

The Karyotype of the Arabian Camel, *Camelus dromedarius*

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Abstract. The diploid chromosome number of *Camelus dromedarius* was found to be 74 and the autosomes have been classified into three groups. The first group consists of 31 pairs of acrocentric autosomes designated as number 1 to 31. The second group includes four pairs of metacentric autosomes designated as 32,33,34 and 36. The third group is one pair of submetacentric autosome designated as number 35. The sex chromosomes are medium sized metacentric X-chromosome and small metacentric Y-chromosome.

Introduction

Though the Arabian camel, *Camelus dromedarius*, has been considered as one of the most popular domesticated animals in the Arabian peninsula, little research has been undertaken on its various parameters when compared to other domestic animals. However, there has recently been accumulation of published work carried out on the various aspects of the Arabian camel especially in the fields of parasitology, physiology, histology and histochemistry [1-16].

However, cytogenetic studies on the dromedary are under represented. There is a single report on the subject [17]. Other members of the Camelidae, the Bactrian camel as well as the South American camels, have received more attention [18-21]. Therefore, it is important to determine its chromosome complement in order to understand the taxonomy of this animal and its nature, to improve its breeding, and to understand its inherited diseases.

Hence, in this present study, the chromosome morphology of the dromedary was investigated *in vitro*.

Materials and Methods

Peripheral blood was obtained from 10 male and 10 female camels from the King Saud University Animal Farm, using aseptic techniques, 10 ml of sterile complete growth medium (RPMI-1640) were put into a 25 cm² sterile culture flask, then 0.2 ml of sterile phytohemagglutinin (PHA) was added to the flask. An aliquot of 0.5 ml of blood was drawn from a well suspended blood sample using a 1 ml disposable syringe fitted with 21G needle and added into the flask. The flask was inverted several times before incubating the cell culture for 72 hours at 37°C in an incubator supplied with continuous flow of 5% CO² and 80% humidity. After 72 hours of incubation and 1 hour before harvesting the cell culture, 2 drops of colcemid (10 µg/ml) were added to the culture flask in order to synchronize the dividing cells at the metaphase stage. The cultured cells were then harvested by vigorously shaking the flask before transferring the cell suspension into centrifuge tube. The cell suspension was then centrifuged at 100g for 8 minutes, the supernatant removed under vacuum and the pellet of cells were resuspended in 5 ml of 0.075 M KCl and incubated in a water bath at 37°C for 15 minutes as a hypotonic treatment. The cell suspension was then centrifuged and the cells were fixed in 3:1 absolute methanol:glacial acetic acid for a minimum of 30 minutes. The fixation procedure was repeated three times before spreading the cells on the slides. The slides were stained with Giemsa stain and at least 100 metaphase stages were studied from each stained slides. Karyotypes were constructed from photomicrographs and chromosomes were arranged according to centromere position and in order of decreasing size of chromosomes.

Results and Discussions

The chromosome number and morphology of the Arabian camel, *C. dromedarius*, was studied using the standard technique of karyotyping. The chromosomes were examined after staining with Giemsa and the diploid number (2n) for the camel was found to be 74. There are 36 pairs of autosomes and one pair of sex chromosomes. XY for male and XX for female (Figs. 1-3). The autosomes are divided into three distinct morphological groups:

Group 1. Displays 31 autosomal pairs of acrocentric chromosomes. These are numbered from 1-31, ranging in size from the largest to the smallest chromosomes.

Group 2. Includes 4 autosomal pairs of medium to small metacentric chromosomes. They are numbered 32, 33, 34 and 35.

Group 3. Includes one pair of submetacentric autosome designated as 35.

The sex chromosomes are medium sized metacentric X-chromosomes and a small metacentric Y-chromosome.

