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Cytological Studies of Certain Desert Mammals of Saudi Arabia 2. The Karyotype of *Meriones libycus syrius* Thomas 1919

A.A. Al-Saleh and Mohammad A. Khan

Department of Zoology, College of Science, King Saud University, Riyadh, Saudi Arabia

ABSTRACT. The diploid (2n) chromosome number of *Meriones libycus syrius* from Saudi Arabia is 44; the fundamental number (FN) is 78 and the fundamental number of autosomes (FN^a) is 74. The autosomes consist of 11 pairs of metacentric, 5 pairs of submetacentric and 5 pairs of acrocentric chromosomes. The X chromosome is the second largest metacentric and the Y is the smallest metacentric element. These findings differ from those previously published for this species.

Many rodents, especially in the subfamily Gerbillinae, are being investigated as possible experimental models in various biological studies (Schwentker 1963, Rich 1968). Moreover, the small desert rodents have special physiological characteristics which make them suitable as experimental animals in space research (Pakes 1969). Thus, the precise identification of such species is imperative.

No serious attempt has been made in the past to study karyotypes of the rodents in Saudi Arabia. The karyotype of *Jaculus jaculus* L., a desert rodent of the family Dipodidae, has been described by Al-Saleh and Khan (1982) as Part 1 of a series of cytological studies of certain desert mammals of Saudi Arabia. *Meriones lybicus syrius* is one of many species of small rodents found in Saudi Arabia and is commonly known as the Libyan jird.

Karyological investigations of certain species of the genus *Meriones*, as exemplified by *M. unguiculatus*, have resulted in findings that do not agree with

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descriptions given by other authors (Nadler and Lay 1967, Pakes 1969, Vorontsov and Korobitsina 1970, Weiss *et al.* 1970 and Gamperl and Vistorin 1978).

Our studies confirm the findings of Matthey (1953) that the diploid number of chromosomes of *Meriones libycus* is 44, but differs from his description of chromosome morphology. Also our identification of the sex chromosomes of the species in Saudi Arabia differs considerably from the description by Lay and Nadler (1969) based on specimens from Rachtagan, Iran and Dalbandin and Nushki, West Pakistan.

Material and Methods

Our investigation was carried out on six male and female individuals, live-trapped from Al-Washm and Dawadami regions near Shakra, 230 km North-West of Riyadh, Saudi Arabia. Positive identification of the species as *M. libycus syrius* was made by Dr. P.H.D.H. D'Silva of the Natural Science Museum of King Saud University, on the basis of cranial morphology and pelage characteristics. The identification was confirmed by the British Museum (Natural history, Mammal section), accessed into the museum collection (# BM (NH) 1983, 314).

Metaphase chromosomes of bone marrow cells were prepared by a modification of Ford and Hamerton (1956a) colchicine-hypotonic citrate technique. Each experimental animal was injected intraperitoneally with 0.1 ml of colchicine (1 mg/ml in water) per gram of body weight and 2 to 3 hr later the animals were sacrificed. Bone marrow cells, collected from femoral bones, were treated with hypotonic solution (0.075 *M* KCl) for 30 minutes at 37°C. The cell suspension was centrifuged and the cells were fixed in 3:1 absolute alcohol-glacial acetic acid and spread on cold slides. The slides were stained with Giemsa stain; at least 20 metaphase plates were photographed from each sex. Karyotypes were constructed from photomicrographs and morphologically similar pairs of chromosomes were arranged on the basis of centromeric position and in order of decreasing size. Relative length of long and short arms and centromeric index for classification of chromosomes were calculated according to the system proposed by Levan *et al.* (1964).

Results

From a total of 200 metaphase cells and analysis of the karyotype from 40 photomicrographs, it was found that the diploid number of chromosomes (2n) of *Meriones libycus syrius* is 44. The fundamental number (FN) is 78 while the fundamental number of autosomes (FN^a) is 74 (Fig. 1 and 2).

