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Karyology of three bat species of the genus *Myotis* (*M. myotis*, *M. bechsteinii*, *M. brandtii*) (Chiroptera: Vespertilionidae) from Turkey

by Ahmet Karataş, Mustafa Sözen, Şakir Özkurt and Ferhat Matur

Abstract. The karyotypes of three vespertilionid bat species from Turkey were examined. The karyotypes of these species were found as $2n = 44$, $NF = 54$ and $NFa = 50$ for *Myotis myotis*; $2n = 42$, $NF = 50$, and $NFa = 46$ for *Myotis bechsteinii*; $2n = 44$, $NF = 54$, and $NFa = 50$ for *Myotis brandtii*. The *M. brandtii* karyotype of was studied for the first time for Turkey. Further details on the karyotype of *M. bechsteinii*, which had been described previously, are given.

Kurzfassung. Die Karyotypen von drei Fledermausarten aus der Familie der Vespertilionidae werden aus der Türkei beschrieben. Für *Myotis myotis* wurde die Chromosomenzahl zu $2n = 44$, $NF = 54$ und $NFa = 50$ ermittelt, für *Myotis bechsteinii* $2n = 42$, $NF = 50$ und $NFa = 46$ sowie für *Myotis brandtii* $2n = 44$, $NF = 54$ und $NFa = 50$. Der Karyotyp von *M. brandtii* wurde erstmals für die Türkei untersucht. Zum Karyotyp von *M. bechsteinii*, der zuvor schon beschrieben worden war, werden weitere Einzelheiten mitgeteilt.

Key words. *Myotis myotis*, *Myotis bechsteinii*, *Myotis brandtii*, karyology, Chiroptera, Vespertilionidae, Turkey.

Introduction

The genus *Myotis* is represented with 11 species in Turkey (BENDA & HORÁČEK 1998, BENDA & KARATAŞ 2005). Of these, Brandt's Whiskered Bat, *Myotis brandtii*, is one of the rarest species in Turkey and has been recorded only in two localities in north-eastern and central Anatolia (BENDA & KARATAŞ 2005). Data on its chromosome complements have been reported by several authors previously only from the former Czechoslovakia (ZIMA 1976, 1982, VOLLETH 1987).

M. myotis is distributed throughout Turkey (SPITZENBERGER 1996, BENDA & HORÁČEK 1998, KARATAŞ et al. 2004). Its karyology has been studied in Switzerland (BOVEY 1949), Italy (CAPANNA et al. 1968), Spain (VALENCIUC & TEODORESCUS 1972), the former Yugoslavia (BICKHAM & HAFNER 1978), Greece (ILIOPOULOU-GEORGUDAKI & GIAGIA 1984) and Anatolia (KARATAŞ et al. 2004).

On the other hand, there are only a few distribution records for *M. bechsteinii*; it has been recorded only in Antalya, Artvin, İstanbul and Kırklareli provinces (HELVERSEN 1989, BENDA & HORÁČEK 1998). Its karyotype was recorded in the former Czechoslovakia (ZIMA 1978), southern Turkey and Europe (VOLLETH 1987). The karyotype of *M. brandtii* has been recorded in the former Czechoslovakia (ZIMA 1976, 1982).

In addition to traditional taxonomical studies of morphological characteristics, karyologi-

cal comparisons can also provide very useful data on phylogenetic and taxonomic problems (VOLLETH et al. 2001). The aim of the study is therefore to compare the three species *Myotis myotis*, *M. bechsteinii* and *M. brandtii* in Turkey from a karyological point of view.

Material and methods

Bat specimens were captured with a mist net and hand net at three localities in Turkey between 2001 and 2005. Localities and sample size of animals examined are as follows: *Myotis myotis*: Ankara prov.: Kızılcahamam, River Kirmir (40°19'N, 32°42'E), 12.ix.2001: 1 ad. ♂ (ZDNU 2001/156); – *M. bechsteinii*: Zonguldak prov.: Sofular Village (41°26'N, 31°57'E), 9/10.viii.2004: 1 ad. ♂ (ZDNU 2004/295); – *M. brandtii*: Rize prov.: Çamlıhemşin, Çat Village (2290 m a.s.l.) (40°51'N, 40°56'E), 8.viii.2005: 2 subad. ♀ (ZDNU 2005/76-77).

Staining and examination of chromosomes was done in accordance with 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. The skins, skulls and karyotype preparations have been deposited at the Department of Biology, Niğde University (ZDNU).

Results and discussion

Myotis brandtii (Eversmann, 1845)

The karyotype of *M. brandtii* was established as $2n = 44$ and $NFa = 50$. The X chromosome is small-sized metacentric. The autosomal set consists of four pairs of metacentric and 17 pairs of acrocentric chromosomes (Fig. 1). The karyotype studied here from Çat village in Turkey was consistent with the results from other parts of its distribution range (Tab. 1). *M. brandtii* is one of the rarest bat species in Turkey and had been known previously from only one locality in northeastern Anatolia. It was recently recorded from a second locality in Yozgat province in central Anatolia (BENDA & KARATAŞ 2005).

Myotis myotis (Borkhausen, 1797)

The karyotype of the species was composed of 44 chromosomes (2n). The number of autosomal arms (NFa) is 50, the number fundamental (NF) is 54, the X chromosome is medium-sized metacentric, and the Y chromosome is a dot-like acrocentric. The autosomal set can be divided into two groups: four pairs of metacentric, 17 pairs of acrocentric (Fig. 3).

