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C-Banded Karyotype of *Myocastor coypus* (Molina, 1782) from Turkey (Mammalia: Rodentia)

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The present study reports the C-band patterns of chromosomes of *Myocastor coypus* from Turkey. The karyotype of *M. coypus* is comprised of (2n) 42 chromosomes, the number of chromosomal arms (FN) was 83 and the number of autosomal arms (FNa) was 80. The X chromosome was a medium-sized metacentric and the Y chromosome was acrocentric and the smallest in the set. Two metacentric chromosomes have secondary constrictions. Most autosomes in this species were centromeric C-positive and some autosomes had telomeric C-bands. The X chromosome has centromeric heterochromatin, while the Y chromosome appeared to be entirely heterochromatic.

Key words: *Myocastor coypus*, nutria, coypu, cytogenetics, Turkey.

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Nutria or coypu (*Myocastor coypus*: Capromyidae) is monospecific and native to South America (GOSLING & BAKER 1991). It is distributed from central Bolivia and southern Brazil to Tierra del Fuego. As a result of escapes from fur farms, feral populations are known to occur in Europe, Asia, South Africa, Japan and North America (CORBET 1978; WOODS *et al.* 1992; MITCHELL-JONES *et al.* 1999; CARTER & LEONARD 2002; DUFF & LAWSON 2004; WILSON & REEDER 2006). PURGER and KRYŠTUFEK (1991) noted that they are rarely observed in Yugoslavia as well. The existence of coypu in Turkey was first noted in the European part of Turkey (Thrace) (ÖZKAN 1999) and from then on there have been numerous local reports. This determination is based on coypu samples obtained from hunters. The first reports of the invader population of coypu were associated with the Armenian and Iranian borders in Karasu/Aralık and Arpaçay (MURSALOĞLU 1973; AGSA 1975; KUMERLOEVE 1975). Furthermore, this species was also reported from the Caucasian, Syrian and Israeli borders by VERESCHAGIN (1967) and KUMERLOEVE (1975).

The karyotype of *M. coypus* was described by FREDGA (1966) from South America, TSIGALIDOU *et al.* (1966), HSU & BENIRSCHKE (1967), GEORGE & WEIR (1974), PIENKOWSKA *et al.* (1994) from Poland and CHENG *et al.* (1999) from China. The G- and C-banding patterns were studied by KASUMOVA *et al.* (1976) and LUNGEANU *et al.* (1982). Also, C-banding patterns of Polish specimens were investigated by PIENKOWSKA *et al.* (1994).

The karyological features of Turkish specimens of this species are unknown. Therefore in this study, we presented conventional and C-banded karyotypical data on *M. coypus* from Turkey.

Material and Methods

Two injured *Myocastor coypus* individuals (male and female) were obtained from hunters from Iğdır province in 2007 (Fig. 1). Blood and marrow samples were taken directly from the heart and femur and cultured for 72 hr at 37°C in 10 ml of medium supplemented with 15% fetal calf serum, antibiotics (penicillin 250 U/ml and streptomycin 250 mg/ml), and phytohaemagglutinin. Five mg/ml of colchicine was added for 2 hr before harvest. After these preparations, conventional Giemsa-staining was carried out. Constitutive heterochromatin was detected with C-banding (SUMNER 1972). Twelve slides were prepared and