Based on the centromeric position and relative length of the arms, the autosomal karyotype has been divided into three morphological groups: metacentric,

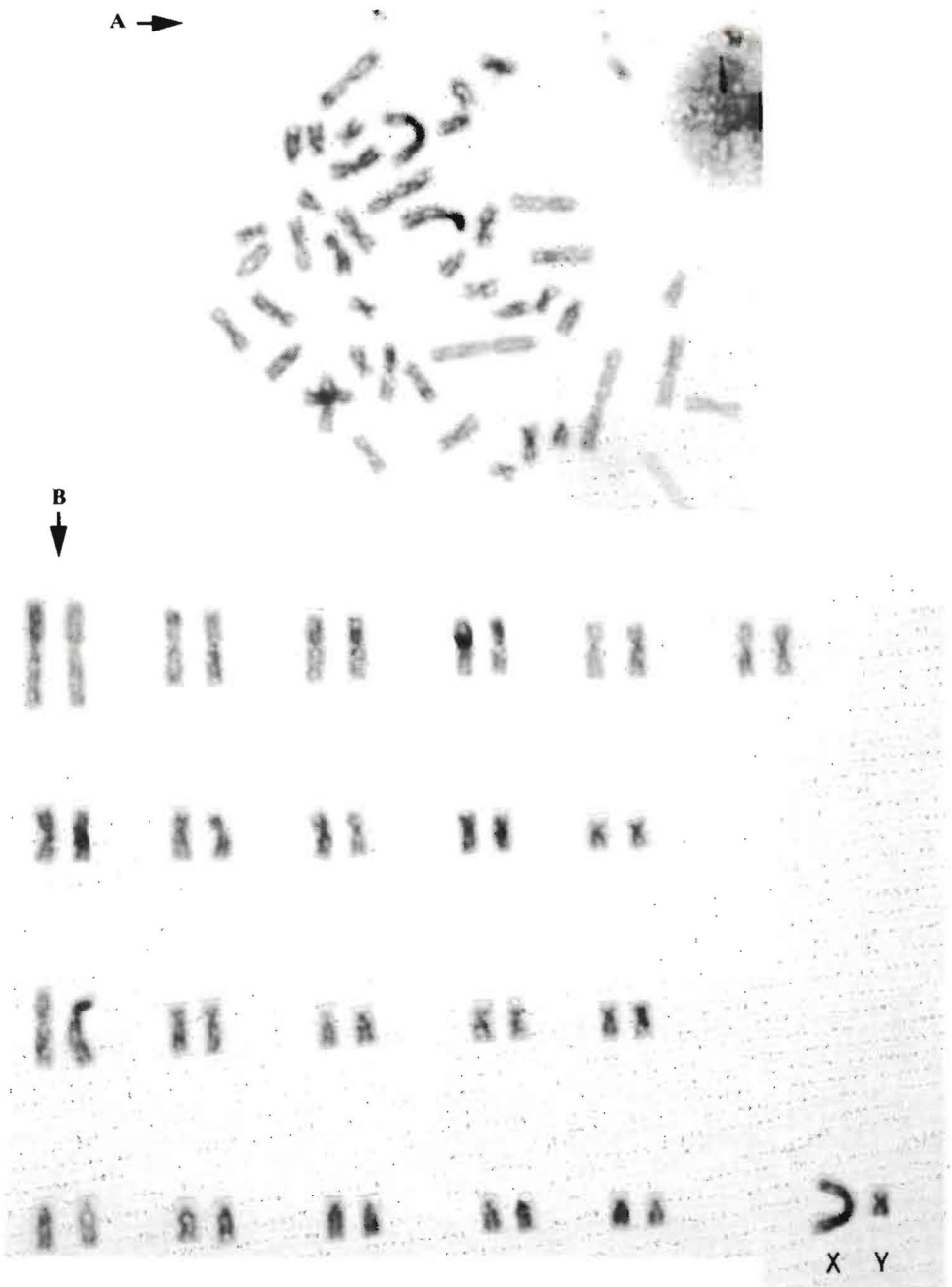

Fig. 1. Male *Meriones libycus syrius*. **A.** photomicrograph metaphase chromosomes. **B.** Karyotype.

