126. Karyological Studies on Hybrids between the Guinea Fowl (♀) and the Vulturine Guinea Fowl (♂)*)

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Genetically, hybrids are subjects of particular interest on account of their sterile reproduction. Cytogenetic studies on the hybrids are on the whole less extensive in animals than in plants, except the classical work on the lepidopterous insects. In birds, crossing is rather easy between either species or genera and the hybrid offspring are sterile in most cases. Based on extensive karyological studies on hybrid birds by means of the old testis-sectioning method, Yamashina (1943) has expressed the following view that the cause of hybrid sterility lies in 1) the dissimilarity of the chromosomes of parental forms, and 2) the disharmonious condition existing between the maternal cytoplasm and paternal chromosomes. Makino (1954) was of similar opinion with an emphasis that chromosomal imbalance involving genic dissimilarity was an essential factor for the production of infertile offspring.

Recent literature refers to chromosome studies on some gallinaceous birds carried out by current cytogenetic techniques. The chromosomal accounts of the guinea fowl were presented by Piccinni and Stella (1970). Very recently, Takahashi and Hirai (1974) published a paper on the karyotypes of the guinea fowl and the vulturine guinea fowl, reporting that the two forms showed a close morphological similarity of chromosomes.

The present paper offers some accounts on the chromosomes of pure and hybrid lines of the guinea fowl (*Numida meleagris*) and the vulturine guinea fowl (*Acryllium vulturinum*).

Material and methods. Female and male hybrids were produced by artificial insemination between the female guinea fowl and the male vulturine guinea fowl. Chromosome slides were prepared with the leucocyte cultures established from peripheral blood of both

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pure and hybrid specimens. On 68- to 72-hour cultures, colchicine was added to cell suspension, prior to the KCl hypotonic treatment and methanol-acetic acid (3:1) fixation. The slides were made by means of the conventional air-drying and Giemsa-staining procedures. Many metaphase plates, 21 to 24 in number, served for chromosome counting. Five metaphases in each were karyotyped specially for the macrochromosomes, noting the size and position of the centromere.

Findings. Figures 1 and 2 are the karyotypes of the guinea fowl (*Numida meleagris*) (♀) and the vulturine guinea fowl (*Acryllium vulturinum*) (♂). The chromosomes showed no visible difference in general morphology and number between the two species. In both species, the chromosome number was obtained as 74 ± 2 in both sexes. The diploid complement was characterized by an avian karyotype made up of two morphological categories, the macrochromosomes and the microchromosomes. The female somatic complement

Figs. 1-2. Karyotypes of a guinea fowl, ♀ (1), and a vulturine guinea fowl, ♂ (2); each showing 74 chromosomes.

consisted of 2 pairs of large submetacentrics, 1 pair of medium-sized acrocentrics, 1 pair of medium-sized subtelocentrics, 1 pair of medium-sized submetacentrics, 1 pair of small acrocentrics, and the remaining microchromosomes lying in descending order of size. The microchromosomes are acrocentric in general appearance and their exact number was difficult to determine, with a frequent variation

Table I. Chromosome counts of the guinea fowl hybrids under study

Sex	Chromosome-number distribution									Total
	70 ≤	71	72	73	74	75	76	77	78	
Female	4		3	2	2	4	4	1	1	21
Male	2	1		4	3	4	7	1	2	24

Fig. 3. Karyotype of a female hybrid (guinea fowl×vulturine g.f.), showing 76 chromosomes.

Fig. 4. Karyotype of a male hybrid (guinea fowl×vulturine g.f.), showing 76 chromosomes.

from 56 to 62. Female heterogamety was recognized by the heteromorphic Z and W chromosomes: the Z-chromosome was a medium metacentric element lying between no. 5 and no. 6 chromosomes, while the W was an acrocentric smaller than no. 6 chromosomes. The male somatic complement was identical with that of the female excepting the sex chromosome of a Z-Z condition.

The results of chromosome counts in cells of the hybrid specimens (guinea fowl $\times$ vulturine guinea fowl) are presented in Table I. It was shown that the somatic chromosome number of the hybrids varied from 70 to 78, being 76 at mode. The macro-autosome group of the female consisted of 2 pairs of large submetacentrics, 1 pair of medium-sized acrocentrics, 1 pair of medium-sized subtelocentrics, 1 pair of medium-sized submetacentrics, 1 pair of small acrocentrics, while the microchromosome group is made up of acrocentrics forming a graded seriation (Fig. 3). Since the number of the microchromosomes was inaccurate in counting, the total chromosome number was not decided. In the modal cells with 76 chromosomes, the number of the microchromosomes was 62. The Z-chromosome was identified as a medium-sized metacentrics which ranks between no. 5 and no. 6 chromosomes, while the W was a small acrocentrics. The complement of the male hybrid was essentially corresponding to that of the female, excepting the sex-chromosome complex which consisted of two homomorphic Z chromosomes (Fig. 4). The karyotypes of the parent forms and the hybrid specimens were apparently similar, each element composing the complement being identical in general appearance between them. So far as the general morphological analysis was gone, there was no detectable difference of chromosomes between the parent and hybrid forms.

Remarks. Ghigi (1936) seemed to be the first to deal with crossing between the guinea fowl and the vulturine guinea fowl, reporting male hybrids which were sterile. In our crosses the hybrids of both sexes, 32 females and 16 males, were obtained in the F_1 generation, but they were all infertile. Our morphological analysis demonstrated a general similarity of the chromosomes between the guinea fowl (*Numida meleagris*) and the vulturine guinea fowl (*Acryllium vulturinum*). We are aware of examples indicating that hybrids between the parents having an identical chromosome complement are of a complete, or partial in some cases, fertility. But, the morphological similarity of the chromosomes at metaphase is not necessarily corresponding to the similarity of their genic structure. Sturtevant (1929) showed that *Drosophila melanogaster* and *D. simulans* had morphologically identical chromosomes, but the chromosomes differed in gene arrangement, and their hybrids were sterile.

The situation seems to be similar to that of our guinea fowl hybrids. With the advent of recently advanced procedures which differentially banded the chromosomes, it is possible to identify unequivocally individual chromosomes by recognizably different banding patterns produced along the chromosomes. The banding analysis of chromosomes in related forms of animals may be efficiently used to assess the similarity and dissimilarity of chromosomes among them. The application of G-banding techniques to avian chromosomes could provide critical evidence for the discussion of the homology of individual chromosomes in related bird species (Takagi and Sasaki 1974). A new approach to the etiological problems of hybrid sterility would be made through the advent of the new banding techniques. Further, histological and embryological investigations of hybrid specimens should provide another criterion for the analysis of the cause of sterility involved.

Summary. Somatic chromosomes of the guinea fowl (*N. meleagris*) and the vulturine guinea fowl (*A. vulturinum*), and of their F_1 hybrids are described. The chromosomes of the parent species are generally similar both morphologically and numerically. The somatic chromosome complement of hybrids is hardly distinguishable morphologically from that of the parent forms, but the hybrids between them are infertile. Further karyological and biological studies are in progress.

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