

KARYOLOGY OF THREE VESPERTILIONID BATS
(CHIROPTERA: VESPERTILIONIDAE) FROM TURKEY

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The karyotypes of three vespertilionid bat species from Turkey were examined. The karyotypes of *Eptesicus serotinus* and *Eptesicus bottae* were found to be identical in diploid number (2n) and fundamental number of chromosomal arms (NF) with 2n = 50, NF = 52 and NFa = 48. The karyotypes were found as 2n = 42, NF = 54, and NFa = 50 for *Nyctalus noctula*. The karyological characteristics of *E. bottae anatolicus* and *N. noctula* were studied for the first time from Turkey.

Keywords: Chiroptera, *Eptesicus serotinus*, *Eptesicus bottae*, *Nyctalus noctula*, karyotype, Turkey

INTRODUCTION

According to the most recent taxonomical studies, there are 37 species of bats in Turkey (KOOPMAN 1994, BENDA & HORÁČEK 1998, SACHANOWICZ *et al.* 1999, HORÁČEK *et al.* 2000, SPITZENBERGER *et al.* 2003, BENDA *et al.* 2003, JUSTE *et al.* 2004, BENDA & KARATAŞ 2005). To date, karyotypes of *Eptesicus bottae* and *Nyctalus noctula* have not been examined in Turkey. There is no information on the karyology of *E. b. anatolicus* in all the distributional area. On the other hand, karyology of the *Eptesicus serotinus* from Turkmenistan has been studied (VORONTSOV *et al.* 1969), Poland (FEDYK & FEDYK 1970, FEDYK & RUPRECHT 1983), Tunisia (BAKER *et al.* 1975), Azerbaijan (FATTAEV 1978), former Czechoslovakia (ZIMA 1978), Greece (VOLLETH 1987), Kyrgyzstan (ZIMA *et al.* 1991), Turkey (AŞAN 2001) and Taiwan (LIN *et al.* 2002); *E. bottae* from Kyrgyzstan (ZIMA *et al.* 1989), *N. noctula* from former Yugoslavia (ĐULIČ *et al.* 1967), former Czechoslovakia (ZIMA 1978), former USSR (VORONTSOV *et al.* 1969), Germany (VOLLETH 1987, 1992).

E. serotinus is distributed in almost all regions of Turkey (SPITZENBERGER 1994, BENDA & HORÁČEK 1998, KARATAŞ 2000). But there are only a few distributional records of *N. noctula* from Mersin and the European part of Turkey (BENDA & HORÁČEK 1998). Additionally, *E. bottae* is commonly restricted to the Turkish Mediterranean coasts (SPITZENBERGER 1994, KARATAŞ 2000).

In addition to traditional taxonomical studies of morphological characteristics, karyological comparisons can also provide very useful data on phylogenetic and taxonomic problems (VOLLETH *et al.* 2001), that is why the karyological characteristics of *Eptesicus serotinus*, *E. bottae anatolicus*, and *Nyctalus noctula* were determined.

MATERIAL AND METHODS

Bat specimens (N = 12) were captured by using mistnet and handnet from five localities (Alanya, Demirköy, İzmit, Silifke, Zonguldak) in Turkey between 2001 and 2004 (Fig. 1) and were examined with respect to karyological characteristics.

Conventional stained chromosomes of specimens were examined according to standard procedures. By examining the photographs of about 20–30 metaphase cells of each animal, the diploid number of chromosomes (2n), the fundamental number of chromosomal arms (NF) and the number of autosomal arms (NFa) were determined along with metacentrics, submetacentrics, subtelocentrics and acrocentrics with respect to centromere positions.

All specimens were skinned in the standard museum format, their skins, skulls and karyotype preparations have been deposited at the Department of Biology, Niğde University (ZDNU).