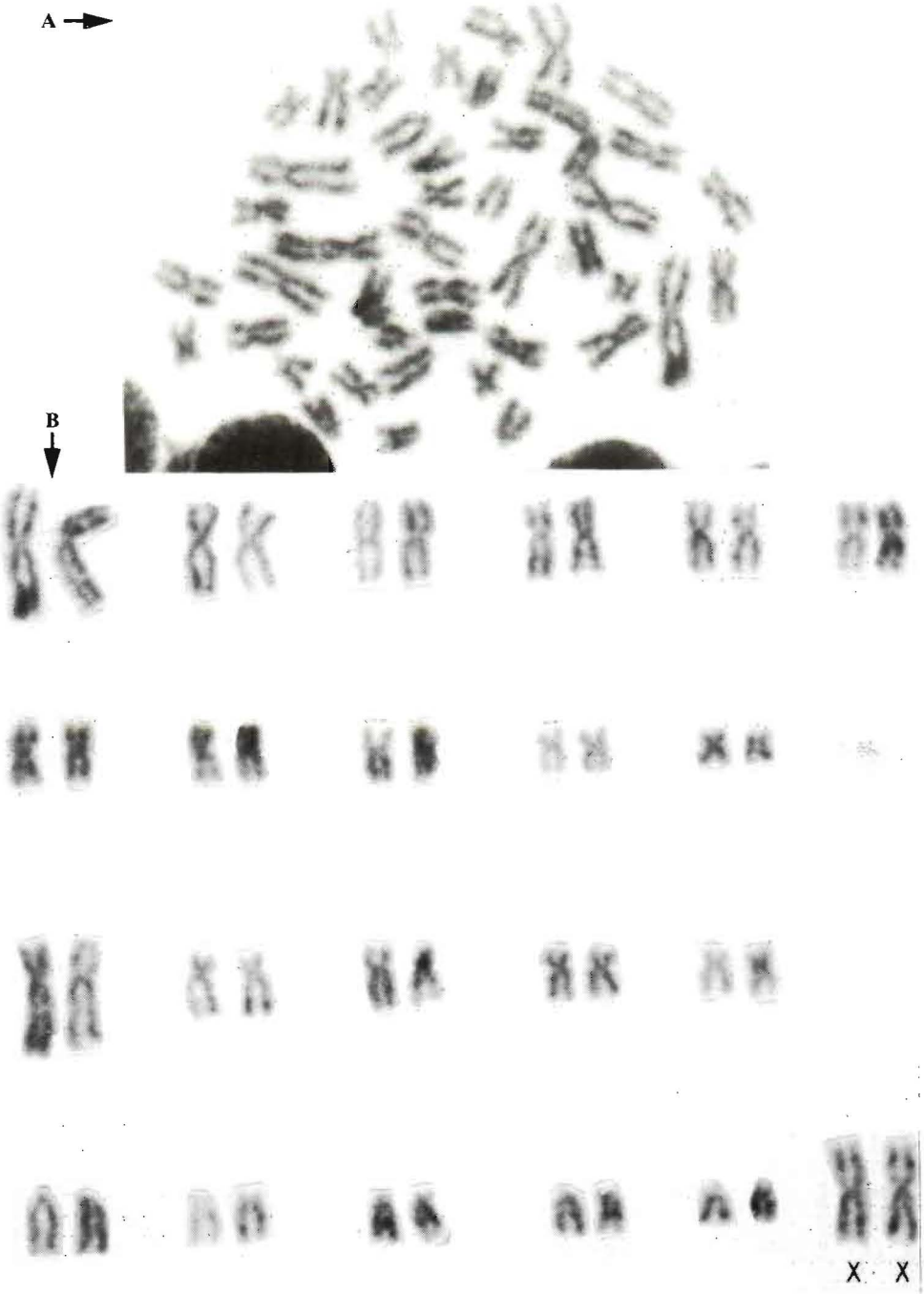

Fig. 2. Female *Meriones libycus syrius*. **A.** photomicrograph of metaphase chromosomes. **B.** Karyotype.

submetacentric and acrocentric. The metacentric group has 11 pairs, the submetacentric 5 pairs and the acrocentric group 5 pairs of chromosomes. The members of each group show a gradual decrease in size except one pair in the submetacentric group which is much larger than the rest.

The sex chromosomes are XY in the male and XX in the female. The X in the male is designated as the single second largest metacentric element and the Y is the smallest and metacentric element. The second largest metacentric pair in the female, similar to the single unique element in the male, is identified as XX.