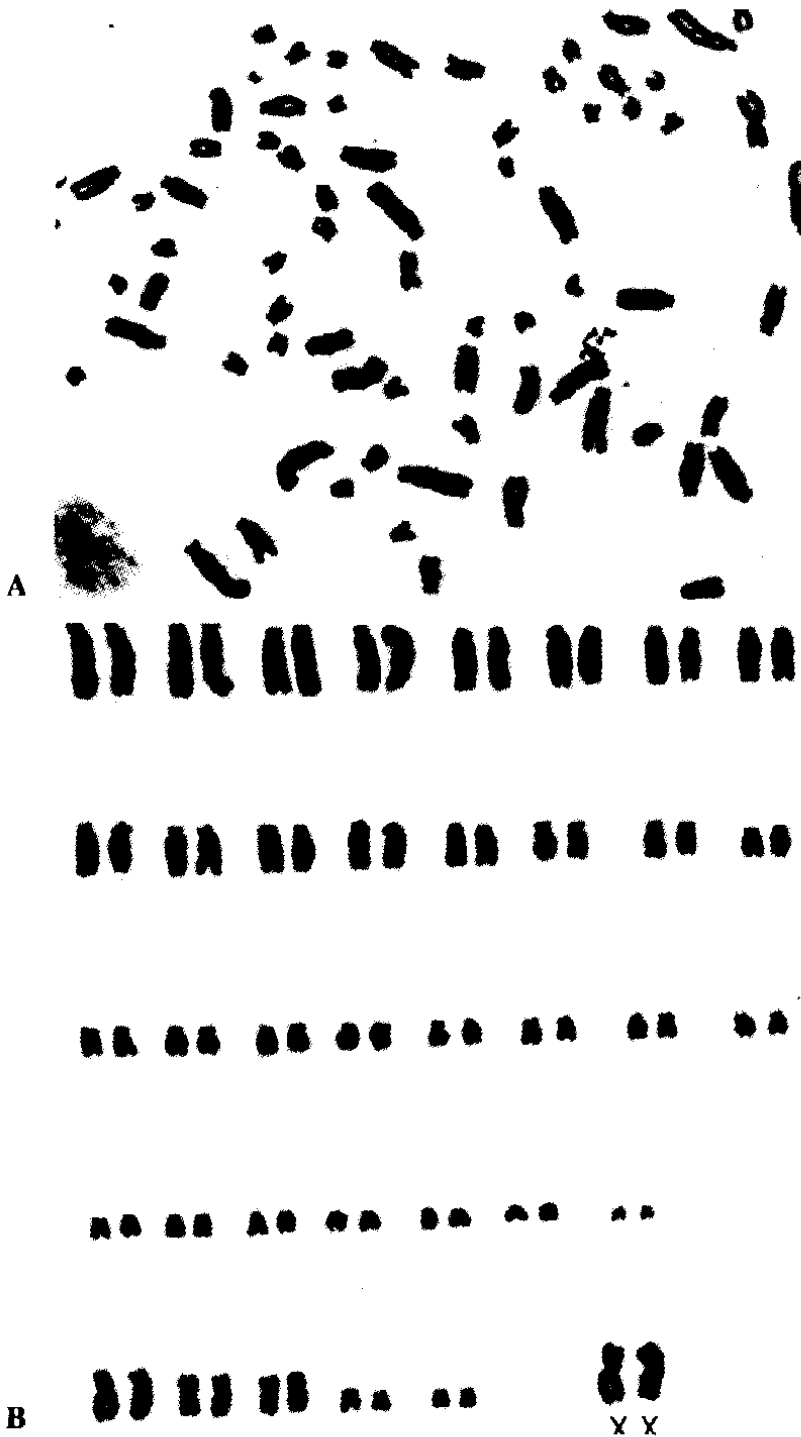


Fig. 1. The chromosomes of the male of the Arabian Camel: *Camelus dromedarius*. 5000 x.

