

1-1-2008

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ARSLAN, ATILLA and AKAN, ŞÜKRİYE (2008) "G- and C-Banded Karyotype of *Cricetulus migratorius* Pallas, 1773 (Mammalia: Rodentia) in Central Anatolia," *Turkish Journal of Zoology*. Vol. 32: No. 4, Article 15. Available at: <https://journals.tubitak.gov.tr/zoology/vol32/iss4/15>

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G- and C-Banded Karyotype of *Cricetulus migratorius* Pallas, 1773 (Mammalia: Rodentia) in Central Anatolia

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Received: 28.12.2007

Abstract: The present study reports the banding patterns (G- and C-banding) of chromosomes of *Cricetulus migratorius* from Central Anatolia. Karyotype of *C. migratorius* comprised (2n) 22 chromosomes. The number of chromosomal arms (FN) was 44 and the number of autosomal arms (FNa) was 40. Subtelocentric X and Y chromosomes were very similar in size, but they differed on G- and C-banding patterns. Most autosomes in this species were C-negative. Pair no. 4 had very small centromeric C-bands, autosome no. 8 possessed an under-centromeric heterochromatin block, and the distal part of chromosome no. 9 had a C-positive band. The Y chromosomes had an entirely heterochromatic long arm. The X chromosome possessed a very large under-centromeric block of heterochromatin.

Key Words: *Cricetulus migratorius*, cytogenetic, Central Anatolia

Orta Anadolu'daki *Cricetulus migratorius* Pallas, 1773 (Mammalia: Rodentia)'un G- ve C-Bantlı Karyotipi

Özet: Bu çalışmada, Orta Anadolu'daki *Cricetulus migratorius*'un kromozomlarının bantlı örnekleri (G- ve C-bant) rapor edildi. *C. migratorius*'un karyotipi (2n) 22 kromozomdan oluşmuş, temel kromozom kol sayısı (FN) 44 ve otozomal kromozom kol sayısı (FNa) 40'dır. Subtelosentrik X ve Y kromozomlarının büyüklükleri çok benzerdir, fakat G- ve C-bantlı örnekleri farklıdır. Bu türün otozomlarının çoğu C-negatiftir, 4 nolu kromozom çifti çok küçük sentromerik C-bantlara, 8 nolu otozom alt-sentromerik heterokromatin bloğa ve 9 nolu kromozomun distal kısmı da C-pozitif banda sahiptir. Y kromozom tamamen heterokromatin olan uzun kola sahiptir. X kromozom çok geniş alt-sentromerik heterokromatin bloğa sahiptir.

Anahtar Sözcükler: *Cricetulus migratorius*, sitogenetik, Orta Anadolu

Introduction

Cricetulus genus, including 6 species, is found in Asia, Europe, and Africa (Duff and Lawson, 2004). Gray hamster, *Cricetulus migratorius*, is distributed in southeast Greece, northwest Romania, southeast Bulgaria, and south European Russia, eastwards through Kazakhstan to south Mongolia and north China, southwards through Turkey and Transcaucasia to Israel, Palestine, Jordan, Lebanon, Iraq, Iran, Afghanistan, Pakistan, and north India (Corbet, 1978; Wilson and Reeder, 2006). The karyotype of *C. migratorius* was described by Matthey (1952), Radjabli (1975) from Russia, Yerganian and Papoyan (1964), Sonnenschein and Yerganian (1969), Lavappa (1977), Lavappa and Hay (1979) from Armenia, Zima and Kral (1984) in Europe, Dođramacı and Kefeliođlu (1991) from Turkey as diploid chromosome (2n) = 22 and the number

of fundamental arms (FN) = 44. However, Gharkheloo (2006) determined that Iran specimens have FN = 42 and the number of autosomal arms (FNa) = 38. Prior to our study, C-banding in this species was firstly carried out by Lavappa and Hay (1979) and Akhverdian (1993) from Armenia, and O'Brien et al. (2006) from Russia.

In this study, we presented a comparison of conventional, G- and C-banded karyotypical data on *C. migratorius* from Turkey and compared them with previous studies regarding the species.

Materials and Methods

The animals we studied (5 males) were collected from Konya Province (Beyşehir, Kadınhanı, and Ilgın) in 2007 (Figure 1). Specimens were karyotyped from the bone

