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PJBS

ISSN 1028-8880

**Pakistan
Journal of Biological Sciences**

ANSI*net*

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Karyological Study of *Spalax leucodon* (Nordmann, 1840) in Central Anatolia, Turkey

Coşkun Tez,¹ İslam Gündüz and ²Haluk Kefeliödlü

Department of Biology, Faculty of Arts and Sciences, Erciyes University, 38039 Kayseri, Turkey

¹Department of Biology, Faculty of Arts and Sciences, Ballıkesir University, 10100 Ballıkesir, Turkey

²Department of Biology, Faculty of Arts and Sciences, Ondokuz Mayıs University, Kurupelit, Samsun – Turkey

Abstract: Karyological characteristics of two specimens belonging to the superspecies *Spalax leucodon* (Nordmann, 1840) from two central Anatolian localities, Kayseri and Sivas-Gürün, were studied to provide insight into chromosomal variations. The two subterranean mole rats examined in this study had karyotypes with $2n=60$, $NF=78$ and $NFa=74$. This karyotype has already been described at two sites in previous studies but given here for two new additional localities for the first time.

Key words: *Spalax leucodon*, karyology, Turkey, Middle East

Introduction

Two superspecies of the subterranean mole rats, *Spalax leucodon* (Nordmann, 1840) and *S. ehrenbergi* (Nehring, 1898) are characteristic to Palaearctic region and have been recorded from Turkey. Recently, these two taxa have been studied intensively as model mammals in terms of chromosomal variations and ecologically mediated chromosomal speciation (Nevo *et al.*, 1994, 1995). Studies on species of *Spalax* in Palaearctic region revealed about 40 chromosomal forms of which 14 were described in various localities in Asia Minor (Gülkaç & Yüksel, 1999; Yüksel & Gülkaç, 1990, 1992, 2001; Musser & Carleton, 1993; Nevo *et al.*, 1994, 1995; Coşkun, 1998a,b, 1999; Ivanitskaya *et al.*, 1997; Sözen & Kılınç, 1998a, b; Sözen *et al.*, 1999; Gülkaç & Kükükdumlu 1999). Nevo *et al.* (1995) have pointed out that each chromosomal form must be assigned to separate biological species and that there presumably are about 20 species in Turkey.

So far, 10 karyological forms of *S. leucodon* with $2n = 38, 38, 40, 50, 52, 54, 56, 58, 60$ and 62 and four karyological forms of *S. ehrenbergi* with $2n = 52, 54, 56$ and 58 have been reported from Turkey (Yüksel & Gülkaç, 1992, 2001; Nevo *et al.*, 1994, 1995; Ivanitskaya *et al.*, 1997; Sözen & Kılınç, 1998a, b; Sözen *et al.*, 1999; Gülkaç & Kükükdumlu, 1999; Coşkun, 1999).

The purpose of the present study was to provide further information about karyotypic variation observed in central Anatolian mole rats and to contribute the mapping of geographic distributions of each chromosomal form.

Materials and Methods

This study was conducted on two specimens of *S. leucodon* collected from two distant localities, Kayseri and Sivas-Gürün, in 1999 (Fig. 1). Animals were trapped alive and brought to laboratory for chromosomal preparations. Chromosome preparations were made on bone marrow according to Ford

