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Temperature-related chromosome polymorphism in *Drosophila ananassae*

D P DASMOHAPATRA, N K TRIPATHY and C C DAS
Department of Zoology, Berhampur University, Berhampur 760 007, India

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Abstract. Correlated studies on the influence of temperature in the frequency of inversions in the *D. ananassae* population of Golabandha shows that temperature fluctuation has a positive bearing on 2LA inversion while negatively so with respect to 3LA and 3RA inversions.

Keywords. *Drosophila ananassae* ; inversion ; 2LA ; 3LA ; 3RA.

1. Introduction

Clear evidences exist to sustain the evolution of differential gene arrangements in species of *Drosophila* to meet the adaptive needs in a dynamic environment. In as much as the adaptive values of different genomes differ considerably, the fitness of certain kinds of gene arrangements may, therefore, decrease or increase with fluctuation in environmental mileu. *D. ananassae*, a cosmopolitan domestic species, is known to be invested with a large number of inversions in its natural population (Kaufmann 1936 ; Kikkawa 1938 ; Dobzhansky and Dreyfus 1943 ; Shirai and Moriwaki 1952 ; Seecof 1957 ; Freire-Maia 1961 ; Ray-Chaudhuri and Jha 1966 ; Singh and Ray-Chaudhuri 1969 ; Sreeram Reddy and Krishnamurthy 1969, 1970 ; Sajjan and Krishnamurthy 1970 ; Singh 1970 ; Siddaveere Gowda and Krishnamurthy 1971). Again, of the several paracentric inversions, 2LA, 3LA and 3RA (Rajeswari and Krishnamurthy 1969), or their equivalent alpha, delta and eta (Ray-Chaudhuri and Jha 1966) are common to all populations of this species (Singh 1970), while all other inversions are selectively restricted to these populations. Certain populations of *Drosophila* undergo seasonal changes with respect to their chromosomal composition which, however, varies in intensity (Carson and Stalker 1949 ; Spiess 1950). For instance, Levitan (1951, 1957) reported marked seasonal fluctuation in the frequency of inversions in *D. robusta* population of Virginia while Carson's (1958) data on the same species endemic to Missouri are quite contradictory in being insignificant. Epling *et al* (1953) have argued that seasonal changes of gene arrangement in the chromosomes promote the adaptive values of the inversions which in turn influence the nature and frequency of the polymorphism itself. In an attempt to assess the correlation if any, between the frequency of different inversions and the environmental temperature, the present study has been undertaken.