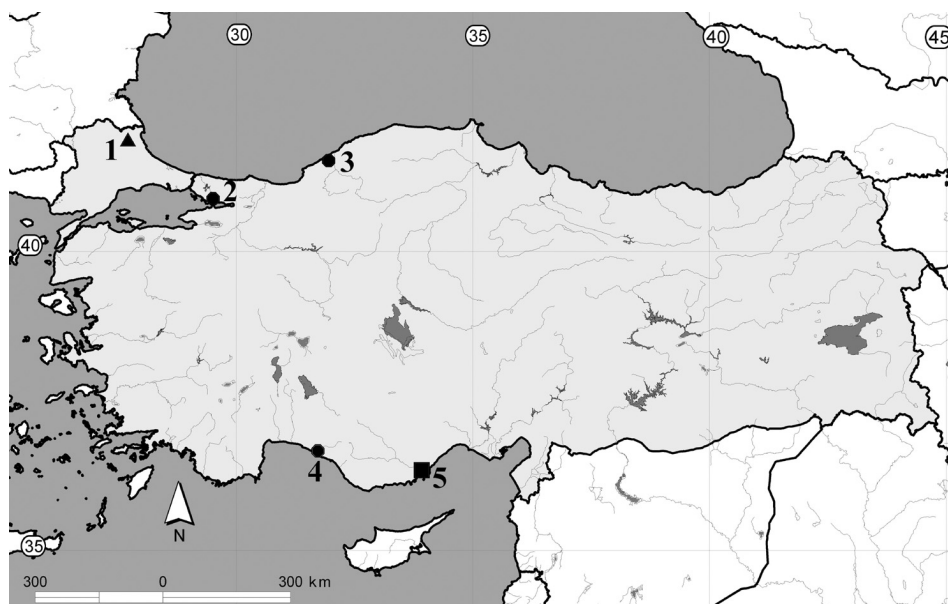


Fig. 1. Map of localities studied in Turkey: 1 = Demirköy (Kırklareli), 2 = Gebze (Kocaeli), 3 = Sofular (Zonguldak), 4 = Alanya (Antalya), 5 = Silifke (Mersin). *Eptesicus serotinus* (●), *E. bottae anatolicus* (■), *Nyctalus noctula* (▲)

RESULTS

Eptesicus serotinus (SCHREBER, 1774)

Karyotype: The karyotype of the species consisted of $2n = 50$ and $NF = 52$. Since the specimens examined were females, we could not determined sex chromosomes directly, however, it is most likely that bi-armed chromosomes are X chromosomes. In this case, the NFa value is 48. Autosomal chromosomes are acrocentrics, but, two pairs are dot-like (Fig. 2).

Specimens examined: Antalya: Alanya, Çakallar Village: Alarahan Caravanserai; 08.VII.1998: 6 ♀♀ (ZDNU 1998/07, -08, -10, -14, -15, -18); Kocaeli: Gebze, Tavşanlı Village, Ballıkayalar Natural Park, 30/31.VIII.2004: 1 ♂ (ZDNU 2004/277); Zonguldak: Sofular Village, Sofular Cave, 13.IX.2001: 1 ♀ (ZDNU 2001/158); 09/10.VIII.2004: 2 ♀♀ (ZDNU 2004/298).

Eptesicus bottae anatolicus FELTEN, 1971

Karyotype: The species had a karyotype of $2n = 50$, $NF = 52$ and $NFa = 48$. All of the autosomal chromosomes are acrocentrics, the two smallest of which are