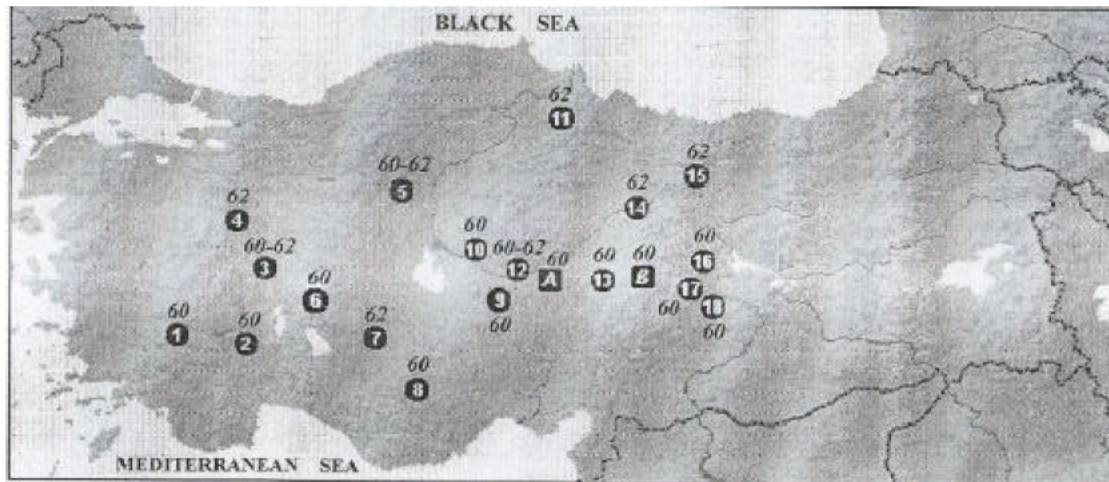


Fig. 1: Map showing the distribution of central Anatolian *Spalax leucodon* populations with karyotypes of $2n=60$ and 62 both in this study and in those given in Table 1. Localities A and B were studied in present work, whereas localities 1-18 were studied by previous workers (see Table 1.). Sampling localities are as follows: A: Kayseri (central), B: Sivas-Gürün, 1: Denizli; 2: Burdur; 3: Afyon; 4: Kütahya; 5: Ankara; 6: Akşehir; 7: Konya; 8: Karaman; 9: Nevşehir, Kırşehir; 11: Havza; 12: Kayseri; 13: Pınarbaşı; 14: Sivas; 15: Suşehri; 16: Arguvan; 17: Yazlıhan; 18: Malatya. Numbers in italic refer to the diploid numbers ($2n$) recorded from each site.

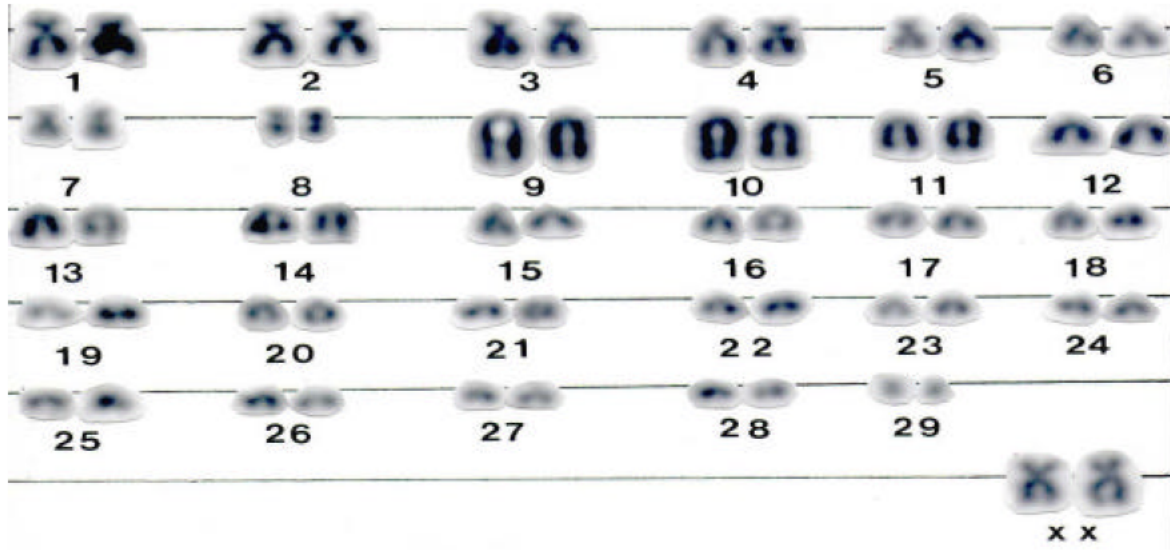


Fig. 2: Karyotype of a female *Spalax leucodon* ($2n = 60$) from Sivas-Gürün, Turkey.