2. Materials and methods

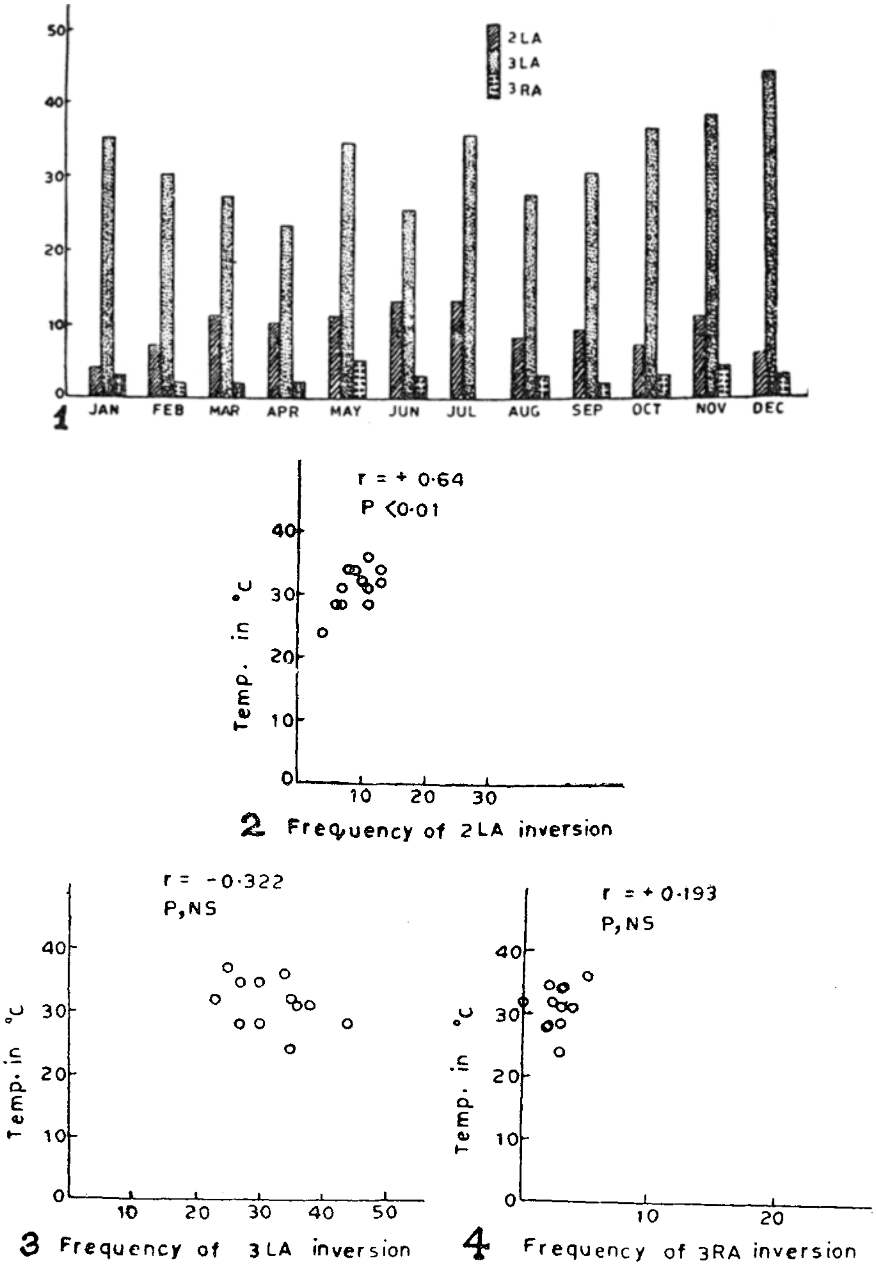
The flies were collected from the natural population of *D. ananassae* of Golabandha situated at an altitude of 17·5 m and about 6 km to the south of the University campus. Collections were made in the first week of every month on fermented banana bait in glass bottles. Fertilised females collected from nature were transferred to independent vials with wheat cream agar media. Chromosomal polymorphism was studied from the salivary glands of a hundred larvae from lacto-aceto-orcein squash preparations.

3. Results

Table 1 represents the percentage of homo- and hetero-karyotypes of *D. ananassae* in different months, i.e., January to December. The percentage of homokaryotypes were more than 50 every month while that of the heterokaryotypes ranged between 31 and 48. The frequency of the three commonly occurring inversions, as found in this population, are repre ented in figure 1. It is observed that the frequencies of 2LA inversion vary between 4% (in January) and 13% (in June and July) and that of 3RA between 2% (in February, March, April and September) and 5% (in May) while the percentage of 3LA inversion varies between 23% (in April) and 44% (in December) in a year. Moreover, it has been marked that 3RA inversion is completely absent in the population in the month of July.

4. Discussion

Extensive qualitative chromosomal variability has no doubt been reported in *D. ananassae* but unfortunately the information on the frequencies of these qualitative chromosomal variabilities and their correlation, if any, with the fluctuation of environmental factors is extremely meagre (Dobzhansky 1947; Stalker and Carson 1948; Carson and Stalker 1949; Spiess 1950; Battaglia and Birch 1956; Carson 1967). Curiously however the data of Dobzhansky (1956) on *D. pseudoobscura* while indicating seasonal fluctuations in the frequency of chromosomal composition, those of Battaglia and Birch (1956) on *D. willistoni* deny such correlation. In our studies, what is still more intriguing, the annual temperature fluctuation has positive bearing on 2LA inversion but negatively so with respect to 3LA and 3RA inversions (figures 2, 3 and 4). Indeed if this is proved to be a widely occurring phenomenon, then we must conclude that the inversions in their very nature confer such 'position effects' as seemingly contribute to the homeostatic mechanism of the species.



Figures 1–4. 1. Histogram showing the frequency of different types of inversions in *D. ananassae*. 2–4. Correlation between inversion and environmental temperature. 2. 2LA inversion. 3. 3LA inversion. 4. 3RA inversion.

Table 1. Number of heterokaryotypes of *Drosophila ananassae* in different months.

Months	Average temp. in °C	% Heterokaryo-types*
January	24	42
February	28	31
March	28	36
April	32	34
May	36	43
June	34	35
July	32	48
August	34	37
September	34	38
October	31	42
November	31	45
December	28	47

* 100 larvae were examined every month.

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