

Contributions to the karyology and taxonomy of *Spalax leucodon nehringi* Satunin, 1898 and *Spalax leucodon armeniacus* Mehely, 1909 (Mammalia: Rodentia) in Turkey

By M. SÖZEN, E. ÇOLAK, and N. YİĞİT

Department of Biology, University of Zonguldak Karaelmas, Zonguldak, Turkey and Department of Biology, University of Ankara, Ankara, Turkey

*Receipt of Ms. 16. 12. 1999
Acceptance of Ms. 05. 05. 2000*

Key words: *Spalax leucodon*, karyology, taxonomy, Turkey

The subterranean mole rats belonging to the family Spalacidae are widely distributed in southeastern Europe, Asia Minor, Caucasus, Transcaucasus, Ukraine, Armenia, Syria, Palestine, Iraq, Israel, Jordan, and northeastern Africa (OGNEV 1947; ONDRIAS 1966; LAY and NADLER 1972; CORBET 1978; SAVIC and NEVO 1990; NEVO 1991; HARRISON and BATES 1991). To date, about 50 chromosomal forms of *Spalax* have been reported in the literature from these areas.

According to the most recent morphological studies there are two species (*S. leucodon* (Nordmann, 1840) and *S. ehrenbergi* Nehring, 1898) and nine subspecies (*S. I. nehringi* Satunin, 1898; *S. I. armeniacus* Mehely, 1909; *S. I. cilicicus* Mehely, 1909; *S. I. anatolicus* Mehely, 1909; *S. I. turcicus* Mehely, 1909; *S. I. tuncelicus* Coşkun, 1996; *S. I. nevoi* Coşkun, 1996; *S. e. intermedius* Nehring, 1898, and *S. e. kirgisorum* Nehring, 1898) of blind mole rats in Turkey (KIVANÇ 1988; COŞKUN 1996 a, b). However, the results from karyological studies revealed ten karyological forms ($2n = 36, 38, 40, 50, 52, 54, 56, 58, 60$, and 62) of *S. leucodon* and four karyological forms ($2n = 52, 54, 56$, and 58) of *S. ehrenbergi* in Turkey, and the number of chromosome arms (NF) for *S. leucodon* and *S. ehrenbergi* varied from 70 to 84 and from 72 to 90, respectively (SOLDATOVIC and SAVIC 1978; SAVIC and SOLDATOVIC 1979; YÜKSEL 1984; GÜLKAÇ and YÜKSEL 1989; YÜKSEL and GÜLKAÇ 1992, 1995; NEVO et al. 1994, 1995; IVANITSKAYA et al. 1997; SÖZEN and KIVAÇ 1998 a, b; SÖZEN et al. 1999) (Tab. 2). NEVO et al. (1994, 1995) stated that each of the chromosomal forms is a separate biological species. They also examined the populations by using Nei's genetic distance between populations obtained by allozyme electrophoresis and claimed that some populations having identical diploid chromosome numbers are different biological species, presumably representing about 20 such species in Turkey. Later, SÖZEN and KIVANÇ (1998 a, b) and SÖZEN et al. (1999) added 7 karyotypes. These results have increased the total number of alleged biological species of *Spalax* in Turkey to about 30.

The karyotypes of 5 specimens from a site 10 km W of Ardahan, 3 specimens from a site 3 km S of Susuz (Kars), and 3 specimens from a site 20 km E of Erzurum belonging to *Spalax leucodon* were analysed in the present study (Fig. 1, Tab. 1). Chromosome preparations from bone marrow were made in accordance with FORD and HAMERTON (1956), and about 30 metaphase cells from each animal were examined. The karyotype preparations and animals examined were deposited in the Department of Biology, Faculty of Science, University of Ankara.

