

Karyotypes of Two Iranian Bat Species, *Myotis blythii* and *Miniopterus schreibersii* (Chiroptera: Vespertilionidae, Miniopteridae)

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Abstract: The karyotypes of 2 bat species from Iran were examined. The diploid number of chromosomes (2n) and the fundamental numbers of chromosomal arms (NFa) were determined to be 2n = 44 and NFa = 54 for *Myotis blythii* and 2n = 46 and NFa = 50 for *Miniopterus schreibersii*, respectively. The karyotypes of Iranian bats show similarity within populations in other countries with respect to the diploid chromosome numbers; however, they are quite different in the fundamental chromosome numbers and the numbers of autosomal arms.

Key Words: Karyology, *Myotis blythii*, *Miniopterus schreibersii*, Vespertilionidae, Miniopteridae, Chiroptera, Iran

İran'dan İki Yarasa, *Myotis blythii* ve *Miniopterus schreibersii*, (Chiroptera: Vespertilionidae, Miniopteridae)'nın Karyotipleri

Özet: Vespertilionidae familyasından İran'dan iki yarasa türünün karyotipi incelenmiştir. Diploid kromozom sayıları (2n) ve otozomların temel kol sayıları (NFa), *Myotis blythii*'de 2n = 44, NFa = 54 ve *Miniopterus schreibersii* için de 2n = 46 ve NFa = 50 olduğu belirlenmiştir. Bu karyolojik analizler İran'dan ilk kez yapılmıştır. Diploid kromozom sayıları dikkate alındığında, İran'dan olan bu yarasaların karyotipleri, diğer ülkelerdeki popülasyonlarında yapılanlarla benzerlik göstermektedir. Ancak kromozom kol sayıları ve dolayısıyla otozom kol sayılarında biraz farklılıklara rastlanmaktadır.

Anahtar Sözcükler: Karyoloji, *Myotis blythii*, *Miniopterus schreibersii*, Vespertilionidae, Miniopteridae, Chiroptera, İran

Introduction

Although Iran occupies an important area of the Middle East, little information on the Iranian bat fauna (especially their karyotypes) is available. We did not find any karyological paper concerning Iranian bats except for that by Karataş et al. (2006). Here, we present a second paper on the karyology of Iranian bats. However, the karyotypes of *Myotis blythii* and *Miniopterus schreibersii* have been obtained from various countries (Bovey, 1949; Capanna and Civitelli, 1965; Vorontsov et al., 1969; Radjabli et al., 1970; Valenciuc and Teodorescu, 1972; Baker et al., 1974; Kuliev and Fattaev, 1975; Bickham and Hafner, 1978; Fattaev, 1978; Zima, 1978; Zima and Horáček, 1984; Pérez-Suárez et al., 1991; Volleth and Heller, 1994; Karataş and Sözen, 2004; Karataş et al., 2004) (see Table for details).

In addition to traditional taxonomical studies of morphological characteristics, karyological comparisons could also provide very useful data on phylogenetic relationships (Volleth et al., 2001). Therefore, the aim of this study was to present the karyotypic data on *Myotis blythii* and *Miniopterus schreibersii* from Iran and to compare data obtained with those recorded from other areas in the Palaearctic region.

Materials and Methods

Bat specimens were captured by use of mist-nets and hand-nets at 2 localities in Iran in 2005 and 2006 (Figure 1). They were examined with respect to karyological characteristics. Localities and sample size of animals were examined as follows: *Myotis blythii*: Kirmanshah Prov.,

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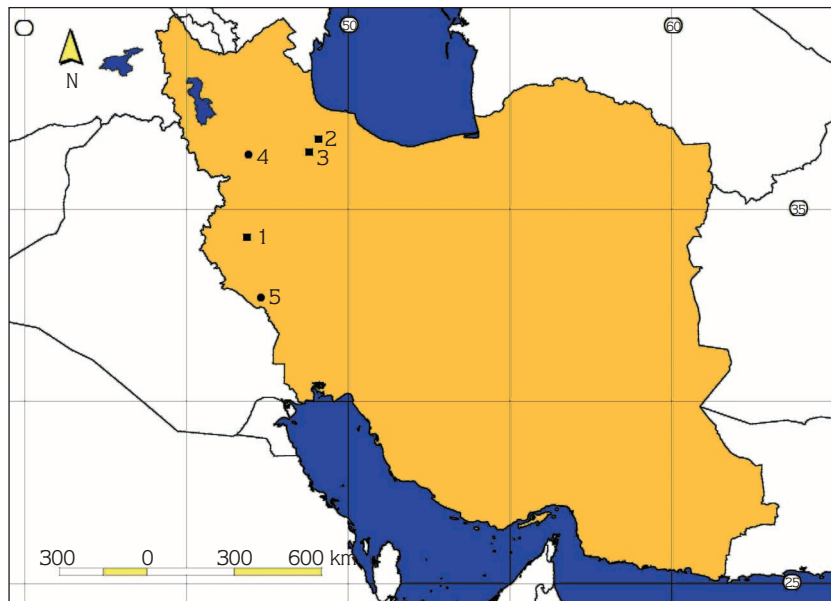