A. Metaphase stage spread

B. Karyotype

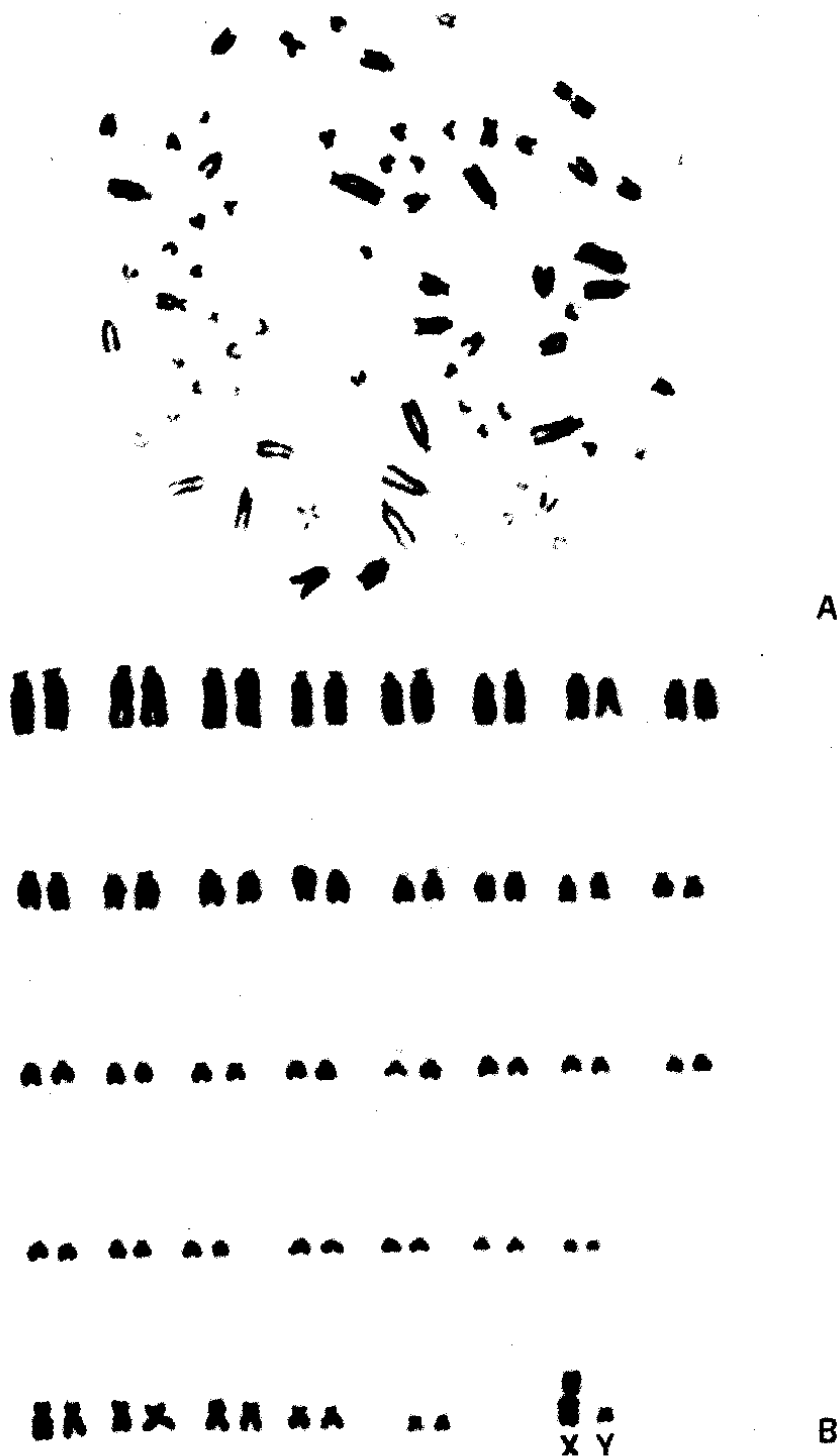


Fig. 2. The chromosomes of the female of the Arabian Camel: *Camelus dromedarius*. 5000 x.