It was determined that specimens have $2n = 50$ and NF = 72 in all populations examined. The X chromosome is a large-sized metacentric, and the Y chromosome is a small

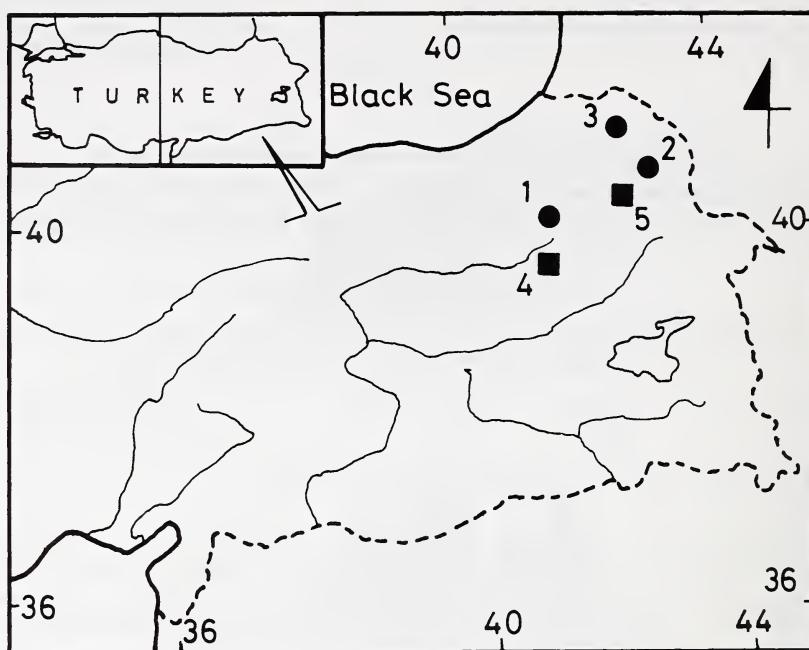


Fig. 1. Geographic distribution of 3 sampling localities (●), and recorded localities (■) by NEVO et al. (1994,1995) in Turkey: 1: 20 km E of Erzurum, 2: 3 km S of Susuz, 3: 10 km W of Ardahan, 4: 80 km S of Erzurum, 5: 14 km W of Sarıkamış.

Table 1. The location and the number of animals examined

<i>Spalax leucodon nehringi</i> Satunin, 1898			
Locality	Male	Female	Total
Erzurum 20 km E	2	1	3
<i>Spalax leucodon arméniacus</i> Mehely, 1909			
Susuz 3 km S	2	1	3
Ardahan 10 km E	2	3	5

acrocentric. The autosomal set has 6 pairs of meta-submetacentrics, 4 pairs of subtelo-centrics, and 14 pairs of acrocentrics. The same karyotypes were found by NEVO et al. (1994,1995) in specimens from a site 80 km S of Erzurum and 14 km W of Sarikamış (Fig. 1, Tab. 2).

KIVANÇ (1988) classified the specimens from Ardahan and Susuz as *S. I. arméniacus* and from Erzurum as *S. I. nehringi*. Nevertheless, we determined the karyotype of these populations as belonging to the same karyotypes. This result shows that, as indicated by SAVIC and NEVO (1990), NEVO (1991), NEVO et al. (1994, 1995), the results of morphological studies at the subspecies level require a modern revision based on chromosome and molecular-genetic data, in addition to their morphology, physiology, and behaviour.

Table 2. Chromosomal records of *Spalax leucodon* (Nordmann, 1840) and *Spalax ehrenbergi* Nehring, 1898 from Turkey

