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G-banding karyotypes of *Myotis myotis* (Borkhausen, 1797) and *Myotis blythii* (Tomes, 1857) (Mammalia: Chiroptera) in Turkey

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Abstract: This study is based on the G-banding karyotype of 2 sibling bat species *Myotis myotis* (Borkhausen, 1797) (Greater Mouse-eared *Myotis*) and *M. blythii* (Tomes, 1857) (Lesser Mouse-eared *Myotis*) distributed in Turkey. G-banding karyotypes showed that the 2 taxa possessed identical G-banded chromosome arms. It was concluded that G-banded chromosomes are not sufficient as a diagnostic character for separating *M. myotis* from *M. blythii.*

Key words: *Myotis myotis, Myotis blythii*, G-banding, Turkey

Türkiye'de *Myotis myotis* (Borkhausen, 1797) ve *Myotis blythii* (Tomes, 1857) (Mammalia: Chiroptera)'in G-bantlama karyotipleri

Özet: Bu araştırma Türkiye'de yayılış gösteren iki sibling yarasa türü, *Myotis myotis* (Borkhausen, 1797) (Farekulaklı Büyük Yarasa) ile *M. blythii* (Tomes, 1857) (Farekulaklı Küçük Yarasa)'nin G-bantlamasına dayanmaktadır. G-bantlama karyotipleri iki taksonun aynı G-bantlama gösteren kromozom kollarına sahip olduğunu göstermiştir. G-bantlı kromozomların *M. myotis*'in *M. blythii*'den ayrımında yeterli ayırıcı özellik olmadığı tespit edilmiştir.

Anahtar sözcükler: *Myotis myotis, Myotis blythii*, G-bantlama, Türkiye

Little estimation of the genetic homology of chromosomes can be provided by conventionally stained karyotypes. However, G- and C-banding of chromosomes are the most commonly used techniques in cytogenetic studies for comparison of related taxa (Baker et al., 1987; Qumsiyeh and Baker, 1988). Bickham (1979a, 1979b), Baker (1984), and Baker et al. (1985) determined some cryptic mammal species by using G-banding.

Myotis is one of the most karyotypically conservative genera in mammals. All species possess a diploid number, 2n = 44, and an autosomal fundamental number, NFa = 50. Kulijev and Fattajev (1975), Bickham and Hafner (1978), Harada and Yosida (1978), and Zima (1978, 1982) described the G-banded karyotypes of some species of the genus in the Palearctic region.

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In Turkey *Myotis myotis* (Borkhausen, 1797) is represented by 2 subspecies: *M. myotis myotis* from Turkish Thrace, and *M. myotis macrocephalicus* from the Mediterranean region. In addition, *M. blythii* (Tomes, 1857) is represented by *M. blythii oxygnathus* from Turkish Thrace and *M. blythii omari* from the rest of Anatolia (Aşan and Albayrak, 2011). Conventionally stained karyotypes of the 2 taxa are reported from Turkey (Karataş et al., 2004; Aşan and Albayrak, 2011).

This study is based on the G-banding of 28 (23 ♂♂ and 5 ♀♀) *M. myotis* and 4 (3 ♂♂ and 1♀) *M. blythii* specimens collected from different localities in Turkey between 2003 and 2006 (Table).

Standard karyotypes were obtained from bone marrow cells using the technique described by Patton (1969). From each specimen a total of 15 slides were prepared. G-banding was performed by using the method of Seabright (1971). At least 20 metaphase plates of each specimen were analysed to determine the shape of chromosomes, the diploid number (2n), autosomal fundamental number (NFa), and fundamental number (NF). The terminology of Bickham (1979b) was applied for the G-banded autosome arms.

The stuffed and skinned specimens as well as karyotype preparations are deposited in the zoology

Table. Localities of the specimens of *Myotis myotis* and *Myotis blythii* examined in this study (M = male, F = female).