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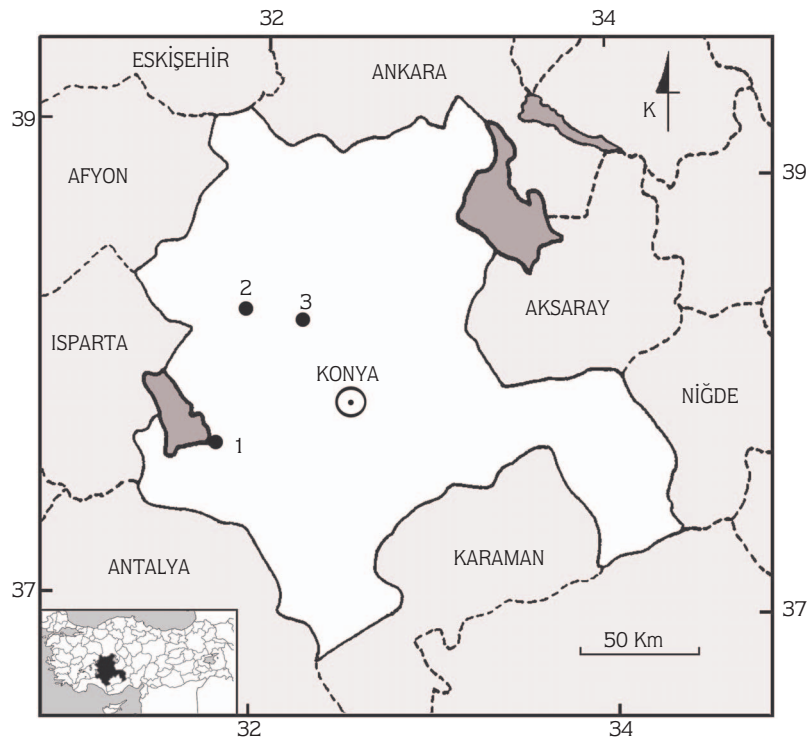


Figure 1. Collecting localities of *Cricetulus migratorius* in Konya. 1. Budak/Beyşehir (1 male), 2. Ağalar/Ilgın (3 males), 3. Çubuk/Kadınhanı (1 male)

marrow of the colchicined animal (Ford and Hamerton, 1956). After these preparations, conventional Giemsa-staining was carried out. To identify each autosomal pair and both sex chromosomes, G-banding by trypsin treatment stained with Giemsa (GTG) was performed (Seabright, 1971). Constitutive heterochromatin was detected with C-banding (Sumner, 1972). From each specimen, 10 to 20 slides were prepared, and at least 20 well-spread metaphase plates were analysed. Standard voucher specimens (skins and skulls) were deposited in the Department of Biology, Faculty of Science and Arts, Selçuk University, Konya, Turkey.

Results and Discussion

The karyotype of *C. migratorius* contains 22 chromosomes. The number of autosomal arms (FNa) is 40 and the number of fundamental arms (FN) is 44. Five autosomal pairs are metacentric (nos. 1-5) and chromosome no. 1 is larger than others, one pair is medium-sized submetacentric (no. 6) and one pair is large and 3 pairs are medium-sized subtelocentric (nos. 7-10). The sex chromosomes were determined as isomorphic and

subtelocentric (Figure 2). All autosomes and both sex chromosomes were precisely identified on the basis of unique G-banding patterns. The X chromosome is different from Y chromosome, because its long arm has a light G-band and the short arm has a dark one (Figure 3). Matthey (1952) determined that the sex chromosomes of these species might have been large metacentric. According to Radjabli (1975), the sex chromosomes of Russian specimens have different size and they are acrocentric. Isomorphic subtelocentric sex chromosomes were established by Yerganian and Papoyan (1964), Sonnenschein and Yerganian (1969), Lavappa (1977), Lavappa and Hay (1979) from Armenia, Zima and Kral (1984) from Europe and Gharkheloo (2006) from Iran as in our specimens. Doğramacı and Kefelioğlu (1991) reported that the sex chromosomes from Turkey were isomorphic and large subtelocentric. However, they did not give pictures of Y chromosome. The autosomes of all other populations are bi-armed, except for the Iran population. However, in Gharkheloo (2006)'s article, all of the chromosomes in metaphase spread were mentioned as bi-armed. For that reason, especially the early-metaphase chromosomes of specimens from Iran must be re-

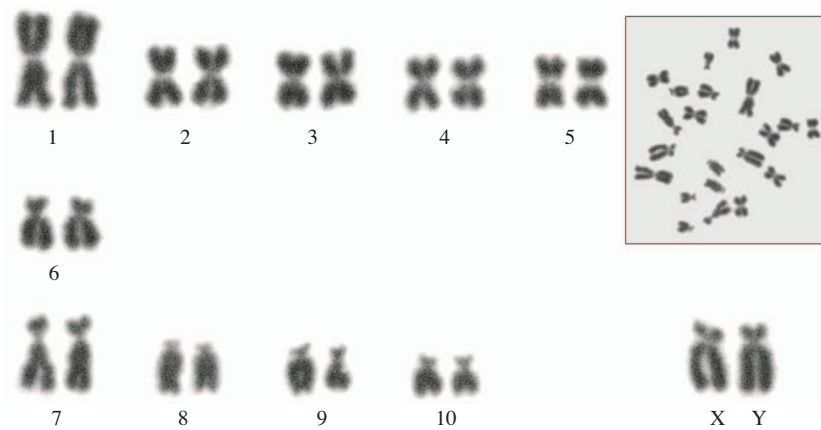


Figure 2. Metaphase spread and karyotype of *Cricetulus migratorius*.