A. Metaphase stage spread

B. Karyotype

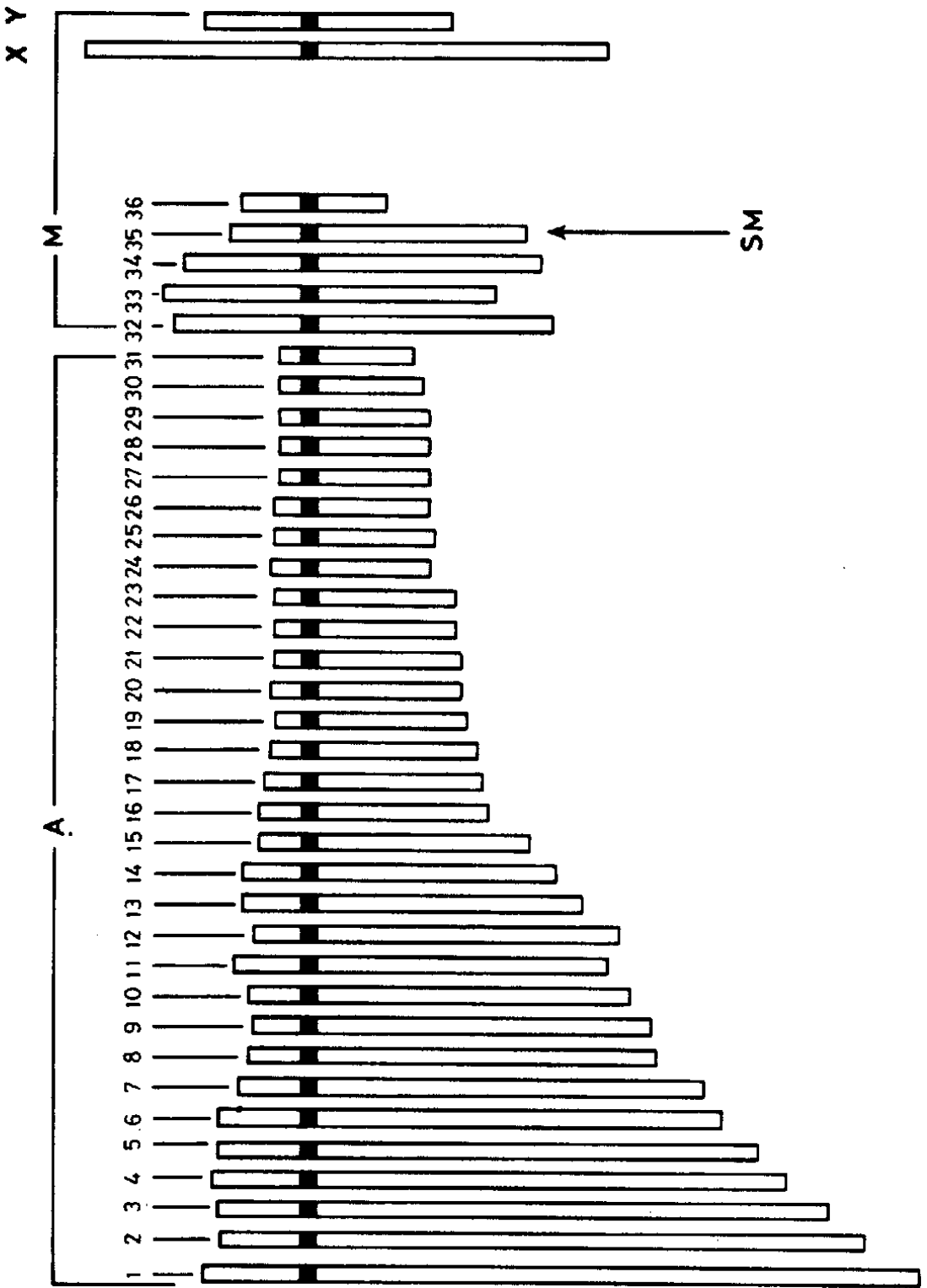


Fig. 3. An idiogram of the Arabian Camel (*Camelus dromedarius*) chromosomes. A, acrocentric; M, metacentric; and SM, submetacentric.

This finding of the diploid number of *C. dromedarius* as 74 chromosomes has previously been reported for the guanaco, the Bactrian camel and the vicugna in addition to the dromedary [17,19,20,22]. However, Capanna and Civitelli (1965) have reported 72 for the vicugna, and guanaco, but the vicugna was found to have $2n = 74$ and more metacentric autosomes than the Bactrian camel [19]. By means of the present techniques it was possible to classify the chromosomes of the dromedary into 31 pairs of acrocentric autosomes, 4 pairs of metacentric autosomes, one pair of submetacentric autosomes and metacentric X and Y sex chromosomes. However, some authors have experienced some difficulties in classifying chromosomes of the Camelidae including Taylor *et al.* [17] who found difficulties in classifying Y and smaller chromosomes of the dromedary and Koulischer *et al.* [19] who were unable to classify chromosomes of the Bactrian camel and the vicugna due to indiscernible morphology.

Although the previous report of the diploid number of *C. dromedarius* [17] is in general agreement with the present study but with some differences. Taylor *et al.* [17] stated that it was not possible to identify the Y chromosome specially in any of the karyotypes prepared from the two male. Furthermore, Taylor *et al.* [17] found difficulties in classifying the camel chromosomes because of the close gradation of their size. They stated that identification was possible for the X chromosome and five distinctive pairs of meta- and submetacentric autosomes. Moreover, Taylor *et al.* [17] used tissue samples from a dead female camel which was pregnant with a dead male fetus. The third sample was derived from a male camel. We have obtained our samples from 10 healthy females and 10 healthy males.

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الطبيعة الكرموسومية للجمل العربي

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ملخص البحث . لقد وجد أن العدد الكرموسومي المزدوج للجمل العربي يبلغ ٧٤ كرموسوماً وأن الكرموسومات الجسدية قد صنفت إلى ثلاث مجموعات . المجموعة الأولى تتكون من ٣١ زوجاً من الكرموسومات الجسدية فوقية السنرومير وأخذت الأرقام من ١ إلى ٣١ . المجموعة الثانية تشمل ثلاثة أزواج من الكرموسومات الجسدية وسطية السنرومير وأعطيت الأرقام ٣٢، ٤٤، ٣٦ . أما المجموعة الثالثة فتتمثل في زوج واحد من الكرموسومات الجسدية تحت وسطية السنرومير وأعطى الرقم ٣٥ . أما كرموسومي الجنس كلها وسطية السنرومير لكن الكرموسوم الجنسي المؤنث متوسط الحجم بينما الذكر صغير الحجم .