The karyotype of *M. myotis* studied here from Kızılcahamam in Turkey was consistent with the results presented in Tab. 1 in BAKER (1970) and ZIMA (1978) that have different NFa values.

Myotis bechsteinii (Kuhl, 1817)

The karyotype was $2n = 42$, $NF = 50$, and $Nfa = 46$. The X chromosome is a large-sized metacentric, and the Y chromosome is dot-like acrocentric. The autosomal set consists of three pairs of metacentric and 17 pairs of acrocentric (Fig. 4).

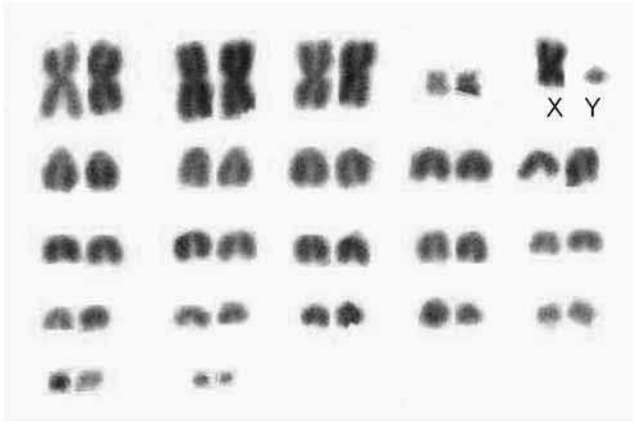


Fig. 1. Karyotype of a male *Myotis myotis* from Kızılcahaman ($2n = 44$, $NFa = 54$).

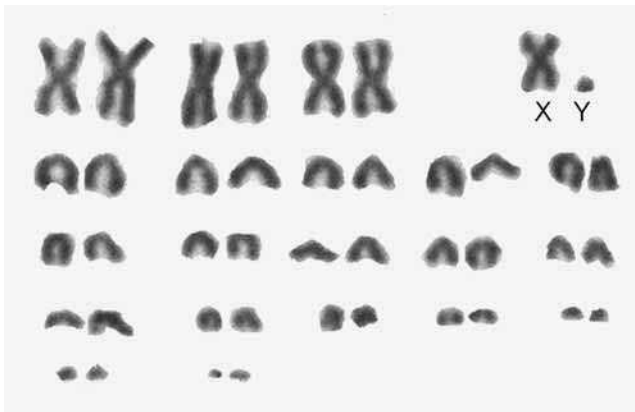


Fig. 2. Karyotype of a male *Myotis bechsteinii* from Zonguldak ($2n = 42$, $NFa = 46$).



Fig. 3. Karyotype of a female *Myotis brandtii* from Çat village in Çamlılıhemşin ($2n = 44$, $NFa = 50$).

Tab. 1. Comparison of the chromosomal data for the *Myotis* species examined in the study. M/Sm: meta-submetacentric, M: metacentric, Sm: submetacentric, St: subtelocentric, A: acrocentric, D_M: dot-like metacentric, D_A: dot-like acrocentric.

Species	2n	M/Sm	A	D _M	D _A	NF _a	X	Y	References
<i>M. bechsteinii</i>	44	8	30	2	2	52	M	D _A	former Czechoslovakia (ZIMA 1978)
	44								Turkey (Antalya) (VOLLETH 1987)
	42	6	34			46	M	D _A	This study
<i>M. myotis</i>	44	8	34			50	M	D _A	Switzerland (BOVEY 1949); Italy (CAPANNA et al., 1968); Spain (VALENCIUC & TEODORESCUS 1972); former Yugoslavia (BICKHAM & HAFNER 1978); Greece (LIOPOULOU-GEORGUDAKI & GIAGIA 1984); Turkey (KARATAŞ et al. 2004)
	44	10	32			52	M	A	Tunisia (BAKER 1970); former Czechoslovakia (ZIMA 1978)
	44	8	34			50	M	D _A	This study
	44	8	30	2	2	50	M	A	former Czechoslovakia (ZIMA 1976, 1982)
<i>M. brandtii</i>	44	8	30	2	2	50	M	A	Europe (VOLLETH 1987)
	44						M	A	This study
	44	8	34			50	M	–	This study

This karyotype appears typical of representatives of the same *Myotis*, which are characterised by $2n = 44$ and with the unarmed chromosome pair as the largest easily recognisable element of the complement (ZIMA 1976, ZIMA & KRÁL 1984).

M. bechsteinii has only been karyotyped from Czechoslovakia by ZIMA (1978) and from Antalya (Turkey) by VOLLETH (1987). The karyotype referred to by ZIMA (1978) differs from ours in $2n$ and NF_a values (Tab. 1). The karyotype referred to by VOLLETH (1987) from Turkey (Antalya), included only the $2n$ value and its $2n$ value differs from that in our material. Additionally, the NF_a value of the specimen from Antalya is not made clear in the latter publication. This result shows that two different karyological forms of *M. bechsteinii* are to be found in Turkey. There are only a few records of this species in Turkey: it was found previously only in Thrace (European part of Turkey) (BENDA & HORÁČEK 1998), Antalya province (HELVERSESEN 1989) and Artvin province (KARATAŞ, unpubl.). The specimen karyotyped here was collected from the Sofular Cave in Zonguldak. This is the first record of the species from northern Anatolia.

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