* m: metacentric, sm: submetacentric, st: subtelocentric, a: acrocentric

<i>Spalax leucodon</i> (Nordmann 1840)						Reference
Locality	2n	NF	NFa	X	Y	
Bayındır	36	70	—	—	—	SÖZEN et al. (1999)
Baliikesir and İzmir	38	74	70	st	a	NEVO et al. (1994, 1995)
Havran and Selçuk	38	74	70	st*	a	SAVIC and SOLDATOVIC (1979)
Beyşehir	40	72	68	sm	—	NEVO et al. (1994, 1995)
Aydın, Erzurum	50	—	—	—	—	NEVO et al. (1994, 1995)
Sarıkamış	50	72	68	sm	—	NEVO et al. (1994, 1995)
Sebil	52	72	68	sm	a	SÖZEN and KIVANÇ (1998 a)
Bolu and Bingöl	54	—	—	—	—	NEVO et al. (1994, 1995)
Yozgat	54	74	70	sm	st	YÜKSEL and GÜLKAÇ (1995)
Gülek	56	72	68	m	a	SÖZEN and KIVANÇ (1998 a)
Çorlu and Karaevli	56	78	74	sm*	a*	SOLDATOVIC and SAVIC (1978)
Madenköy	58	72	68	sm	a	SÖZEN and KIVANÇ (1998 b)
Denizli, Pınarbaşı	60	—	—	—	—	NEVO et al. (1994, 1995)
Akşehir	60	76	72	sm	st	SÖZEN et al. (1999)
Malatya	60	78	74	sm	a	IVANITSKAYA et al. (1997)
Malatya	60	78	74	sm	a	NEVO et al. (1994, 1995)
Malatya	60	80	76	sm	st	YÜKSEL (1984)
Malatya and Yazihan	60	80	76	sm	st	GÜLKAÇ and YÜKSEL (1989)
Kırşehir, Nevşehir and Kayseri	60	80	76	sm	st	YÜKSEL and GÜLKAÇ (1995)
Arguvan	60	82	78	sm	—	GÜLKAÇ and YÜKSEL (1989)
Ankara	60	82	78	sm	st	SÖZEN et al. (1999)
Afyon	60	82	78	sm	st	SÖZEN et al. (1999)
Burdur	60	84	80	sm	st	SÖZEN et al. (1999)
Kütahya, Afyon, Konya, Sivas, Ankara, Kayseri, Havza, Suşheri	62	—	—	—	—	NEVO et al. (1994, 1995)
Erzurum 20 km E	50	72	68	sm	a	This study
Susuz 3 km S	50	72	68	sm	a	This study
Kars 10 km W	50	72	68	sm	a	This study
<i>Spalax ehrenbergi</i> Nehring, 1998						Reference
Locality	2n	NF	NFa	X	Y	
Kilis	52	74	70	sm	a	SÖZEN et al. (1999)
Birecik, Siverek, Diyarbakır, Elazığ	52	76	72	sm	—	IVANITSKAYA et al. (1997)
Diyarbakır, Urfa	52	76	72	—	—	NEVO et al. (1994, 1995)
Elazığ	52	76	72	sm	st	YÜKSEL (1984)
Adıyaman, Hilvan	52	76	72	m*	st	YÜKSEL and GÜLKAÇ (1992)
Urfa	52	80	76	sm	—	IVANITSKAYA et al. (1997)
Suruç	54	76	72	m	st	YÜKSEL and GÜLKAÇ (1992)
Tarsus	56	72	68	—	—	NEVO et al. (1994, 1995)
Tarsus	56	72	68	m	—	IVANITSKAYA et al. (1997)
Gaziantep	56	82	78	sm	—	IVANITSKAYA et al. (1997)
Gaziantep	56	90	86	m	st	YÜKSEL and GÜLKAÇ (1992)
Gaziantep	58	82	78	—	—	NEVO et al. (1994, 1995)

