euchromatic short arms (Figure d). 8 *Peromyscus* were homozygous for a biarmed pair 10 with heterochromatic short arms, L422 was homozygous for a biarmed pair 10 with euchromatic short arms (Figure e), and L195 was heterozygous. 3 individuals were homozygous for a biarmed pair 18 with euchromatic short arms and 3 individuals were heterozygous and had 1 chromosome 18 with a heterochromatic short arm (Figure f). The structurally polymorphic autosome 7 was heterozygous for a heterochromatin polymorphism in L428 but had euchromatic short arms in L195 and L196. Heterochromatin polymorphisms could arise either by saltatory replication in the short arm of a submetacentric chromosome or by a translocation between the short arm of a submetacentric and the heterochromatic short arm of another chromosome. There was no evidence of translocation pairing configurations during spermatogenesis in any individual studied.

The present study demonstrates that variation in the FN in *Peromyscus* results from both the addition of heterochromatic short arms to acrocentric chromosomes and pericentric inversions. The amount of heterochromatin varied within this population due to changes in the number of biarmed chromosomes present in the karyotype and constitutive heterochromatin polymorphisms. The evolutionary significance of variation in the fundamental number and amount of heterochromatin in *Peromyscus* is unknown.

## Frequency-Dependent Mating Success Among Mutant Ebony of *Drosophila melanogaster*[1]

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*Summary.* Measurements of the mating success of wild and ebony strains of *D. melanogaster* with different degrees of competition have shown a frequency-dependent effect in both cases, but with a negative correlation for the wild and a positive correlation for the ebony strain.

Frequency-dependent mating success, mainly among males of flies of the genus *Drosophila*, is a phenomenon broadly demonstrated at least under certain experimental conditions. The experiments developed by Petit[2–4] were more recently followed by several others with different species[5–8]. Nevertheless, the explanation of such behaviour is not yet well understood. Certain hypotheses have been advanced by Spiess[9], Ehrman[10], Ehrman and Spiess[11] in order to explain the experimental results without reaching general agreement.

Even with an apparent homogenity in the results it is possible that different causes are opperating in different genetical constitutions. On the other hand, different experimental designs may mask differences in the factors producing the frequency-dependent mating success. Different strains have different mating speeds which can be controlled either by the male, the female or both, depending of the strain. Sexual preference among certain strains has been suspected in some cases. The interaction between these components has not yet been completely studied. The scope of the present communication is to show a case in which the mating success of males of the wild genotype is more successful when rare, and the other genotype, on the contrary, is more successful when more frequent.

The experiment was done with wild type and ebony mutant strains of *Drosophila melanogaster*. The wild type stock was obtained from a mixture of 3 different strains: Oregon-R, Samarkand and Canton-S, and maintained in laboratory for about 3 years in large number. The ebony

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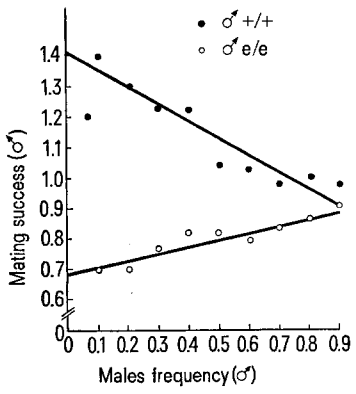


Regression lines of the mating success.

Table I. Mating success of wild and ebony males of *Drosophila melanogaster* in population cages with different compositions

| Cage | Composition of male population | | Total number of mating and the mating success of each genotype in 5 runs | | | |
|---|---|---|---|---|---|---|
| Cage | +/+ | e/e | +/+ | | e/e | |
| 1 | 18 | 2 | 88 | 0.98 | 7 | 0.70 |
| 2 | 16 | 4 | 80 | 1.00 | 14 | 0.70 |
| 3 | 14 | 6 | 68 | 0.97 | 23 | 0.77 |
| 4 | 12 | 8 | 62 | 1.03 | 33 | 0.82 |
| 5 | 10 | 10 | 52 | 1.04 | 41 | 0.82 |
| 6 | 8 | 12 | 49 | 1.22 | 48 | 0.80 |
| 7 | 6 | 14 | 37 | 1.23 | 59 | 0.84 |
| 8 | 4 | 16 | 26 | 1.30 | 69 | 0.86 |
| 9 | 2 | 18 | 14 | 1.40 | 82 | 0.91 |

