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A new chromosomal form of *Nannospalax ehrenbergi* from Turkey

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A b s t r a c t . Different chromosomal races of the *Nannospalax ehrenbergi* (Nehring, 1898) complex inhabit south-eastern Turkey. In spite of the fairly restricted range of this mole rat in Turkey, no less than eight different karyotypes have been reported so far. These differ in diploid number (range from 52 to 58), fundamental number of chromosomal arms (ranging between 72 and 90) and in the fundamental number of autosomal arms (ranging from 68 to 86). The most common chromosomal form is 2n = 52, NF = 76, NFa = 72, which is known from Southeast Anatolia. In this paper I report on a new *N. ehrenbergi* karyotype from south-eastern Turkey. In 18 specimens investigated, the diploid number of chromosomes was 2n = 56, NF = 66, and NFa = 62. The karyotype consisted of 4 pairs of metacentrics/submetacentrics and 23 pairs of acrocentrics. The X chromosome was medium-sized submetacentric and the Y chromosome was small acrocentric. This chromosomal set is different to the most common Turkish *N. ehrenbergi* karyotype (2n = 52) and also differs markedly from the known chromosomal forms from Gaziantep (2n = 56, NF = 82, NFa = 78) and Tarsus (2n = 56, NF = 72, NFa = 68).

Key words: Mammalia, Rodentia, Spalacidae, *Spalax*, karyology, Turkey

Introduction

The family Spalacidae is at present confined to the Palearctic region. The distribution area of the family includes northeastern Africa, the Balkans, southeastern Europe, Central Asia, Middle East and Caucasus (C o r b e t 1978).

Mole rats of the family Spalacidae range over Turkey (Asia Minor) in two taxa: ancestral *Spalax leucodon,* (over most of Turkey) and descendant *Spalax ehrenbergi* in south-eastern Turkey (N e v o et al. 1995).

Nannospalax ehrenbergi was first described by N e h r i n g (1898) from specimens collected from Yafa (Israel). This species is distributed in Libya, Syria, Jordan, Lebanon, Israel, Egypt, Iraq, and south-east Anatolia (Turkey) (T o p a c h e v s k i 1969).

According to M e h e l y (1909), and M u r s a l o ğ l u (1979) *Spalax ehrenbergi* is present in south eastern Anatolia. T o p a c h e v s k i i (1969) considered that the nominate subspecies *S. e. ehrenbergi* is distributed in this region, whereas K ı v a n ç (1988) suggests that *Spalax e. intermedius* occurs here. N e v o et al. (1994a, 1995) described a superspecies, *Spalax ehrenbergi*, for this region's mole rats.

Karyotype studies of *Nannospalax ehrenbergi* from across their distribution revealed obvious chromosome polymorphisms and several different karyotypes from this region have already been described.

The first studies on the karyological peculiarities of *Nannospalax ehrenbergi* were carried out in 1969 by W a h r m a n et al. (1969). In this study four different chromosomal forms

were recorded in Israel with the diploid number of chromosomes of 2n = 52, 54, 58 and 60. Also L a y & N a d l e r (1972) confirmed the diploid number of chromosomes of Egyptian specimens of this species as 2n = 60.

The first karyological analyses of Turkish *Nannospalax ehrenbergi* populations were made by Y ü k s e l (1984) from the Elazığ population. In this study it was determined that this population of *Spalax ehrenbergi* has a karyotype of 2n = 52, NFa = 72 and NF = 76.

Y ü k s e l & G ü l k a ç (1992) evaluated the population of mole-rats from Şanlıurfa as *Spalax ehrenbergi kirgisorum* from studies of specimens from Şanlıurfa, Adıyaman and Gaziantep. Their karyotypes are 2n = 52, NF = 76 and NFa = 72; they also concluded that the populations of Adıyaman and Gaziantep specimens are *Spalax ehrenbergi intermedius* and the karyotype of these specimens are 2n = 52, NF = 76 and 2n = 56, NF = 90 respectively.

