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CHROMOSOMAL VARIABILITY IN NATURAL POPULATION OF *DROSOPHILA ANANASSAE* FROM JAMMU

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ABSTRACT

The natural population of *Drosophila ananassae* from Jammu was analysed for chromosome inversions. All the three cosmopolitan inversions have been detected. The data on the frequencies of different gene arrangements and the level of inversion heterozygosity for Jammu population of *D. ananassae* are presented.

Key words: Chromosome inversions, natural population, *Drosophila ananassae*.

Due to the main work of Dobzhansky on *Drosophila pseudoobscura*, da Cunha and Dobzhansky on *D. willistoni*, Carson and Levitan on *D. robusta* and Sperlich on *D. subobscura*, it has been proved that chromosomal polymorphism owing to inversions is an adaptive trait in *Drosophila* (cf. [1]). According to the ecological niche hypothesis of da Cunha and Dobzhansky [2], the amount of chromosomal polymorphism of a given species is a function of the number of ecological niches exploited by that species. The results obtained by various investigators in different species support this hypothesis.

Drosophila ananassae is a cosmopolitan and domestic species. It is of common occurrence in India. Chromosomal polymorphism of this species has been studied by various workers (cf. [3, 4]) and more than fifty inversions are known in *D. ananassae*. However, only three paracentric inversions are coextensive with the species [5]. Chromosomal polymorphism in Indian populations has also been studied and several inversions reported [6–8]. The quantitative data on inversion frequencies suggest that Indian populations of *D. ananassae* are genetically differentiated at the level of chromosomal polymorphism [9–13]. The present communication reports the results of chromosomal analysis of the natural population of *D. ananassae* from Jammu.

MATERIALS AND METHODS

D. ananassae flies were collected in October 1987 from fruit and vegetable markets of Jammu, and brought to the laboratory, where each female was placed individually in a food vial. The chromosomal analysis of F_1 larvae was done using the acetocarmine method. The present quantitative analysis is based on the identification of karyotypes of only one F_1 larva from each wild female.

RESULTS AND DISCUSSION

The chromosomal analysis of natural population of *D. ananassae* from Jammu has revealed the presence of three cosmopolitan inversions. These inversions are alpha (subterminal) in 2L, delta (terminal) in 3L, and eta (basal) in 3R. These three inversions and their standard alternatives generate nine karyotypes: three in 2L (ST/ST—standard homozygote, ST/AL—inversion heterozygote, and AL/AL—alpha homozygote), three in 3L (ST/ST—standard homozygote, ST/DE—inversion heterozygote, and DE/DE—delta homozygote), and three in 3R (ST/ST—standard homozygote, ST/ET—inversion heterozygote, and ET/ET—eta homozygote). Table 1 shows the observed and expected (as per Hardy–Weinberg rule) numbers of different karyotypes in the natural population of *D. ananassae* from Jammu. All the nine karyotypes were detected but deviation from the Hardy—Weinberg expectation is not significant as indicated by low χ^2 values (2L = 0.83, 3L = 0.12, 3R = 0.49; $P > 0.5$). The mean number of heterozygous inversions per individual is 1.18. The frequencies of alpha inversion heterozygote (ST/AL), delta inversion heterozygote (ST/DE) and eta inversion heterozygote (ST/ET) are 45.8%, 50.4% and 22.1%, respectively. The frequency of different chromosome arrangements is given in Table 2. Chromosomes with AL inversion occur with higher frequency than ST chromosomes. However, the delta and eta inversions are less frequent than the standard sequence in the third chromosome.

Table 1. Observed and expected number of 2L, 3L and 3R karyotypes in natural population of *Drosophila ananassae* from Jammu

	Frequencies of different karyotypes												Total
	2L				3L				3R				larvae
	ST/ST	ST/AL	AL/AL	χ^2	ST/ST	ST/DE	DE/DE	χ^2	ST/ST	ST/ET	ET/ET	χ^2	examined
Observed	31	60	40	0.83*	42	66	23	0.12*	101	29	1	0.49*	131
Expected	28.4	65.19	37.41		42.94	64.12	23.94		101.84	27.33	1.83		

*P>0.5, d.f. = 1.

Thus, the natural population of *D. ananassae* from Jammu situated in Northern India exhibits chromosomal variability due to the occurrence of three cosmopolitan inversions which have been detected earlier in most Indian populations studied. Singh [9–12] found significant variation in the frequency of different inversions and in the level of inversion heterozygosity in the Indian populations of *D. ananassae*. The values of genetic identity (I) and distance (D), calculated to measure the degree of genetic divergence, suggest that *D. ananassae* populations have undergone considerable amount of genetic differentiation at the level of chromosomal polymorphism [12, 14, 15]. Further the populations from South maintain these inversions in high frequency.

It is apparent from these results that the *D. ananassae* population from Jammu is chromosomally polymorphic due to the occurrence of three cosmopolitan inversions.

Table 2. Frequency of different chromosomal arrangements in natural population of *D. ananassae* from Jammu

Chromosome	Total chromosomes examined	Arrangement type	Frequency, %
2L	262	ST	46.6
		AL	53.4
3L	262	ST	57.2
		DE	42.8
3R	262	ST	88.2
		ET	11.8

The frequency of AL, DE and ET inversions is 53.4, 42.8 and 11.8%, respectively, and the mean number of heterozygous inversions per individual is 1.18 in the Jammu population of *D. ananassae*. Singh [9–12] studied inversion polymorphism in a large number of Indian populations of *D. ananassae* from different localities in Uttar Pradesh, Bihar, West Bengal, Tamil Nadu, Andhra Pradesh, Kerala, Maharashtra, Goa, and Andaman and Nicobar Islands. The results of chromosomal analysis of these populations show that the frequencies of alpha (AL), delta (DE) and eta (ET) inversions vary significantly among different populations. The frequency of alpha inversion varies from 23 to 96%. The chromosomes with delta inversion occur with the frequency varying from 3 to 93%. The frequency of eta inversion fluctuates between 3 and 38%. The level of inversion heterozygosity, measured in terms of mean number of heterozygous inversions per individual, ranges from 0.43 to 1.40 in the populations studied earlier by the present author [9–12]. The three inversions detected in the Jammu population occur in several populations from South India with much higher frequency (AL 96%, DE 93%, and ET 38%) as compared to Jammu population. In some populations, particularly from Varanasi, Ghazipur, Jamsoti and Lowari of Chakia forest area, U.P., chromosomes with inverted sequence occur at low frequency (AL < 30%, DE < 25% and ET < 6%) and the level of inversion heterozygosity is also less when compared with other populations. Thus, the Jammu population of *D. ananassae* shows significant differences when compared with other populations with respect to the pattern of chromosomal polymorphism. Based on the results of chromosomal analysis of the Indian populations of *D. ananassae*, it may be concluded that chromosomal polymorphism is adaptively important in *D. ananassae* although it is a cosmopolitan and domestic species.

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