Species	**Sex**	**Locality (Latitude and Longitude)**
Myotis myotis	1 M	Centre-Edirne (41°40′N 26°33′E)
Myotis myotis	2 M, 2 F	Ardanuç-Artvin (41°07′N 42°03′E)
Myotis myotis	1 M	Birecik-Şanlıurfa (37°01′N 37°59′E)
Myotis myotis	2 M, 1 F	Nizip-Şanlıurfa (37°00′N 37°47′E)
Myotis myotis	3 M, 1 F	Centre-Kırklareli (41°44′N 27°13′E)
Myotis myotis	2 M	Ergani-Diyarbakır (38°16′N 39°45′E)
Myotis myotis	2 M	Çermik-Diyarbakır (38°08′N 39°27′E)
Myotis myotis	2 M	Hasankeyf-Batman (37°42′N 41°26′E)
Myotis myotis	2 M	Keskin-Kırıkkale (39°40′N 33°36′E)
Myotis myotis	3 M	Gerede-Bolu (40°47′N 32°11′E)
Myotis myotis	2 M, 1 F	Center-Kilis (36°43′N 37°06′E)
Myotis myotis	1 M	Pazar-Tokat (40°16′N 36°17′E)
Myotis blythii	1 M	Mut-Mersin (36°38′N 33°26′E)
Myotis blythii	1 M	Ergani-Diyarbakır (38°16′N 39°45′E)
Myotis blythii	1 F	Keskin-Kırıkkale (39°40′N 33°36′E)
Myotis blythii	1 M	Centre-Gaziantep (37°03′N 37°22′E)

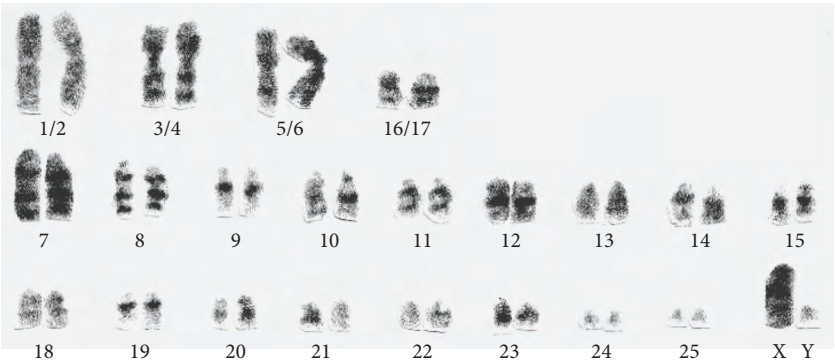

Figure. G-banded karyotype of the *Myotis* species.

museum of the Department of Biology, University of Kırıkkale.

The G-banded karyotypes of the 2 species consisted 3 large (1/2, ¾, 5/6) and 1 small (16/17) metacentric pairs, 15 pairs of acrocentrics decreasing in size from large to small (7-15, 18-23), and 2 pairs of tiny autosomes (24-25). The X chromosome was a medium-sized metacentric while the size of the Y chromosome varied from dot-like acrocentric to small acrocentric due to the heterochromatin density (Figure).

We did not encounter a biarmed dot-like pair in the examined metaphases; therefore, tiny autosomes (24 and 25) were evaluated as acrocentrics in this study. In addition, one of the largest uniarmed chromosomes (7) possessed a minute arm; it is also considered to be an acrocentric chromosome.

Although *Myotis* is one of the most speciose genera, it represents a karyologically conservative group. To date all species studied in the Palearctic region have been determined to possess a karyotype of 2n = 44, NFa = 50 by various authors (Bickham and Hafner, 1978; Zima, 1982; Volleth, 1987; Zima et al., 1991; Aşan, 2001; Karataş et al., 2004; Aşan and Albayrak, 2011).

Bickham and Hafner (1978) examined the G- and C-band patterns of *M. myotis*, *M. blythii* (*M. oxygnathus*), and *Miniopterus schreibersi* from former Yugoslavia and stated that the band patterns were identical in the species of *Myotis*. Zima (1982) determined the G-banded karyotype of *M. myotis, M. brandti*, and *M. mystacinus* from former Czechoslovakia and pointed out that morphologically identical karyotypes of different species of these genera described by standard karyotypes also did not differ when examined by G-banding methods. Bickham and Hafner (1978) and Zima (1982) concluded that the genus distributed in the Palearctic region is karyologically conservative with respect to standard and banded karyotypes. In our study, the conventionally stained karyotypes and G-banding patterns of the chromosomes of *M. myotis* and *M. blythii* were found to be identical, as stated by the previous authors. The only minor difference determined in the karyotypes of both species is due to the heterochromatin density in the Y chromosome.

Arlettaz et al. (1997) examined the allozyme variation of *M. myotis* and *M. blythii* populations from the Mediterranean islands, North Africa, Europe, and Kyrgyzstan (Kirghistan) using protein electrophoresis and stated that only 2 allozyme loci provided a criterion for separating the 2 taxa. Moreover, recently Berthier et al. (2006) examined the genetic relationship with mtDNA analysis between the 2 species from Europe and Kyrgyzstan and stated that only the European *M. blythii* specimens shared identical haplotypes with European *M. myotis*. The authors also added that the 2 taxa could interbreed in the areas of sympatry.

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