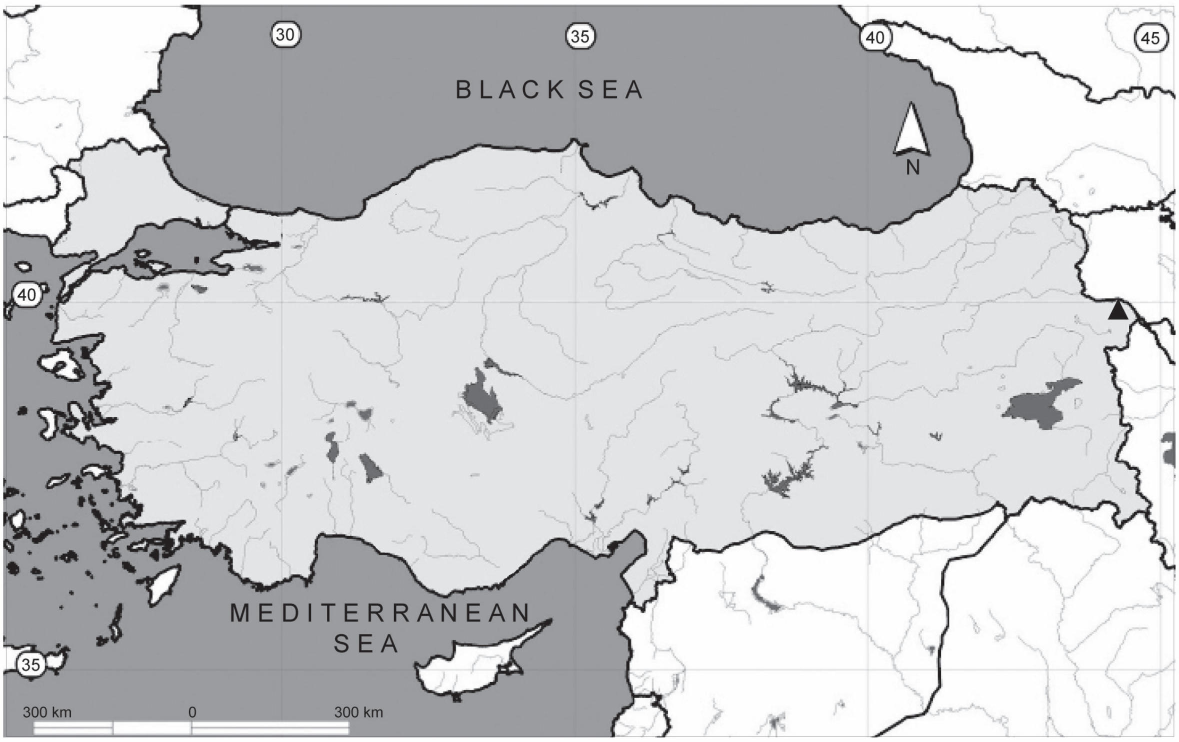

Fig. 1. A map showing the recorded locality (▲) of *Myocastor coypus* in Aralık (Iğdır), Turkey.

20 to 30 metaphase plates were examined. Chromosome morphology was established according to ZIMA (1978) by calculating centromeric indexes. Each autosomal pair and both sex chromosomes were identified. Standard voucher specimens (skins and skulls) are deposited in the Department of Biology, Faculty of Science and Arts, Kırıkkale University, Kırıkkale, Turkey.

Results

The karyotype of coypu contains 42 chromosomes, the number of fundamental arms (FN) is 83 and the number of autosomal arms (FNa) is 80. All the autosomal pairs are bi-armed. Six autosomal pairs are large metacentrics (nos. 1-6), six pairs are medium-sized metacentrics (nos. 7-12), three

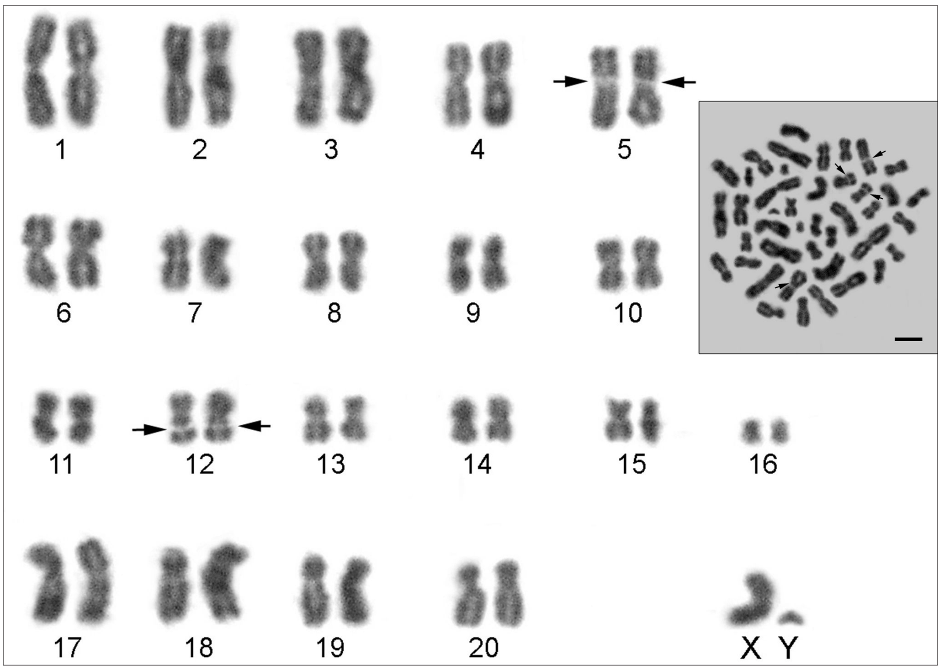

Fig. 2. Metaphase plate and karyotype of *Myocastor coypus.* Arrow indicates secondary constrictions (NOR). Bar=10 μm.