Figure 1. Map of sampling localities of *Myotis blythii* (■) and *Miniopterus schreibersii* (●): 1. Azerbaijan-e Gharbi: Tikab, 2. Ilam: Dehloran, 3. Kirmanshah: Zangolava, 4. Zanjan: Abbar, 5. Sultaniye.

10 km southwest, Zangolava, Mahidasht Cave, 15-20 June 2006: 3 ad. ♀♀ (ZDNU 2006/32, 34, 45); Zanjan Prov.: Abbar, Kızılöz River, 21/22 July 2006: 2 sad. ♀♀; Sultaniye, Kumbet of Molla Hasan Kâshi, 19/20 July 2006: 1 ad. ♂ (ZDNU 2006/67) – *Miniopterus schreibersii*, Azerbaijan-e Gharbi Prov., 25 km to Tikab, Karaftu Cave, 9 June 2006: 2 ♀♀ (ZDNU 2006/33, 40); Ilam Prov., Dehloran, Sarin Ab-Garma Cave, 25 July 2006: 1 ♀ (ZDNU 2006/78) (Figure 1).

Conventional stained chromosomes of specimens were karyotyped based on the colchicine hypotonic citrate technique described by Ford and Hamerton (1956). By examining the photographs of about 20-30 metaphase cells of each specimen, 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, and acrocentrics with respect to centromere positions. All the respective specimens were skinned in the standard museum way, and their skins, skulls, and karyotype preparations have been deposited at the Department of Biology, Niğde University (Turkey) (ZDNU).

Results and Discussion

Myotis blythii (Tomes, 1857)

The karyotype of 3 females from Iran was found to be $2n = 44$, NFa = 50, and NF = 54. The autosomal chromosomes comprised 3 pairs of large metacentrics and 1 pair of middle sized metacentrics. The autosomal set consisted of 14 pairs of medium sized acrocentrics and of 3 pairs of small acrocentrics. The X chromosome was a medium sized submetacentric and the Y chromosome an acrocentric (Figure 2).

The diploid number of chromosomes of *M. blythii* is stable ($2n = 44$). However, the fundamental numbers of autosomes (NFa) range from 50 to 54. Our results mentioned above support those given from Romania by Valenciuc and Teodorescu (1972), former Yugoslavia by Bickham and Hafner (1978), Spain by Pérez-Suárez et al. (1991), and Turkey by Karataş et al. (2004) (Table). On the other hand, Radjabli et al. (1970) from Turkmenistan, Kuliev and Fattaev (1975) and Fattaev (1978) from Azerbaijan, and Zima (1978) from the former Czechoslovakia reported the same diploid chromosome numbers; however, they were quite

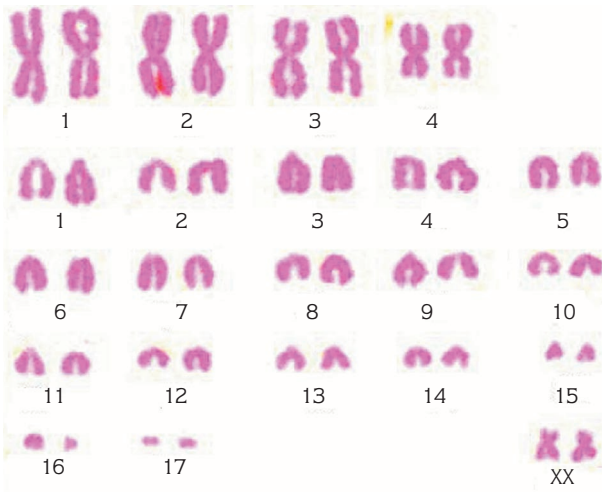


Figure 2. Karyotypic plate of a female *Myotis blythii* from Iran (2n = 44, NF = 54).

different in terms of NFa (50 to 54) and NF (54 to 58) values. One pair of 2 small chromosomes was determined as biarmed (NFa = 52) (Radjabli et al., 1970; Zima, 1978) or both of them as metacentric (NFa = 54) (Kuliev and Fattaev, 1975; Fattaev, 1978). In the present study, these chromosomes were acrocentric (Table).