Table II. Linear Regression and $t$-test on the mating success of +/+ and e/e males

| | +/+ | e/e |
|---|---|---|
| $X$ | 0.500 | 0.500 |
| $Y$ | 1.130 | 0.802 |
| b | −0.550 | 0.241 |
| a | 1.405 | 0.682 |
| r | 0.657 | 0.312 |
| t | 5.723[b] | 2.150[a] |

[a] $p < 0.05$; [b] $p < 0.001$.

strain was prepared from an old stock of ebony from Pasadena, California, by crossing successively with Oregon-R, Samarkand and Canton-S in order to get a genetical background close to that of the wild strain.

The experimental populations consisted of 20 females and 20 males. In every group the 20 females were always ebony. The males were a mixture of the ebony and wild strains, varying from 2 ebony: 18 wild type, to 2 wild: 18 ebony. Each experiment was done with 5 replica. All experiments were performed using 4-day-old virgin flies. The process of virgin separation was done so that the right number of flies were isolated for each experiment, avoiding a second etherization. The experiments were done in plastic box 15 × 5 × 2 cm, with a thin layer of agar-agar and sugar medium on the bottom. The right number of males and females was placed in the box at same time and left for 3 h at 25 °C, in the dark. After that, all the population was etherized and females put one per vial with culture medium. The genotype of mating male was determined through a $F_1$ analysis. No case of double cross was found. The results obtained are presented in Table I.

Mating success was measured by the relation between the number of females that copulated with males of one genotype and the total number of males of this genotype present in the populations. The Figure shows the regression lines of the mating success (MS) for wild type and for ebony plotted against population, based on the total of the 5 repetitions. The linear regression of the mating success of males on its frequencies (Table II) shows that mating success among wild male decreases with the increase of the frequency, but for ebony male the mating success increases.

Differences in mating speed are found in several strains of *Drosophila*; MAGALHÃES et al.[12] have shown that wild males are much more active than the ebony males. During the duration of the experiment, some males are able to copulate with more than one female on average, so the 1:1 sex-ratio does not correspond necessarily to a physiological sex-ratio of 1:1. The male activity of each genotype being different, we must have different degrees of competition in different population composition. The mating success must be greater when competition is lower. The wild type males being more active, the competition should be lower when the frequency of this class of genotype is lower. In that case the mating success is higher for both genotypic classes of males. When the more active genotypic class increases in frequency, the competition is strong, decreasing the mating success of both male genotypes.

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## The Chromosomes of Four Species of Falconiformes

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*Summary.* Leucocyte cultures were used in four species of Falconiformes for the purpose of karyotypic sex determination and the establishment of a breeding pair. The Andean condor has 80, Guiana eagle 54, Crane hawk 66, and Turkey vulture 76 chromosomes with readily distinguished ZW elements in the female.

In order to establish breeding pairs of rare birds that lack sexual dimorphism, a cytogenetic method for determining sex was employed. 1 to 3 ml of blood were obtained from a peripheral wing vein and grown for 4 days in McCoy's 5a or Basal media enriched with 17.5% fetal calf serum and pokeweed mitogen or phytohemagglutinin as a stimulant. The technique was adapted from the leucocyte culture method of TAKAGI et al.[2], and from that of OTIS and SHOFFNER[3]. It produced excellent metaphases in sufficient number to determine sex successfully. Both whole blood and sedimented plasma, obtained by sedimenting the whole blood for 10 min at 300–400 rpm, were used. The latter method was developed in an effort to enrich the number of white cells and metaphases on a given slide.

It was found that in all the birds of prey examined, the technique using sedimented plasma was the easiest to work with and saved many hours in the screening of slides. The cultures were grown at 37 °C and interrupted with a colchicine concentration of between 0.1–0.3 µg/ml of media added 1 h prior to harvest. Sodium citrate (0.45%) was used as a hypotonic for 20 min. The cells were next fixed and washed 3 times with a 3:1 mixture of absolute methanol and glacial acetic acid prior to the preparation of slides. Both carbol fuchsin and Giemsa stains were used with comparable results.

Four birds were studied using the above methods; 1 Andean condor (*Vultur gryphus*), 1 Crane hawk (*Geranospiza caerulescens*), 2 Guiana eagles (*Morphnus guianensis*)

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