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Genotype environment interaction and fecundity in *Drosophila.*

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Fecundity is the major determinate of female fitness (Roff, 1992). A given female's fecundity can be influenced by her genetics, body size (Robertson, 1957), age (David, 1988), and also by her mate or male effects (Pitnick, 1991). Fecundity is also strongly influenced by environmental factors such as crowding and temperature (David *et al*., 1983). Lints and Lints (1971) raised hybrids of two highly inbred lines at six different temperatures, and maximum daily fecundity appeared to be similar for intermediate developmental temperatures but reduced for more extreme developmental temperatures. Rajasekarasetty *et al.* (1987) have demonstrated the incidence of increased fecundity when the females of *D. n. nasuta* were crossed with males of *D. n. albomicans* and vice versa. They also observed breakdown with respect to fitness parameters when these F_1 females were inbred. However, they did not consider the data from individual crosses but instead they have pooled the data from the reciprocal crosses. The embryos from reciprocal crosses differ in their chromosomal as well as cytoplasmic composition. Present investigations were undertaken to determine whether the observed breakdown in the F_1 flies of *D. n. nasuta* × *D. n. albomicans* is a function of genotype or due to temperature or both through the analysis of their fecundity separately in different crosses at two different temperatures.

For the present investigations we have employed two members of the *nasuta* subgroup, namely *D. n. nasuta* (Coorg, India; Stock No. 201.001) and *D. n. albomicans* (Okinawa, Japan; Stock No. 202.001). Both these stocks were obtained from the Drosophila Stock Center, University of Mysore, Mysore, India. Uniformity was maintained with regard to temperature, space, amount of food, moisture and the larval population density in raising the parental populations that are used in the present analysis. Synchronized eggs were collected from both the cultures by modified method of Delcour (Ramachandra and Ranganath, 1988). 50 eggs were placed in to each vial (8 cms × 2.5 cms) containing wheat cream agar medium seeded with yeast. All the experimental cultures were maintained at 22 ± 1°C. Unmated males and virgin females were isolated from the above mentioned cultures within 3 hr of their eclosion from the pupal case. They were transferred to vials containing fresh media and aged for 5 days. Reciprocal crosses were conducted between *D. n. nasuta* and *D. n. albomicans* to get the F_1 generation. To determine the fecundity, pair matings were conducted by placing 5 days old F_1 virgin females and unmated males in 8 × 2.5 cm culture vials. The males were removed from these vials after 48 hr of pairing and the females were transferred to fresh culture vials every 24 hours. The number of eggs laid per female per day was counted until the oviposition rate is greatly reduced. Thirty such replicates were set up for each cross as per the standard procedure (Ramachandra and Ranganath, 1986). Using the data thus obtained, total number of eggs per individual was calculated. The data were subjected to ANOVA followed by DMRT to determine the significance. These experiments were carried out at two constant temperatures, namely 20 ± 1°C and 25 ± 1°C.

Perusal of Table 1 that embodies the data on fecundity of *D. n. nasuta*, *D. n. albomicans*, and their hybrids reveals that the fecundity of F_1 females is significantly less than their parental females irrespective of the direction of the cross at both the temperatures. When reciprocal crosses were conducted between *D. n. nasuta* and *D. n. albomicans*, the resulting embryos would have the cytoplasm of the female parent. That is, the embryos in one cross get the cytoplasm of *D. n. nasuta* and in the other cross, the embryos will inherit *D. n. albomicans* cytoplasm. Therefore, the hybrid females from reciprocal crosses, though they are similar with respect to chromosomal composition, they differ with respect to their cytoplasmic composition. However, the hybrid males of reciprocal crosses differ with respect to chromosomal as well as cytoplasmic composition, and cytoplasm forms the immediate milieu for the activity of gene products. In the present investigations the fecundity of the F_1 females obtained from reciprocal crosses was analyzed separately.

Andrewartha and Birch (1954) have divided the environment of an animal into four components - weather, food, other animals, and a place to live. The important component of weather may be temperature, humidity, and light. For ectothermic animals, such as *Drosophila*, temperature is certainly the most important factor of the environment, which affects all possible biological processes at the molecular, cellular, and organismic levels (David *et al.*, 1983). It is the consequence of an interaction of the genotypes and the environmental factors. Therefore, the phenotypic expression of a character is decided by both nature (genotype) and the nurture (environment). Nature provides the raw material and the environment decides the extent of its expression. Perusal of Table 1 reveals that the hybrids significantly differ from their parents with respect to fecundity at both the temperatures. In both parents and their hybrids, the fecundity at 20°C was found to be less than the fecundity at 25°C. However, at both temperatures, the fecundity of the hybrids was found to be significantly less than their parents. Thus, it is evident that the significant reduction in the fecundity of hybrid females is not due to

Table 1. Fecundity in *D. n. nasuta*, *D. n. albomicans* and their hybrids.

	Fecundity (Number of eggs/individual)	
	20±1°C	25±1°C
D. n. nasuta	248.40[a]	243.0[a]
D. n. albomicans	194.9[b]	250.4[a]
F_1 females (of *D. n. nasuta* EE X *D. n. albomicans* ΓΓ)	77.7[c]	90.3[b]
F_1 females (of *D. n. nasuta* ΓΓ X *D. n. albomicans* EE)	54.59[c]	56.8[b]
F value	472.81	278.7

Note: The members with similar letters in the parenthesis are not significantly different at 5% level according to DMRT. df = (3, 116)

temperature. This forms a clear indication that, though environment has some role to play in the phenotypic expression, it is the genotype that ultimately decides the expression patterns. The genotypes of *D. n. nasuta* and *D. n. albomicans* represent an integrated and adapted genetic system. Ranganath (1978) has attributed the F_1 heterosis for fitness parameters of these hybrids to the dissociation of the coherent system and F_2 breakdown to the destruction of these integrated and coherent genetic organizations through recombination. The observed breakdown with respect to fecundity might be due to interactions between gene products and the cytoplasm.

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