N e v o et al. (1994b, 1995) determined that specimens from Tarsus, Gaziantep, Urfa and Diyarbakır had karyotypes of 2n=56, 58, 52W (west) and 52E (east), in range respectively. I v a n i t s k a y a et al. (1997) studied the karyological peculiarities from populations Tarsus Gaziantep, Birecik, Şanlıurfa, Siverek, Diyarbakır and Elazığ. The diploid chromosome number of Diyarbakır, Elazığ, Siverek and Birecik specimens is 2n=52, NFa=72; Tarsus is 2n=56, NFa=68; Şanlıurfa is 2n=52, NFa=78 and Gaziantep is 2n=56, NFa=78. C o ş k u n (1997, 1999) reported a new chromosomal form from south east Anatolia with 2n = 52, NF = 74 and NFa = 70 from Kilis.

As mentioned above, *Nannospalax ehrenbergi* has a great variability of diploid numbers and the number of chromosome arms. The analyses of Batman and Siirt population's karyotype, represents a contribution to knowledge of the *Spalax* karyotype. This study has evaluated the chromosomal forms and the distribution of the population of *Nannospalax ehrenbergi* species in this region.

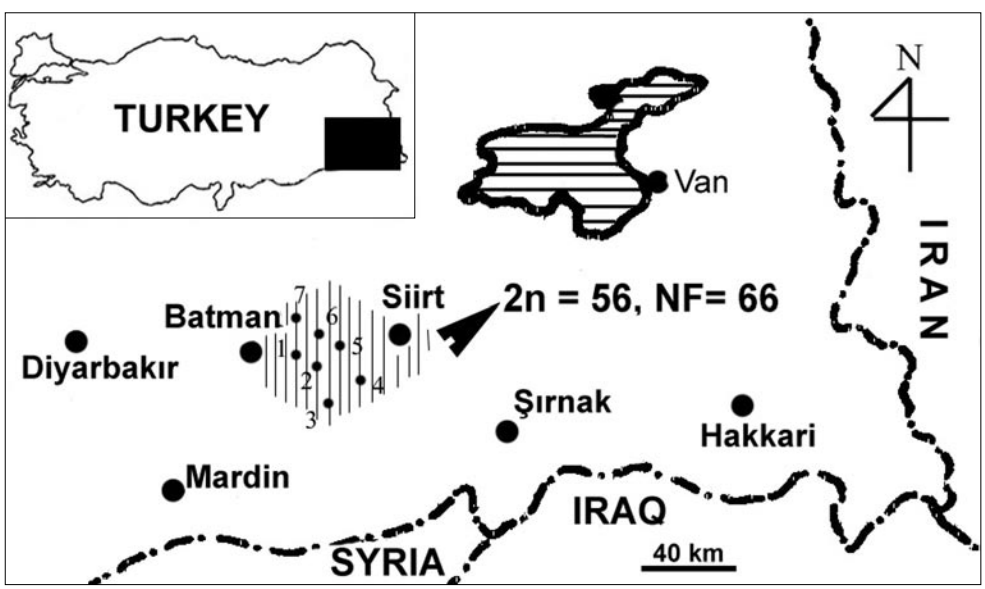

Fig. 1. Collecting localities. 1. Batman-Yolbulan village, 2. Siirt-Kurtalan-İncilik village, 3. Batman-Hasankeyf-Suçeken village, 4. Siirt-Kurtalan-Bağlıca village, 5. Siirt-Baykan road junction, 6. Batman-Beşiri-Yolkonak village, 7. Batman-Kozluk-Yeniçağlar village.

Material and Methods

Eighteen specimens (ten males, eight females) were collected from 7 different localities from Siirt and Batman provinces, by digging the burrow systems (Fig. 1). Preparations of mitotic chromosomes were obtained from bone marrow by means of the general air-drying technique (Lee & Elder 1980). The data obtained from the specimens were compared with the results of previously published accounts. Slides and voucher specimens (skins and skulls) are held in the Biology Department, Science and Art Faculty, Dicle University, Turkey.

