

Band, H.T. Michigan State University, East Lansing. On the negative relation between summer rainfall and average daily temperature range.

Genetics studies on recessive lethal and semilethal frequencies in the S. Amherst D. melanogaster population have usually been made in the Fall until the discovery of a breeding site enabled investigations throughout the breeding season, May-

October (Ives, 1970). A negative significant relationship between lethal and semilethal frequencies and average daily temperature range of the week prior to collection (Band and Ives, 1961) and a positive significant relation between these frequencies in Fall and total summer rainfall (Band and Ives, 1968) has been observed. Studies on the relation between climate and genetic changes further indicated changes in general level of precipitation and average daily temperature range had occurred several times in the past 40 years, May-October, although decade averages for summer temperature range increased regularly (Band, 1971). To explore the rainfall-average daily temperature range relation in summer, data back to 1889 have been analyzed.

Table 1 shows a negative relation between these two climatic variables. Rainfall declines spanning 4 or more summers are noted in the 1890's, 1910's, and 1960's. To a lesser extent rainfall in the 1930's was also reduced. Rowan (1954) reports that although the Bruckner cycle has a periodicity of approximately every 35 years, variations from 20 to 50 years are noted. Average maximum daily temperature can be judged to be about 1°F higher at the Amherst College Weather station (data past Nov. 1948) than at the old U. Mass. weather station site (1889- Nov. 1948) which was moved in 1960. Although low rainfall in summers was most prolonged in 1907-1913, Ives' father recalled that Spring rains and cooler summers mitigated against drought. The number of days with 90° maxima or above have increased since the 1930's.

Table 1. Summer rainfall, average daily temperature range and average daily maximum temperatures in the same season, Amherst, Mass., 1889-1970

Interval	no. years	Rainfall in inches	Daily T ^o range	Max T ^o
1889-1892	4	14.71	22.5	79.0
1893-1896	4	8.96	24.7	80.9
1897-1906	10	14.23	23.0	79.2
1907-1913	7	8.15	25.4	80.7
1914-1922	9	13.09	22.6	79.7
1923-1924	2	6.35	26.3	81.4
1925-1928	4	13.45	21.9	78.2
1929-1936	8	10.11	23.3	80.7
1937-1946	10	12.74	22.7	80.6
1947-1961	15	11.40	24.0	82.0
1962-1966	5	8.60	26.1	82.1
1967-1970	4	12.60	4.0	82.2

Table 2 shows decade averages for daily temperature range in summers since the 1890's. Singer (1970) has commented that nothing is known about climatic stability. Although an apparent stability of temperature range is noted in the first few decades of recorded observations in that area, the data in Table 1 indicate there have been fluctuations in temperature range in association with rainfall levels. We may only speculate that had the tools for Drosophila genetics research been available then, genetic changes in the population in relation to climatic shifts might have been observed in the population as have been witnessed since studies began on recessive lethal and semilethal frequencies in 1938.

Table 2. Average daily temperature range per summer in the past 8 decades in Amherst

1890's	1900's	1910's	1920's	1930's	1940's	1950's	1960's	1970's(?)
24.0	23.9	23.8	23.3	22.5	23.3	24.1	24.9	25.7(?)

References: Band, H.T. 1971. Amer. Nat. (in press); Band, H.T. and P.T. Ives. 1961 P.N.A.S., Wash. 47:180-185; Band, H.T. and P.T. Ives. 1968. Evolution 22:633-641; Ives, P.T. 1970. Evolution 24:507-527; Rowan, W. 1954. J. Wildl. Mgt. 18:52-60; Singer, E.F. 1970. Science 170:125 (editorial).

Band, H. T. Michigan State University, East Lansing, Michigan. Was there a drought in the northern U.S. in the 1960's?

Genetic changes in the South Amherst, Mass. D. melanogaster population in the 1960's appear to have been initiated after the onset of a severe decline in rainfall, July, 1961, which lasted to

June, 1966. In a study of meteorological drought in Michigan, Strommen, van den Brink and Kidder (1969) commented that drought had been an increasing problem in the Northeast in the 1960's. Their study over the past 4 decades indicated prolonged drought effects in both the 1930's and 1960's in many areas of the state. The 1930's drought appears more evident in Michigan data than in Amherst, Mass. data.

Kendeigh (1961) indicates a low rainfall cycle has been observed and effects on duck numbers noted. Bruckner (1890) detected a cycle approximately every 35 years in data back to the 1700's. Rowan (1954) correlated low duck numbers in the 1820's, and 1860's, and 1890's and 1930's with this cycle. Rowan had been at the University of Alberta, Edmonton. A study recently compiled by the U.S.D.I. (1971) indicates that drought was widespread in the prairie provinces of Manitoba, Saskatchewan and Alberta in Canada and upper Great Plains states of Montana, the Dakotas and western Minnesota in the late 1950's and early 1960's, and again in the summer and fall of 1967. About 50-75% of the important game ducks come from this region. Duck numbers, 1955-1970, appear to follow the effects of the drought on numbers of suitable prairie pothole habitats. The following table has been compiled from the survey of breeding size of populations reported annually for the past 15 years and included in the report.

Mean breeding size of duck populations for the past 15 years. Numbers in millions.

1955-1960	1961-1965	1966-1968	1969-1970
42462.3	31254.6	34605.3	42355.0

Duck breeds surveyed include mallards, gadwall, American widgeon, green winged teal, blue winged teal, shoveler, pintail, redhead, canvasback and scaup.

The continuing relationship between drought cycle and duck numbers in that area indicates that population numbers do not fluctuate at random, somewhat at variance with the conclusions of Cole

(1954). It also raises the question, was there a widespread reduction in rainfall throughout the northern United States in the 1960's?

References: Bruckner, E. 1890. Klimaschwankungen seit 1700. Vienna; Cole, L.C. 1954. J. Wildl. Mgt. 18:2-24; Kendeigh, S.C. 1961. Animal Ecology (Prentice-Hall, Inc., Englewood Cliffs, N.J.); Rowan, Wm. 1954. J. Wildl. Mgt. 18:52-60; U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife. Migratory Game Bird Briefing Book. Prepared by the Division of Management and Enforcement. Jan. 1971.