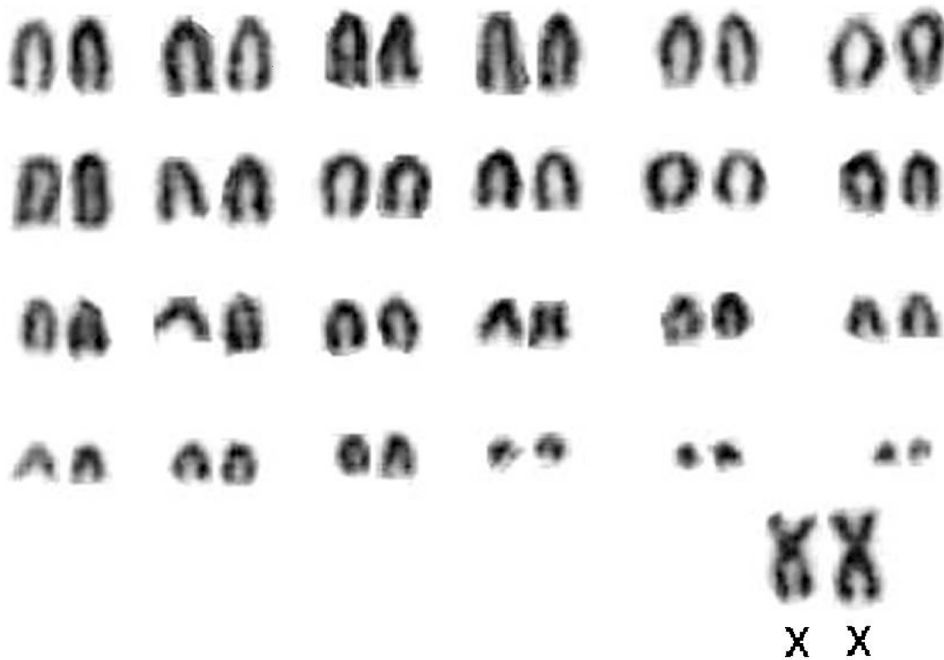


Fig. 2. Karyotype of a female *E. serotinus* from Gebze ($2n = 50$, $NFa = 48$)

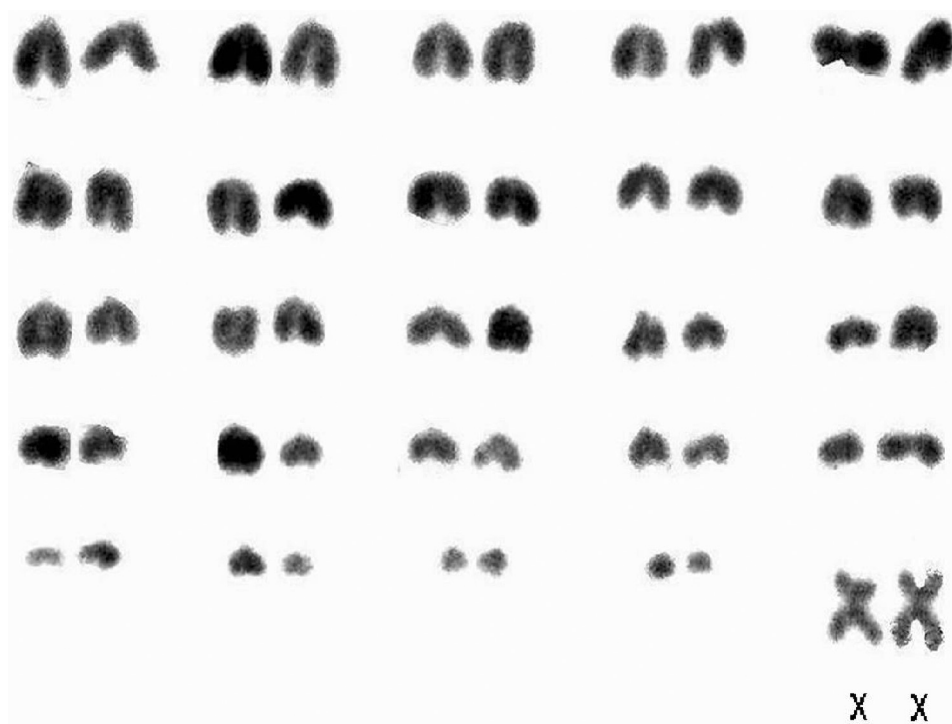


Fig. 3. Karyotype of a female *E. bottae anatolicus* from Silifke ($2n = 50$, $NFa = 48$)



Fig. 4. Karyotype of a male *N. noctula* from Demirköy ($2n = 42$, $NFa = 50$)

Table 1. A comparison of the chromosomal data for the species examined. (M/Sm: meta-submetacentric, M: metacentric, Sm: submetacentric, St: subtelocentric, A: acrocentric, D_M: dot-like metacentric, D_A: dot-like acrocentric)