***Miniopterus schreibersii* (Kuhl, 1817)**

The karyotype of 6 long-winged bats from Iran was determined to be 2n = 46, NFa = 50, and NF = 54. The autosomal set contains 2 pairs of large metacentric, 1

pair of medium sized metacentric, and 19 pairs of acrocentric chromosomes. The acrocentrics could be divided into 3 groups: 7 pairs are medium sized, 10 pairs are small, and 2 pairs are dot-like. The X chromosome was a large sized metacentric and the Y chromosome was not determined since all the specimens examined were female (Figure 3).

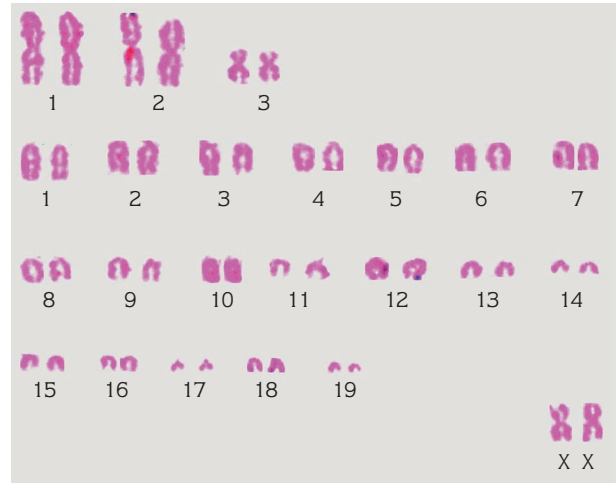


Figure 2. Karyotypic plate of a female *Myotis blythii* from Iran (2n = 44, NF = 54).

The karyology of *M. schreibersii* has been studied in various countries (Table). This is the first description of the karyotype of *M. schreibersii* in Iran. The karyotype of

Table. Karyotypic records of *Myotis blythii* and *Miniopterus schreibersii* (M: meta-/submetacentric, A: acrocentric (incl. dot-like) in different parts of their distribution range; (1) Bovey (1949); (2) Capanna and Civitelli (1965); (3) Vorontsov et al. (1969); (4) Radjabli et al. (1970); (5) Valenciu and Teodorescu (1972); (6) Baker et al. (1975); (7) Kuliev and Fattaev (1975) after Zima and Horáček (1984); (8) Bickham and Hafner (1978); (9) Fattaev (1978); (10) Zima (1978); (11) Pérez-Suárez et al. (1991); (12) Volleth and Heller (1994); (13) Karataş et al. (2004); (14) Karataş and Sözen (2004).

Species/Subspecies	2n	M	A	NFa	X	Y	Location and Reference
<i>M. blythii</i>	44	10	32	52	M	A	Turkmenistan (4), former Czechoslovakia (10)
<i>M. blythii</i>	44	8	34	50	M	A	Romania (5), former Yugoslavia (8), Spain (11)
<i>M. blythii</i>	44	12	30	54	M	A	Azerbaijan (7, 9)
<i>M. blythii</i>	44	8	34	50	M	A	Turkey (13)
<i>M. blythii</i>	44	8	34	50	M	-	Iran (this study)
<i>M. s. schreibersii</i>	46	4	40	48	M	-	Switzerland (1)
<i>M. s. schreibersii</i>	46	6	38	50	M	A	Italy (2)
<i>M. s. pallidus</i>	46	6	38	50	M	A	Turkmenistan (3)
<i>M. s. schreibersii</i>	46	6	38	50	M	A	Tunisia (6)
<i>M. s. schreibersii</i>	46	6 (8)	34	50 (52)	M	A	Slovakia (10)
<i>M. s. schreibersii</i>	46	-	-	50	M	A	Azerbaijan (7)
<i>M. s. schreibersii</i>	46	-	-	-	-	-	Greece (12)
<i>M. s. schreibersii</i>	46	4	40	48	M	A	Turkey (14)
<i>M. schreibersii</i>	46	6	38	50	M	A	Iran (this study)

our specimens of *M. schreibersii* from Iran appears to be identical to that reported for specimens from Italy (Capanna and Civitelli, 1965), Turkmenistan (Vorontsov et al., 1969), and Tunisia (Baker et al., 1974). The diploid chromosome values from Switzerland (Bovey, 1949), Slovakia (Zima, 1978), Greece (Volleth and Heller, 1994), and from Anatolia (Karataş and Sözen, 2004) were $2n = 46$, but the number of chromosomal arms (NF) varied between 52 and 56. As described above,

the karyotypic rearrangement in *M. schreibersii* can be explained by the pericentric inversion that may have occurred in each banded autosome of *M. schreibersii*.