Table 1: List of the localities from which the *Spalax leucodon* samples with karyotypes of $2n = 60$ and 62 , have been recorded in central Anatolia (additionally $2n = 40-58$)

Locality	$2n$	NF	NFa	References
Malatya	60	78	74	Ivanitskaya <i>et al.</i> (1997), Nevo <i>et al.</i> (1994, 1995)
Malatya, Yazihan,				
Kayseri, Kırşehir and Nevşehir	60	80	76	(see Sözen <i>et al.</i> , 1999), Yüksel and Gülkaç (2001)
Ankara, Afyon and Arguvan	60	82	78	Sözen <i>et al.</i> (1999)
Plnarbaşı	60	-	-	Nevo <i>et al.</i> (1994, 1995)
Denizli	60	-	-	Nevo <i>et al.</i> (1994, 1995)
Burdur	60	84	80	Sözen <i>et al.</i> (1999)
Akşehir	60	76	72	Sözen <i>et al.</i> (1999)
Karaman	60	-	-	Nevo <i>et al.</i> (1994, 1995)
Kayseri and Sivas-Gürün	60	78	74	Present study
Kütahya, Afyon, Konya,				
Sivas, Ankara, Kayseri,				
Havza and Suşehri	62	-	-	Nevo <i>et al.</i> (1994, 1995)
Madenköy	58	-	-	Sözen and Klvanç (1998b)
Gülek	56	-	-	Sözen and Klvanç (1998a)
Yozgat, Bolu, Bingöl	54	-	-	Nevo <i>et al.</i> (1994, 1995)
Yüksel and Gülkaç (2001)				
Sebil	52	-	-	Sözen and Klvanç (1998a)
Aydın, Erzurum, Sarıklamış	50	-	-	Nevo <i>et al.</i> (1994, 1995)
Beyşehir	40	-	-	Nevo <i>et al.</i> (1994, 1995)

and Hamerton (1958), and at least 20 metaphase cells were scored for chromosome number. The karyotype slides have been kept at Department of Biology, Faculty of Arts and Sciences, Erciyes University, Kayseri.

Results

The karyotypes of two female specimens, one from central Kayseri ($38^{\circ} 43' N$, $35^{\circ} 29' E$) and the other from Incesu village in Sivas-Gürün ($38^{\circ} 48' N$, $37^{\circ} 7' E$) were subjected to chromosomal analyses. Both individuals had the same karyotypes with $2n = 60$, NF = 78 and NFa = 74. The karyotypes consisted of 21 pairs of acrocentric and 8 pairs of submetacentric. The X chromosome was also large submetacentric (Fig. 2).

Discussion

As seen in Fig. 1, the major karyotypes of blind mole rat populations in central Anatolia have been found to be ranging from $2n = 60$ to 62 . However, the other karyotypes (i.e.

$2n = 40-58$) are also known to occur in this region (Table 1). Subsequent studies reported that the karyotype (i.e. $2n = 60$) for the mole rat populations from Malatya, Yazihan, Arguvan, Kırşehir, Nevşehir, Kayseri, Denizli, Plnarbaşı; Ankara, Afyon, Burdur and Akşehir (Nevo *et al.*, 1994, 1995; Ivanitskaya *et al.*, 1997; Sözen *et al.*, 1999; Yüksel and Gülkaç, 2001). However, the karyotype with $2n = 62$ was found only in the populations from Kütahya, Afyon, Konya, Sivas, Ankara, Kayseri, Havza and Suşehri (Nevo *et al.*, 1994, 1995) (Fig. 1). The karyotypes ($2n = 60$) given for specimens from Kayseri and Sivas-Gürün in this study are similar to those reported for mole rat populations from Malatya, Yazihan, Arguvan, Kırşehir, Nevşehir, Kayseri, Denizli, Plnarbaşı, Ankara, Afyon, Burdur and Akşehir in diploid chromosome number but differ in chromosomal arm size and the chromosome morphology (Nevo *et al.*, 1994, 1995; Sözen *et al.*, 1999; Yüksel and Gülkaç, 2001). On the other hand, exactly the same karyotype (i.e. $2n = 60$, NF = 78 and NFa = 74) was given for *S. leucodon* samples from Malatya populations (Nevo *et al.*, 1994, 1995;

Ivanitskaya et al., 1997). Sivas-Gürün is reported here for the first time to be occupied by *S. leucodon* populations with karyotypes of $2n = 60$, $NF = 78$ and $NFa = 74$. By combining our data with that of Nevo et al. (1995) we were able to confirm that mole rat populations possessing $2n = 60$ and 62 are apparently two major karyotypic forms in the central Anatolia.

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