Species/subspecies	2n	M/Sm	St	A	D _M	D _A	NF _a	X	Y	Reference
<i>E. serotinus</i>	50	–	–	44	–	4	48	Sm	?	Tunisia (BAKER <i>et al.</i> 1975)
	50	–	–	48	–	–	48	Sm	A	Azerbaijan (FATTAEV 1978)
	50	–	–	48	–	–	48	Sm	D _A	S Kyrgyzstan (ZIMA <i>et al.</i> 1991)
<i>E. s. serotinus</i>	50	–	–	48	–	–	48	Sm	M	Poland (FEDYK & FEDYK 1970)
	50	–	–	44	2	2	50	Sm	A	former Czechoslovakia (ZIMA 1978)
	50	–	–	48	–	–	48	Sm	M	Poland (FEDYK & RUPRECHT 1983)
	50	–	–	48	–	–	–	?	?	Greece (VOLLETH 1987)
	50	–	2	46	–	–	50	Sm	A	Turkey (AŞAN 2001)
	50	–	–	44	–	4	48	M	?	This study
	50	–	–	44	–	4	48	Sm	A	Turkmenistan (VORONTSOV <i>et al.</i> 1969)
<i>E. s. horikawai</i>	50	–	–	48	–	–	48	Sm	A	Taiwan (LIN <i>et al.</i> 2002)
<i>E. bottae</i>	50	–	–	48	–	–	48	M	?	Kyrgyzstan (ZIMA <i>et al.</i> 1989)
<i>E. b. anatolicus</i>	50	–	–	48	–	4	48	M	?	This study
<i>Nyctalus noctula</i>	42	8	2	26	–	4	50	M	Sm	former Yugoslavia (ĐULIČ <i>et al.</i> 1967)
	42	8	2	26	–	4	50	M	D _A	former USSR (VORONTSOV <i>et al.</i> 1969)
	42	8	2	26	–	4	50	M	D _A	former Czechoslovakia (ZIMA 1978)
	42	10	–	30	–	–	50	M	D _A	Germany (VOLLETH 1987, 1992)
	42	10	–	26	–	4	50	M	D _A	this study

dot-like and the X chromosome is medium-sized metacentric. The morphology of chromosomes is identical with that of *E. serotinus* (Fig. 3).

Specimen examined: Mersin: Silifke, Silifke Castle, 21.VII.2002: 1 ♀ (ZDNU 2002/101).

Nyctalus noctula (SCHREBER, 1774)

Karyotype: The karyotype of the species was found as 2n = 42, NF = 54, and NFa = 50. The X chromosome is a medium-sized submetacentric, and the Y chro-

mosome is dot-like acrocentric. The autosomal set consists of four pairs of metacentric, one pair of submetacentric and 15 pairs of acrocentric, the two smallest of which are dot-like (Fig. 4).

Specimen examined: Kırklareli: Demirköy, Balaban Stream, Velika (Balaban) Bridge, 06.VIII.2004: 1 ♂ (ZDNU 2004/287).

DISCUSSION

The karyological characteristics of *E. serotinus* from Turkey were studied by AŞAN (2001) and determined as being $2n = 50$, $NFa = 50$ and having one subtelocentric autosomal pair. However, it was found in the present study that the karyotypes of *E. serotinus* from Alanya (Antalya), Gebze (Kocaeli), and Zonguldak did not contain this subtelocentric autosomal pair. Our result is consistent with the results of BAKER *et al.* (1975) from Tunisia; FATTAEV (1978) from Azerbaijan; ZIMA *et al.* (1991) from S Kyrgyzstan; FEDYK & FEDYK (1970), and FEDYK & RUPRECHT (1983) from Poland; VOLLETH (1987) from Greece; VORONTSOV *et al.* (1969) from Turkmenistan and LIN *et al.* (2002) from Taiwan (Table 1). These results show that $2n = 50$, $NFa = 50$ form of *E. serotinus* is common from Europe to Taiwan. *E. serotinus* is widely distributed in Turkey and specimens from Antalya, Kocaeli, and Zonguldak were studied here.

The karyotype of *E. bottae* from central Asia was studied by ZIMA *et al.* (1989). The results of the present study from Anatolia are consistent with S Kyrgyzstan (Table 1). The diploid chromosomes and the number of chromosomal arms of each of these populations were $2n = 50$, $NFa = 48$. Since males were not available, the Y chromosome could not be determined in the present study directly, and the bi-armed pair accepted as X chromosomes.

The distribution of *E. bottae anatolicus* in Anatolia is commonly restricted to the Mediterranean parts of Turkey. The karyotype of the species from Turkey was first described in the present study using a single specimen from Silifke (Mersin).

N. noctula has been karyotyped from the countries presented in Table 1. The results described here were consistent with the result of VOLLETH (1987, 1992) from Germany and ĐULIČ *et al.* (1967) from former Yugoslavia in $2n$ and NFa values, but different from that of others in NFa value (Table 1). On the other hand, there are differences in the shape of the X and Y chromosomes. The distributional records of this species were also very rare and restricted to Thrace (see BENDA & HORÁČEK 1998) and Tarsus (OSBORN 1963) in Turkey. The specimen karyotyped here was collected from Demirköy, and was an important contribution to the distributional records of this species.

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