References

- Baker, R.J., Davis, B.L., Jordan, R.G. and Binous, A. 1974. Karyotypic and morphometric studies of Tunisian mammals: Bats. *Mammalia*, 38: 696-710.
- Bickham, J.W. and Hafner, J.C. 1978. A chromosomal banding study of three species of vespertilionid bats from Yugoslavia. *Genetica*, 48: 1-3.
- Bovey, R. 1949. Les chromosomes des Chiroptères et des Insectivores. *Rev. suisse Zool.*, 56: 371-460.
- Capanna, E. and Civitelli, M.V. 1965. Cariologia e cariomètria del miniottero (Mammalia – Chiroptera). *Caryologia*, 18: 541-546.
- Fattaev, M.D. 1978. Sravnitel'naja kariologija nekotorych rukokrynych Azerbajdzana. PhD thesis, Institute of Zoology, Baku.
- Ford, G.E. and Hamerton, J.L. 1956. A colchicine hypotonic-citrate, squash sequence for mammalian chromosomes. *Stain Technol.*, 31: 247-254.
- Karataş, A., Gharkheloo, M.M. and Rehnema, M. 2006. Karyotypic characterisation of the Large Horseshoe Bat, *Rhinolophus ferrumequinum* (Schreber, 1774) (Chiroptera: Rhinolophidae) from Iran. *Zoology in the Middle East*, 38: 17-20.
- Karataş, A. and Sözen, M. 2004. Contributions to karyology, distribution and taxonomic status of the Long-winged bat, *Miniopterus schreibersii* (Chiroptera: Vespertilionidae), in Turkey. *Zoology in the Middle East*, 33: 51-64.
- Karataş, A., Yiğit, N., Kankılıç, T. and Çolak, E. 2004. Contribution to the distribution and karyology of some vespertilionid bats (Mammalia: Chiroptera) from Turkey. *Zoology in the Middle East*, 31: 5-12.
- Kuliev, G.K. and Fattaev, M.D. 1975. [Karyological investigation on some species bats from Azerbaidjan] [in Russian], pp. 4-7. In: [Systematics and cytogenetics of mammals. Proceedings Allunion Coll.], Moscow.
- Pérez-Suárez, G., López-Caballero, E.J., De Paz, O., Reina, J.M. and Navlet, J. 1991. Chromosome studies of six species of the genus *Myotis* (Chiroptera: Vespertilionidae) from Spain. In: Mathias, M.L., Santos-Reis, M., Amori, G., Libois, R., Mitchell-Jones, A. and Saint-Girons, M.C. (Eds.), *European Mammals, Proceedings of the First European Congress of Mammalogy, Lisbon, Portugal, March 1991*. Chapman & Hall, Lisbon.
- Radjabli, S.I., Vorontsov, N.N. and Volobuev, V.T. 1970. [The karyological analysis of three *Myotis* species (Chiroptera: Vespertilionidae)] [in Russian]. *Citologija*, 12: 767-773.
- Valenciuc, N. and Teodorescu, F. 1972. Investigation sur le caryotype de Chiroptères: *Myotis myotis* Borkh. et *Myotis oxygnathus* Montic. *An. St. Univ. Iasi*, 18: 351-356.
- Volleth, M., Bronner, G., Göpfert, M.C., Heller, K.G., von Helversen, O. and Yong, H.-S. 2001. Karyotype comparison and phylogenetic relationships of *Pipistrellus*-like bats (Vespertilionidae; Chiroptera; Mammalia). *Chromos. Res.*, 9: 25-46.
- Volleth, M. and Heller, K.G. 1994. Phylogenetic relationships of Vespertilionid genera (Mammalia: Chiroptera) as revealed by karyological analysis. *J. Zool. Syst. & Evol. Res.*, 32: 11-34.
- Vorontsov, N.N., Radjabli, S.I. and Volobuev, V.T. 1969. The comparative karyology of the vespertilionid bats, Vespertilionidae (Chiroptera) [in Russian]. pp. 16-21. In: N.N. Vorontsov (Ed.), *The Mammals. – 2nd All Union Mammalogical Conference, USSR Academy of Sciences, Moscow*.
- Zima, J. 1978. Chromosome characteristics of Vespertilionidae from Czechoslovakia. *Acta Sc. Nat. Acad. Sci. Bohem., Brno, N. S.*, 12: 1-38+viii pls.
- Zima, J. and Horáček, I. 1984. Synopsis of karyotypes of vespertilionid bats (Mammalia: Chiroptera). *Acta Univ. Carolinae, Biol.*, 1981: 311-329.

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