EFFECT OF YELLOW MUTANT ON MATING SPEED AND DURATION OF COPULATION IN *Drosophila melanogaster* MEIGEN, 1830

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RESUMO

Influência do mutante "Yellow" de *Drosophila melanogaster* Meigen, 1830 na velocidade do cruzamento e duração de cópula

Analisou-se a influência da velocidade do cruzamento (V. C.) e duração de cópula (D.C.) sobre o "fitness" dos fatores genéticos a elas associados. Utilizaram-se duas linhagens de *Drosophila melanogaster*: uma portadora do gene "yellow" recessivo e ligado ao sexo e a outra pertencente ao estoque selvagem.

Os resultados demonstram que o maior tempo da D.C. é influenciado pelas fêmeas, e, quanto à V.C., a fêmea "yellow" seria mais rápida ou mais susceptível em aceitar a corte dos machos do que as fêmeas selvagens.

INTRODUCTION

Numerous studies have demonstrated that mating speed and duration of copulation are genetically regulated in the genus *Drosophila*, especially *D. melanogaster* Meigen, 1830 and *D. pseudoobscura* Frolova, 1929 (PARSONS, 1964a, 1965a, 1967).

The genetic control of mating speed (m.s.) was determined by PARSONS (1964b) and FULKER (1966). They calculated the heredability of this character through diallel crosses. FULKER stated further that this character could be controlled by a poligenic system. The idea of poligenic heredity was well developed from the study of artificial selection for faster and slower mating speed by MANNING (1961, 1963, 1968) and KESSLER (1969).

In the case of the duration of copulation (d.c.), the si

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tuation is almost the same. HILDRETH (1962) concluded that it is genetically regulated. MACBEAN & PARSONS (1966) calculated the heredability of this trait for *D. pseudoobscura* and *D. melanogaster*. They have found that this character responded to artificial selection (MACBEAN & PARSONS, 1967).

PARSONS (1965b) concluded that there is a relationship between mating and the number of externopleural bristles present on *D. melanogaster* flies, and MAGALHÃES *et alii* (1971) analyzed the effect of the ebony mutant of *D. melanogaster* on m.s. and d.c.

Several workers have reported an association of the mating speed with gene position in the chromossome (BRNCIC & KOREF-SANTIBAÑEZ, 1964; KAUL & PARSONS, 1965; SPIESS & LANGER, 1968; PRAKASH, 1968). The principal objective of this study is to evaluate the effects of m.s. and d.c. on the fitness of different genetic factors. In this report it was analyzed the m.s. and d.c. of two strains of *D. melanogaster*.

MATERIALS AND METHODS

The strains of *D. melanogaster* used in this work were provided by the Biology Department of the "Universidade de São Paulo". One strain was carrying the recessive, sex-linked, yellow gene and other being the wild type. From these stocks we removed some individuals for the observation of mating behavior.

The method used to measure mating speed and duration of copulation was as follows: 40 virgin males and 40 virgin females of the same age from both wild type and the mutants were separated. Three days after hatching, they were placed in pairs in separated glass jars of 1cm diameter and 10cm tall, containing 1cm of culture medium. They were observed continuously at a temperature of 22,5 ± 1°C under constant ilumination.

The types of mating are given in table 1.

TABLE 1. Types of mating observed.

Mating	male	female
1	wild	wild
2	wild	yellow
3	yellow	yellow
4	yellow	wild

The m.s. was measured, in minutes, from the moment that male and female were placed together until the begining of copulation

and d.c. from the begining to the end of copulation.

The observation period was sixty minutes. The experiments were made in two groups, each with 20 couples. For d.c. we made an analysis of average comparisons, using the sum of the data of the two replicas (Tables 2 and 3). The data on m.s. were made in two time intervals: more and less than 20 minutes (Table 4). The latter was accumulated from the former. We submitted these data to the analysis of variance (Table 5).

TABLE 2. Results for duration of copulation.

Mating	Average time in minutes	variance
1	22.857	17.067
2	18.871	14.114
3	18.025	17.563

TABLE 3. Averages comparison for duration of copulation.

Compared average	t
Mating 1 x Mating 2	4.327**
Mating 1 x Mating 3	5.019*
Mating 2 x Mating 3	0.946

* P < 0.05 ** P < 0.01

TABLE 4. Results for mating speed (accumulated values).

Time (t)		Mating			
		1	2	3	4
t less than 20	A.	13	15	17	0
minutes	B.	16	18	20	0
t more than 20	A.	18	19	20	0
minutes	B.	17	20	20	0

A and B are replicas

TABLE 5. Analysis of variance for mating speed.

Source	d.f.	F
Time	1	6.843*
Matings	2	5.312*
Time x Matings	2	0.1907
Orthogonal Partition for Matings Types		
2 x 3	1	2.389
1 x (2.3)	1	8.235**

* P < 0.01 ** P < 0.01

RESULTS

I. DURATION OF COPULATION

The data associated with the d.c. are very homogeneous. The results of the analysis of average comparisons are in Tables 2 and 3, which suggest that d.c. of first mating was greater than that matings. There is no difference between the measurements of the second and third.

It is evident that the enhancement of the first mating is due to the wild type genotype associated with the female flies. When the females are mutants, copulation time will be shortened, irrespective of the males genotype.

In mating number four (yellow male with wild type female) no data was obtained, because the couples did not copulate during the observation time. This is due to the reproductive isolation between wild type females and yellow mutant males, as documented by MIZUGUCHI (1978).

II. MATING SPEED

In the analysis of variance we detected an influence of the time intervals and mating types. On m.s. crosses occurred more frequently for the time period longer than 20 minutes. With respect to the types of crosses the results made with a partition of variance, indicated a significant difference among three matings, but no difference was detected after removing mating one from consideration.

The data showed that the female genotype is responsible for the faster mating speed. The yellow type females accept better the male courtship than the wild type females.

DISCUSSION

A greater mating speed associated with a specific genotype results in a selective advantage, because the males can fecundate more females and produce more descendants (FULKER, 1966 and PRAKASH, 1967). This results in a greater fitness of the genotypes carried by the males. On the other hand, a longer copulation (d.c.) could lead to transfer more sperm to the female.

It has been found that m.s. and d.c. are strongly influenced by the males in numerous cases (SPIESS, 1970).

In this study we detected an influence from the females. The wild type females have a longer copulation, but the yellow type females have a faster mating speed. The difference in mating speed can be explained in two ways: one is the lack of susceptibility of the wild type females to accept the yellow type males, because of differences is courtship behavior (BASTOCK, 1956), while the yellow type females and wild type males are compatible. It is also pos

sible that there is a preference in mating between the yellow type female with the yellow type male, although the former may not refuse the wild type male (MIZUGUCHI, 1973). It must be noted that these two situations are not mutually exclusive, being able to act together in influencing the behavior of these flies.

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ABSTRACT

The influence of mating speed and duration of copulation over fitness of the genetic factors associated to them was analysed. Two strains of *Drosophila melanogaster* Meigen, 1830 were used: the first was the recessive and sex-linked yellow gene, and the second was the wild. The results demonstrated that the longer copulation time is influentiated by females. The mating speed of a yellow female would be faster or more susceptible to accept courtship from males than the wild females.