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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[2] N. TAKAGI and M. SASAKI, Chromosoma *36*, 281 (1972).

[3] J. S. OTIS and R. M. SHOFFNER, personal communication (1975). – J. S. OTIS and R. N. SHOFFNER, Avian Chromosome Newsletter *2*, 16 (1973).

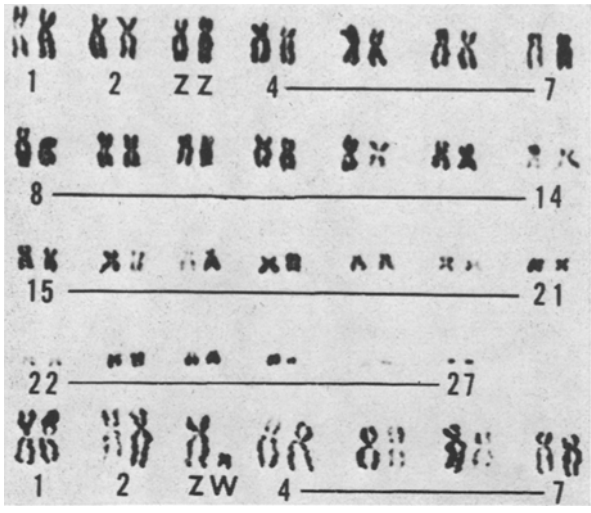

Fig. 1. Karyotype of male (top) and partial karyotype of female (bottom line) Guiana eagles.

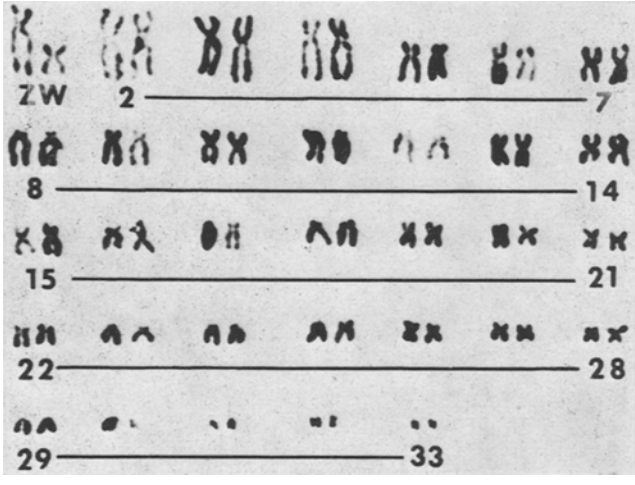

Fig. 2. Karyotype of female Crane hawk.

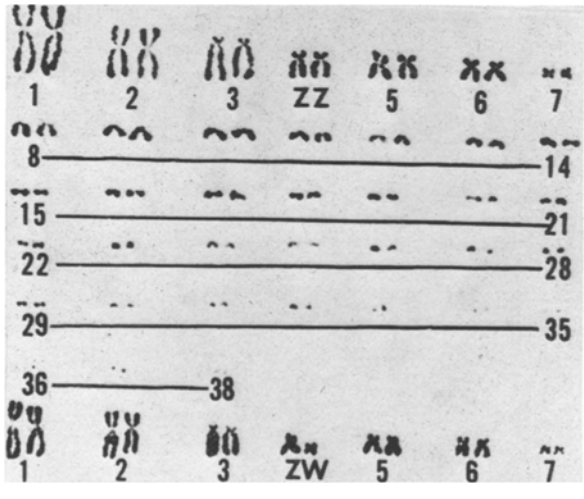

Fig. 3. Karyotype of male (top) and partial karyotype of female (bottom line) Turkey vultures.

and 2 Turkey vultures (*Cathartes aura*). The sole Andean condor available, a species which exhibits a definite sexual dimorphism, was karyotyped as a male. This karyotype confirms the previous findings of $2n = 80$ by DE BOER[4]. The Crane hawk was determined to be female. It was learned to have layed eggs in the past. The 2 young Turkey vultures were found chromosomally to be a male and a female. Finally, 2 Guiana eagles were studied in an effort to assist the Los Angeles and San Diego Zoos in the establishment of a breeding pair.

The karyotypes of the male and female Guiana eagles are shown in Figure 1. This species has 54 chromosomes. It is significant to note the very gradual decline in chromosome size, making karyotyping for sex determination difficult. It is only the lack of a pair for the large submetacentric *Z*-chromosome (No. 3) and the small metacentric *W*-chromosome that makes chromosomal sex determination possible. The presence of only 3 pairs of microchromosomes is interesting and upholds this as a characteristic of the family Accipitridae, previously noted by DE BOER[4] and SASAKI et al.[5].

In Figure 2, the *Z*-chromosome of the Crane hawk, with a complement of $2n = 66$, is the largest submetacentric. The sex is clearly distinguishable due to the radical decrease in size between Nos. 4 and 5, accentuating the odd number of large submetacentrics in the female. Again, it is interesting to note the absence of any true microchromosomes and the presence of the *Z*-chromosome as one of the first several pairs.

The karyotypes of the male and female Turkey vultures are shown in Figure 3. The *Z*-chromosome is the No. 4 chromosome of the complement with $2n = 76$. Sex determination is made possible due to the odd number of submetacentric chromosomes.

[4] L. E. M. DE BOER, personal communication (1975).

[5] M. SASAKI and N. TAKAGI, Chromosome Inform. Serv. *16*, 31 (1974).