Results

In all the samples studied the diploid number of chromosomes is 2n = 56. The number of chromosomal arms is NF= 66 and number of autosomes NFa= 62. Their karyotypes consist of 4 pairs of metacentric/submetacentric and 23 pairs of acrocentric autosomes. The X chromosomes are medium sized and submetacentric; The Y chromosomes are small and acrocentrics (Fig. 2A). Chromosome types and the number of arms are shown in the Table 1. The table gives a comparative survey of all populations analysed to date of the species *Nannospalax ehrenbergi* Nehring, 1898 from Turkey.

Discussion

According to Gromov & Baranova (1981), the Spalacidae has two distinct genera, *Nannospalax* and *Spalax,* and Turkish spalacids belong to the genus *Nannospalax*. I used the genus name *Nannospalax* in this paper.

Sibling species are common in the Spalacidae. Up to now over 30 different chromosomal forms have been recorded with diploid number of chromosomes in the range 2n=38-62; NF= 72-124 (Savic & Nevo 1990). This is also valid for the Turkish *Spalax*. About 10 chromosomal forms were found in Turkish populations of *Nannospalax ehrenbergi* (Yüksel 1984, Yüksel & Gülkaç 1992, Nevo et al. 1994a, 1995, Ivanitskaya et al. 1997 and Coşkun 1998).

The diploid number of chromosomes of Batman and Siirt specimens was found to be 2n=56 and NF=66. Specimens from Batman and Siirt are thus distinct from the population of Adıyaman, Diyarbakır, Elazığ, Şanlıurfa, Gaziantep, and Tarsus population (Table 1). The X chromosome is submetacentric like the other populations.

On the basis of a comparative analysis of karyotypes, it can be concluded that there is great chromosome polymorphism in this region which is manifested in the differences in the number and morphology of the chromosomes. Chromosomal differentiation in mole rats from Turkey has been discussed in connection with speciation and adaptation to different environmental conditions, primarily to different climatic regions varying in aridity and temperature regimes (Wahrman et al. 1969). The chromosome number shows a positive correlation because of the contraints of biotic and climatic factors such as dryness and temperature (Nevo et al. 1994a). The diploid number of chromosomes of Anatolian *Spalax* increases from the rainy and warm coastal regions to the dry and harsh climatic zone of middle Anatolia (Nevo et al. 1994a). As the increase of acrocentrics occurs by Robertsonian fission, the variations in the number of the chromosome arms occur by centromeric translocation (Yüksel 1984, Nevo et al. 1994a, Savic &