References

- CORBET, G. B. (1978): The Mammals of the Palearctic Region: A Taxonomic Review. London: British Museum (Natural History).
- ÇOKSUN, Y. (1996 a): A new subspecies of *Spalax nehringi* (Satunin, 1898) (Rodentia: Spalacidae) from Turkey. *SäugetierkdL Mitt.* **37**, 103–109.
- ÇOKSUN, Y. (1996 b): *Spalax nehringi nevoi*, a new mole rat from southeast Anatolia, Turkey (Rodentia: Spalacidae). *SäugetierkdL Mitt.* **38**, 135–142.
- FORD, C. E.; HAMERTON, J. L. (1956): A colchicine hypotonic citrate, squash for mammalian chromosomes. *Stain Technol.* **31**, 247–251.
- GÜLKAÇ M. D.; YÜKSEL, E. (1989): Malatya yöresi kör fareleri (Rodentia: Spalacidae) üzerine sitogenetik bir inceleme. *Doğa Tu. Biyol. D.* **13**, 63–71.
- HARRISON, D. L BATES, P. J. J. (1991): The Mammals of Arabia. Kent, England: Harr. Zool. Mus.
- IVANITSKAYA, E.; ÇOKSUN, Y.; NEVO, E. (1997): Banded karyotypes of mole rats (*Spalax*, Spalacidae, Rodentia) from Turkey: a comparative analysis. *J Zool. Syst. Evol. Res.* **35**, 171–177.
- KİVANÇ, E. (1988): Türkiye *Spalax*'larının Coğrafik Varyasyonları. Ankara: 72, Teksir-Daktilo-Fotokopi Press.
- LAY, D. M.; NADLER, C. F. (1972): Cytogenetics and origin of North African *Spalax* (Rodentia: Spalacidae). *Cytogenetics* **11**, 279–285.
- NEVO, E. (1991): Evolutionary theory and processes of active speciation and adaptive radiation in subterranean mole rats, *Spalax ehrenbergi* superspecies in Israel. *Evol. Biol.* **25**, 1–125.
- NEVO, E.; FILIPPUCCI, M. G.; REDI, C.; KOROL, A.; BEILES, A. (1994): Chromosomal speciation and adaptive radiation of mole rats in Asia Minor correlated with increased ecological stress. *Proc. Natl. Acad. Sci. USA* **91**, 8160–8164.
- NEVO, E.; FILIPPUCCI, M. G.; REDI, C.; SIMSON, S.; HETH, G.; BEILES, A. (1995): Karyotype and genetic evolution in speciation of subterranean mole rats of the genus *Spalax* in Turkey. *Biol. J. Linnean Soc.* **54**, 203–229.
- OGNEV, S. I. (1947): Mammals of the U.S.S.R. and Adjacent Countries. Vol. V. Rodents. Moskova: Izdatel'stvo Akademii Nauk.
- ONDRIAS, J. C. (1966): The taxonomy and geographical distribution of the rodents of Greece. *SäugetierkdL Mitt.* **14**, 1–136.
- SAVIC, I.; NEVO, E. (1990): The Spalacidae: Evolutionary history, speciation, and population biology. In: Evolution of Subterranean Mammals at the Organismal and Molecular Levels. Ed. By E. NEVO and O. A. REIG. New York: Alan R. Liss. Pp. 129–143.
- SAVIC, I.; SOLDATOVIC, B. (1979): Contribution to the knowledge of the genus *Spalax* (*Microspalax*) karyotype from Asia minor. *Arh. biol. nauka. Beograd* **31**, 1–2.
- SOLDATOVIC, B.; SAVIC, I. (1978): Karyotypes in some populations of the genus *Spalax* (*Mesospalax*) in Bulgaria and Turkey. *SäugetierkdL Mitt.* **26**, 252–256.
- SÖZEN, M.; KİVANÇ, E. (1998 a): Two new karyotypic forms of *Spalax leucodon* (Nordmann, 1840) (Mammalia: Rodentia) from Turkey. *Z. Säugetierkunde* **63**, 307–310.
- SÖZEN, M.; KİVANÇ, E. (1998 b): A new karyotype of *Spalax leucodon cilicicus* Mehely, 1909 (Mammalia: Rodentia) from type locality in Turkey. *Isr. J. Zool.* **44**, 53–56.
- SÖZEN, M.; ÇOLAK, E.; YİĞİT, N.; ÖZKURT, Ş.; VERİMLI, R. (1999): Contributions to the karyology and taxonomy of the genus *Spalax* Güldenstaedt, 1770 (Mammalia: Rodentia) in Turkey. *Z. Säugetierkunde* **64**, 210–219.
- YÜKSEL, E. (1984): Cytogenetic study in *Spalax* (Rodentia: Spalacidae) from Turkey. *Communications, C: Biologie* **2**, 1–12.
- YÜKSEL, E.; GÜLKAÇ, M. D. (1992): On the karyotypes in some populations of the subterranean Mole Rats in the Lower Euphrates Basin, Turkey. *Caryologia* **45**, 175–190.
- YÜKSEL, E.; GÜLKAÇ, M. D. (1995): Kızılırmak Havzası Kayseri – Kirşehir – Nevşehir – Yozgat Kesimi *Spalax* populasyonları üzerine Sitolojik İncelemeler. Ankara: TBAG-904 Tübıtak press.

Authors' addresses: MUSTAFA SÖZEN Department of Biology, Faculty of Science-Art, University of Zonguldak Karaelmas, 67100 İncivez, Zonguldak, Turkey
 (e-mail: spalaxtr@hotmail.com); ERCÜMET ÇOLAK and NURI YİĞİT Department of Biology, Faculty of Science, University of Ankara, 06100 Beşevler Ankara, Turkey

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Mammalian Biology \(früher Zeitschrift für Säugetierkunde\)](#)

Jahr/Year: 2000

Band/Volume: [65](#)

Autor(en)/Author(s): Sözen M., Colak Ercüment, Yigit N.

Artikel/Article: [Contributions to the karyology and taxonomy of *Spalax leucodon* nehringi Satunin, 1898 and *Spalax leucodon armeniacus* Mehely, 1909 \(Mammalia: Rodentia\) in Turkey 309-312](#)