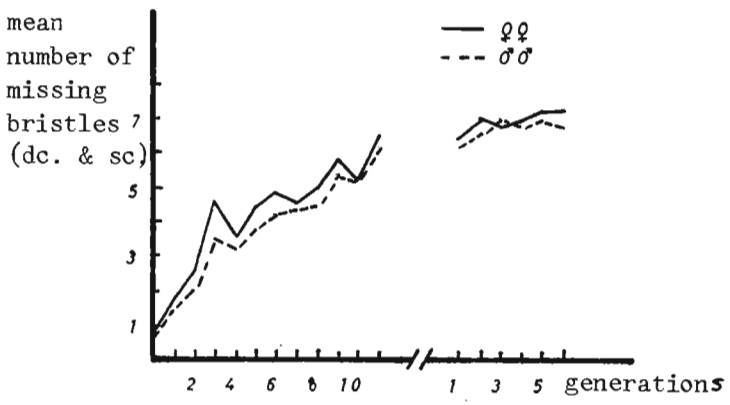

Fig. 1.

Chromosome contribution analysis: Conventional crossing of line S to balanced strain J-407 carrying dominant markers in all three major chromosomes indicates that the presence of chromosome III in homozygous con-