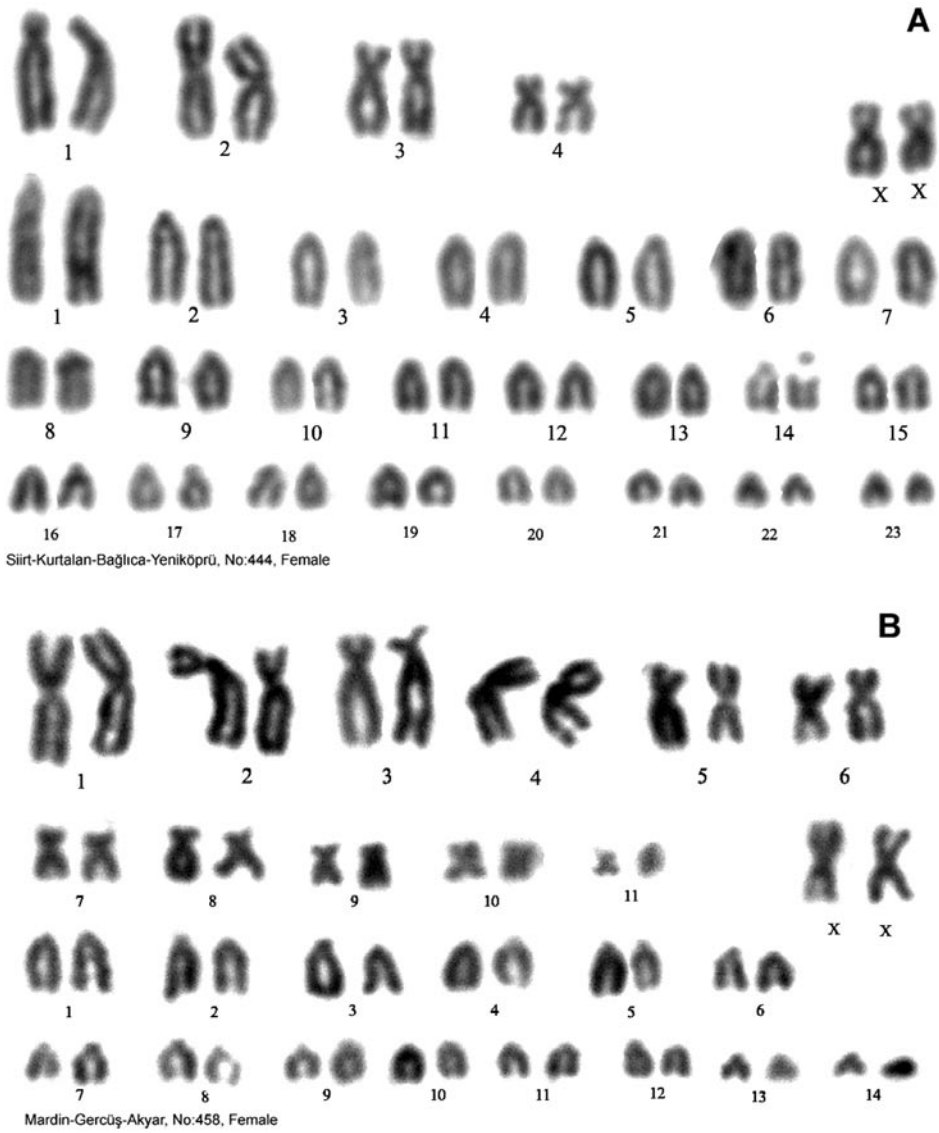

Fig. 2. Comparison with karyotype of the Batman and Siirt populations (A) and neighbour populations (B); (2n=52, NF=76, NFa=72 form, Diyarbakır, Elazığ, Şırnak, Mardin).

S o l d a t o v i c 1979). It is clear that the chromosomal differences of the specimens of Batman and Siirt province are affected by the mechanism mentioned above.

Karyological studies of this group may yield further chromosomal forms in Turkey, which has a wide range of climatic and biotic conditions and the boundaries of the distribution region of the known species might be determined. For this purpose the samples must be collected from the known areas to the periphery and subjected to karyological studies.

Table 1. Comparative survey of the morphology of the karyotypes of *Nannospalax ehrenbergi* from Turkey. **n**: sample size, **2n**: diploid number, **m/sm**: the number of meta-submetacentrics, **A**: acrosentric, **X**: X chromosome, **Y**: Y chromosome, **NF**: chromosome arm number, **NFa**: autosomes arm numbers.

Population	N	2n	m/sm.	A	X	Y	NF	NFa	Literature
Diyarbakır	7	52	11	14	Sm	Sm	76	72	Ivanitskaya et al. (1997)
Elazığ	30	52	11	14	Sm	Sm	76	72	Yüksel (1984)
	6	52	11	14	Sm	Sm	76	72	Ivanitskaya et al. (1997)
Şanlıurfa	18	52/54	11/10	14/16	m	sm	76	72	Yüksel & Gülkaç (1992)
	3	52	14	11	Sm	A	78	74	Nevo et al. (1994a)
	2	52	13	12	Sm	A	80	76	Ivanitskaya et al. (1997)
Gaziantep	15	56	14	13	m	Sm	90(?)	86	Yüksel & Gülkaç (1992)
	2	58	17	11	Sm	Sm	90	86	Nevo et al. (1994a)
	5	56	12	15	Sm	A	82	78	Ivanitskaya et al. (1997)
Adıyaman	10	52	11	14	m	sm	76	72	Yüksel & Gülkaç (1992)
Tarsus	7	56	7	20	Sm	A	72	68	Nevo et al. (1994a)
	1	56	7	20	Sm	A	72	68	Ivanitskaya et al. (1997)
Şırnak	4	52	11	14	Sm	A	76	72	Coşkun (1998)
Kilis	4	52	10	15	Sm	A	74	70	Coşkun (1997, 1999)
Batman and Siirt	18	56	4	23	Sm	A	66	62	This study

A c k n o w l e d g e m e n t s

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