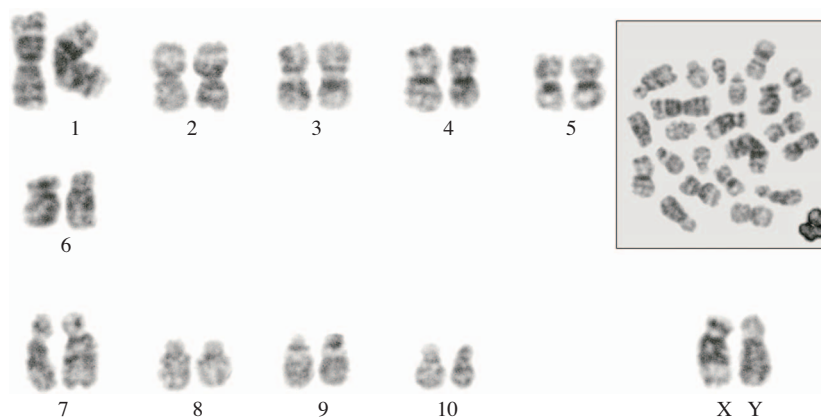


Figure 3. Metaphase spread and G-banded karyotype of *Cricetulus migratorius*.

examined because the short arm of the submetacentric chromosome is more distinctive in early-metaphase.

The C-banded karyotype of *C. migratorius* is illustrated in Figure 4. Some of the autosomes have very slightly centromeric C-bands. Also, chromosome no. 8 has proximal and no. 9 has distal C-band on their long arms. The proximal half of the long arm of X chromosome and the whole of the long arm of the Y chromosome were stained C-positive. Lavappa and Hay (1979) determined blocks of centromeric heterochromatin in all pairs of autosomes and also on the long arms of the 2 smallest pairs from Armenia. Our specimens have no centromeric blocks both in all pairs and on the long arm of the smallest pair (no. 10). Also, Lavappa and Hay (1979) found that the whole of the short arm of the X chromosome and the proximal half of the long arm of the Y chromosome were

stained positively. Akhverdian (1993) determined that the proximal half of the long arm of the X and Y chromosomes or the whole of the long arm of the Y chromosome had C-band in various Armenian populations. According to O'Brien et al. (2006), the whole of the long arm of the Y chromosome of Russian specimens is heterochromatin. The whole of the short arm of the X chromosome of our specimens is euchromatin and, as stated for Armenian and Russian specimens by Akhverdian (1993) and O'Brien et al. (2006), whole of the long arm of the Y chromosome of Turkish specimens is heterochromatin.

In consequence, although the sex chromosomes of *C. migratorius* from Turkey are isomorphic, we determined that they had different G- and C-bands. None of the X and Y chromosomes of our specimens have similar C-bands unlike some of the Armenian populations. We did not

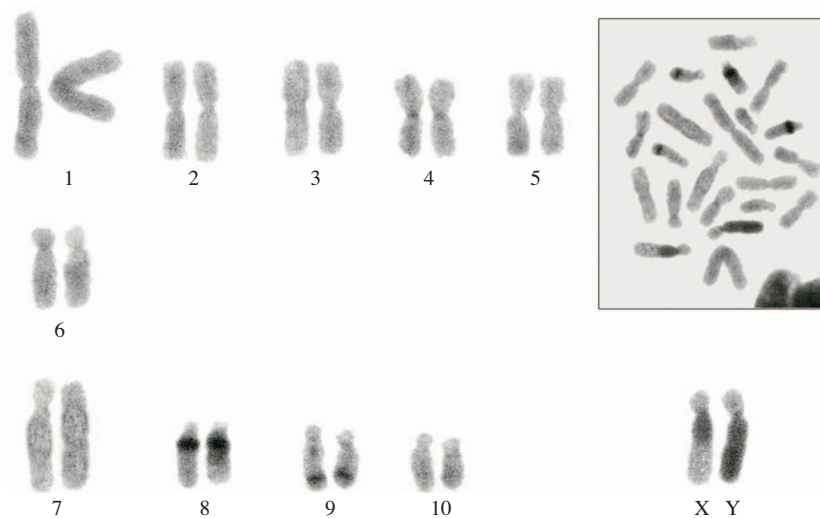


Figure 4. Metaphase spread and C-banded karyotype of *Cricetulus migratorius*.

observe the C-band which was determined earlier by Lavappa and Hay (1979), in the short arm of X chromosomes of our specimens. All of our specimens are different from Armenian population, because of having no distinctive centromeric C-bands on the autosomes and

having different sizes of C-bands on the long arms of sex chromosomes. Determining the different bands with G- and C-bands technique on isomorphic sex chromosomes, which is rarely found at mammals, shows that these methods are very important at karyosystematic.

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