Band, H.T. Michigan State University, East Lansing, Michigan. Increased developmental homeostasis in a natural population and climatic changes.

Natural populations or species inhabiting a more variable climate possess greater developmental homeostasis than those in more equable conditions (Tantawy and Mallah, 1961; Dawson, 1968). Experiments by Beardmore and Levine (1963) demonstrated that populations of D. pseudoobscura maintained in fluctuating temperatures developed greater homeostasis than those in constant temperatures although all populations were initiated by the same founders. Band (1964) presented evidence that the S. Amherst D. melanogaster population displayed greater developmental homeostasis in 1962 than in 1961 or 1960, and that the new level was maintained in the population in 1964 (Band, 1969). Prior to the time of onset of increased developmental homeostasis it was known only that the winter of 1960-61 had been unusually severe and that the combined spring and summer quarters of 1962 were the driest on record (i.e. back to 1889). Subsequently Ives determined that total rainfall in the area had declined about 30% below 1889-1960 norms for a period from July 1961 to June 1966 (see Band and Ives, 1968; Band, 1969). This provides evidence that we are dealing with a population in a period of climatic change but fails to explain why an adaptation to drier conditions should also convey a decreased variability in the population to temperature.

In this issue we have reported that there have been near-parallel climatic shifts in daily temperature range and rainfall in the May-October interval from 1930 to 1969. Both display maximum severity during the 1961-62 through 1965-66 span of the past decade.

The summer months constitute a standardized quarter of the year and chromosome collections analyzed in 1960, 1961, 1962 and 1964 were made in September. Average daily temperature range and number of days having narrow ($3\text{-}20^{\circ}$), intermediate ($21\text{-}25^{\circ}$) and wide ($26\text{-}42^{\circ}$) ranges between minimum and maximum daily temperature are given below for summers in the 1960 decade. Summers 1963 through 1966 have a significantly wider range per day between minimum and maximum temperatures than those in the earlier part of the decade or summer 1967. Average daily range in 1962 misses the significance level, but when total numbers of days with range 26° or above are considered, then summers 1962 through 1966 all have significantly more days in the wide range category.

Table 1. Average daily temperature range per summer

1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
23.5	23.6	25.4	26.4*	25.9*	26.3*	26.6*	23.4	24.2	24.0
±7.4	±7.0	±8.0	±6.7	±7.3	±7.2	±7.2	±7.5	±7.6	±7.8

Table 2. Number of days with narrow, intermediate or wide ranges.

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
N	30	23	23	20	16	21	16	30	21	25
I	23	33	23	17	25	17	22	28	25	20
W	39	36	46*	55*	51*	54*	54*	34	46*	47*

The months of June and July in the summer and May, June, and July in the May-October span in 1962 all have an average temperature range of 26° or over. Hence it would seem that elevated ranges in the natural environment as well as drier conditions have contributed to the onset of increased developmental homeostasis in the natural population detected by September 1962.

If developmental homeostasis in the population can be said to be maintained by stabilizing selection, then an increase in developmental homeostasis indicates the efficiency of directional selection to bring about population adaptedness to the more severe climatic conditions.

Further, since the average le + sle frequency found in the population 1947-1961 is 33.7% (2205 chromosomes, 743 lethals and semilethals; from Ives, 1970, table 1), retention of le + sle frequency at 33.9% in 1962 seems evidence for the operation of genetic homeostasis and indicates that such variants play an adaptive role in population structure.

References: Band, H.T., 1964 Evolution 18: 384-404; ____, 1969 Japan. J. Genet. 44 Suppl. 1: 200-207; ____ and P.T. Ives, 1968 Evolution 22: 633-641; Beardmore, J.A. and L. Levine, 1963 Evolution 17: 121-129; Dawson, P.S., 1968 Evolution 8: 119-134; Ives, P.T., 1970 Evolution 24: 507-518; Tantawy, A.O. and G.S. Mallah, 1961 Evolution 15: 1-14.