Discussion

Much knowledge has been accumulated during the past few decades on the taxonomy of the genus *Meriones*; yet considerable confusion has obscured the position of *M. libycus* because of uncertainty concerning its nomenclature. Hayman (1948) misidentified *M. libycus* from Bahrain as *Psammomys obesus*. Setzer (1961) and Hoogstraal (1963) used the name *M. libycus* in referring to *M. shawi*. Ranck (1968) identified specimens of *M. shawi* as *M. libycus* and used a junior synonym, *M. caudatus* Thomas to refer to specimens of *M. libycus*. Gromov *et al.* (1963) employed the name *M. erythrourus* for the species of *M. libycus*. Confusion among taxonomists has been discussed at length by Lay and Nadler (1969). They also succeeded in hybridizing *M. libycus* and *M. shawi* in captivity and described the karyotypes of the two species and their hybrids.

Our studies on *M. libycus* confirm the findings of Matthey (1953, 1957) and Ford and Hamerton (1956b) that the diploid number (2n) of chromosomes of this species is 44. However, a comparison of results between our specimens obtained from Al-Washm and Dawadami (Saudi Arabia) and the findings of Lay and Nadler (1969) with regard to the karyotype, show some minor differences in the autosomal grouping and major differences concerning the sex chromosomes.

The karyotype of *M. libycus*, according to Matthey (1953, 1957), is divided into two groups: a group of 30 chromosomes which consist of both meta and submetacentric elements and a second group of 14 chromosomes which are acrocentrics and thus the fundamental number (FN) is 74. Lay and Nadler (1969) reported 20 metacentric, 10 submetacentric and 12 acrocentric autosomes; an acrocentric X and a submetacentric Y in the male and 2 acrocentric X's in the female.

Our investigation on the chromosome morphology of the species shows that there are 22 metacentric, 10 submetacentric and 10 acrocentric autosomes. The sex chromosomes consist of a metacentric X and a metacentric Y in the male and two metacentric X's in the female. Thus, the FN according to our calculation, is 78 and not 74 as per the suggestion of Matthey (1953, 1957), nor 75 in the male and 74 in the female as calculated from the karyotype presented by Lay and Nadler (1969). The major difference, however, is with regard to the sex chromosomes; the

karyotype of *M. libycus* by Lay and Nadler shows the X chromosome to be the largest acrocentric element. The X in our specimens, contrary to theirs, is the second largest metacentric element and is the only unmatched and unique element found in the males and is paired in the females of the species. There is no unmatched acrocentric chromosome in the karyotypes we have constructed. The Y chromosome, again is clearly dissimilar; Lay and Nadler (1969) have shown a medium sized, submetacentric element as the Y, whereas the Y chromosome in our specimen appears to be the smallest metacentric element.

Banding experiments are in progress to confirm our findings on the karyotype of *M. libycus*, which would be helpful in clarifying the confusion surrounding the nomenclature of this species and in finding its relationship with the others in its group. Since the karyotype described herein for animals from Saudi Arabia differs from that published for *M. libycus*, and although the specimens have been identified as this species, it is possible that the Saudi Arabian populations represent an undescribed sibling (with *M. libycus*) species.

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References

Al-Saleh, A. and **Khan, M.** (1984) Cytological studies of certain desert mammals of Saudi Arabia. The karyotype of *Jaculus jaculus, J. Coll. Sci., King Saud Univ.* **15** (in press).

Ford, C.E. and **Hamerton, J.L.** (1956a) A colchicine, hypotonic citrate, squash sequence of mammalian chromosomes, *Stain Technol.* **31** : 247-251.

Ford, C.E. and **Hamerton, J.L.** (1956b) Chromosomes of five rodent species, *Nature, London* **177** : 140-141.

Gamperl, R. and **Vistorin, G.** (1980) Comparative studies of G- and C-banded chromosomes of *Gerbillus campestris* and *Meriones unguiculatus* (Rodentia, Gerbillinae), *Genitica* **52/53** : 93-97.

Gromov, I.M., Gureev, A.A., Novikov, G.A., Sokolov, I.I., Strelkov, P.P. and **Chapskii, K.K.** under the general direction of **Sokolov, I.I.** (1963) *Mlekopitayushchie Fauny SSSR*, 2 Vols., Izd. Akad. Nauk Moscow-Leningrad, 2000 p., 540 Fig.

Hayman, R.W. (1948) The Armstrong College Zoological expedition to Siwa Oasis (Libyan Desert) 1935, Mammalia, *Proc. Egypt. Acad. Sci.* **4** : 38-43.

Hoogstraal, H.H. (1963) A brief review of the contemporary land mammals of Egypt (including Sinai). Lagomorpha and Rodentia, *J. Egypt Publ. HLth Ass.* **38** : 1-35.

Lay, D.M. and **Nadler, C.F.** (1969) Hybridization in the rodent genus *Meriones*. 1. Breeding and cytological analysis of *Meriones shawi* (♀) × *Meriones libycus* (♂) hybrids, *Cytogenetics* **8** : 35-50.

Levan, A., Fredga, K. and **Sandberg, A.A.** (1964) Nomenclature for centromeric position in chromosomes, *Hereditas* **52** : 201-220.

Matthey, R. (1953) Les chromosomes du Muridae. Revision critique et materiaux nouveaux pour servir à l'histoire de l'evolution chromosomique chez ces rongeurs, *Revue suisse Zool.* **60** : 225-283.

Matthey, R. (1957) Cytologie et taxonomie de genre *Meriones*, Illiger (Rodentia-Muridae-Gerbillinae), *Säugetierk. Mitt.* **5** : 145-150.

Nadler, C.F. and **Lay, D.M.** (1967) Chromosomes of some species of *Meriones* (Mammalia: Rodentia), *Z. Säugetierk.* **32** : 285-291.

Pakes, S.P. (1969) The somatic chromosomes of the Mongolian gerbil (*Meriones unguiculatus*), *Lab. anim. Care.* **19** : 857-861.

Ranck, G.L. (1968) The rodents of Lybia: Taxonomy, ecology and zoogeographical relationships, *U.S. nat. Mus. Bull.* **275** : vii + 264 p.

Rich, S.T. (1968) The Mongolian gerbil (*Meriones unguiculatus*) in research, *Lab. anim. Care* **18** : 235-243.

Schwentker, V. (1963) The gerbil, a new laboratory animal, *Illinois Vet.* **6** : 5-9.

Setzer, H. (1961) The jirds (Mammalia: Rodentia) of Egypt, *J. Egypt. Publ. Hlth Ass.* **35** : 1-5.

Vorontsov, N.N. and **Korobitsina, K.V.** (1970) Material on a comparative karyology of Gerbillinae, *Tsitologiya* **12** : 152-157.

Weiss, L., Mayeda, K. and **Dully, M.** (1970) The karyotpye of the Mongolian gerbil, *Meriones unguiculatus*, *Cytologia* **35** : 102-106.

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دراسة سيتولوجية لبعض من الحيوانات الثديية الصحراوية فى المملكة العربية السعودية
٢٠ الطبيعة الكروموسومية لمريونس ليبيكس سيريس

عبدالعزيز عبد الرحمن الصالح و محمدعظمة الله خان

كلية العلوم - جامعة الملك سعود - الرياض المملكة العربية السعودية

لقد وجد أن العدد الكروموسومى المزدوج لحيوان مريونس ليبيكس سيريس يبلغ ٤٤ كروموسوماً، بينما يبلغ عدد الكروموسومات الأساسى (FN) ٧٨ كروموسوماً. أما عدد الكروموسومات الجسدية الأساسى (FN^a) فيبلغ ٧٤ كروموسوماً. كذلك يمكن تصنيف الكروموسومات الجسدية إلى ١١ زوجاً من الكروموسومات وسطية السنترومير و ٥ أزواج من الكروموسومات تحت وسطية السنترومير و ٥ أزواج من الكروموسومات قمية السنترومير. أما الكروموسوم الجنسى المذكر (Y) فيمتاز بأنه أصغر الكروموسومات وذو سنترومير قمى، بينما الكروموسوم الجنسى المؤنث (X) فيعتبر كروموسوماً متوسط الحجم وذا سنترومير وسطى.