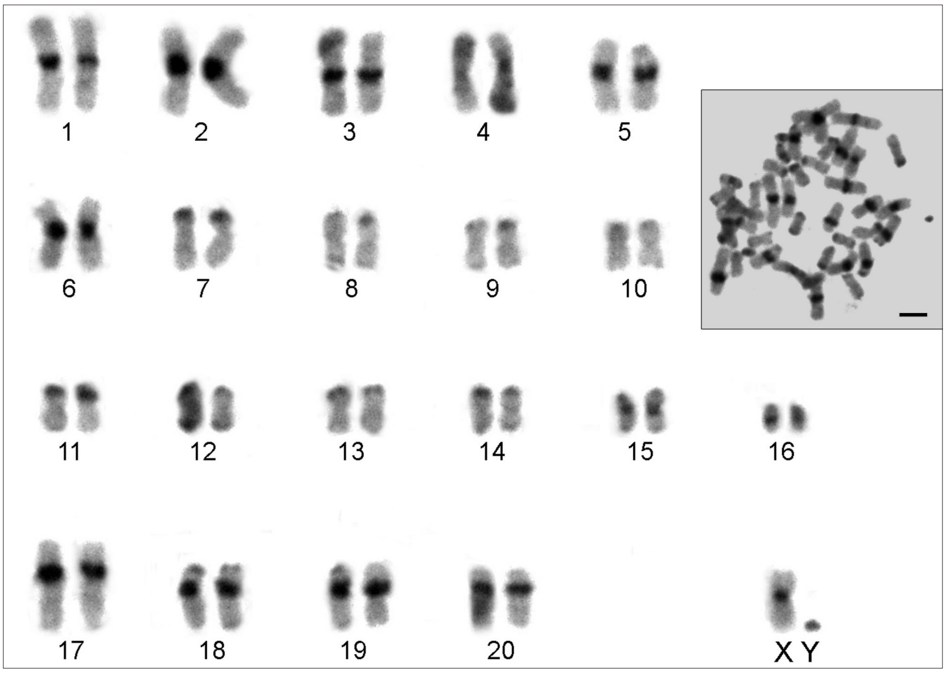

Fig. 3. Metaphase plate and C-banded karyotype of *Myocastor coypus.* Bar=10 μm.

pairs are small metacentrics (nos. 13-15), one pair is the smallest metacentric (no.16) and four pairs are large submetacentrics (nos. 17-20). The X chromosome is a medium-sized metacentric and the Y chromosome is acrocentric and the smallest in the set. One pair of large (no. 5) and one medium-sized pair (no. 12) of metacentric chromosomes have secondary constrictions. Both of the secondary constrictions are on chromosome arms and one of them is on the large metacentric chromosome closer to the centromere (Fig. 2).

Some metacentric and submetacentric autosomal chromosomes (nos. 1-6 and 17-20) have large centromeric C-bands. Excluding metacentric chromosomes 15 and 16, centromeres of the others (nos. 7-14) stained only slightly. Some submetacentric, medium-sized and small metacentric chromosomes have telomeric C-bands. These telomeric bands are only on one arm of 7, 11, 13, 18, 19 pair of chromosomes and on both arms of 8, 9, 12, 14, 15 pairs). The X chromosome has centromeric heterochromatin, while the Y chromosome is entirely heterochromatic (Fig. 3).

Discussion

FREDGA (1966), TSIGALIDOU *et al.* (1966), HSU & BENIRSCHKE (1967), GEORGE and WEIR (1974), KASUMOVA *et al.* (1976), LUNGEANU *et al*. (1980, 1982) and CHENG *et al.* (1999) noted that the chromosome sets of various populations of this species are bi-armed similar to our samples, excluding the Y chromosome. Just as in the samples from Turkey and in the others, the Y chromosome is the smallest and is acrocentric. However, PIEN- KOWSKA *et al.* (1994) have noted that the Y chromosome in Polish samples is subtelocentric (FN=84). Moreover, the morphology of the bi-armed chromosomes varies among populations. For example, TSIGALIDOU *et al.* (1966) and GEORGE & WEIR (1974) pointed out that the karyotypes are mostly composed of submetacentric chromosomes and that subtelocentric chromosomes exist which were not found in our study nor in any other investigation. Probably these differences in the metacentric and submetacentric chromosomes result from methodical inconsistencies in karyotype preparation and the arrangement of pairs in the diploid complement. However, the existence of subtelocentric chromosomes may stem from pericentric inversions which are beneficial for the continuance of species from an evolutionary perspective. A pericentric inversion means that the chromosomal segment containing the centromere is turned 180^{o}. If the centromere is not located exactly in the middle of the inverted segment, its position on the chromosome changes. In this way, a subtelocentric chromosome rather than metacentric or submetacentric could be created by pericentric inversion. All researchers have found that this species has a secondary constriction nucleolus organiser region (NOR) in the pair of submetacentric chromosomes. However, in our samples there is also a secondary constriction on one pair of large metacentrics, apart from a NOR determined on one pair of medium-sized metacentric chromosomes.

Clear centromeric and telomeric dark C-bands on all chromosomes of Romanian coypus were observed by KASUMOVA *et al.* (1976) and LUNGEANU *et al.* (1982). In coypu from Turkey, the telomeric parts of chromosomes have centromeric C-bands, while the centromeric parts of chromosomes have telomeric C-bands that stained slightly. Neither autosomal nor sex chromosomes of our samples have both centromeric and telomeric dark C-bands. Centromeric bands are larger than telomeric bands. However, the telomeric bands in chromosomes no. 7 and 11 are as large as some centromeric bands. That the centromeric bands of Turkish coypu are larger than the telomeric ones, as opposed to Romanian samples, can be the result of inversion in the chromosomes. PIENKOWSKA *et al.* (1994) pointed out that the Polish coypus have centromeric and telomeric C-bands and that there were three separate C-bands on the bi-armed Y chromosome, a single C-band being on one arm and two on the other. Yet in our samples, the acrocentric Y chromosome appeared to be entirely heterochromatic.

In general, rodents have centromeric C-bands, but coypus have both centromeric and telomeric bands, as seen in this study and in many others. These investigations indicate that this is a specific situation for coypu. No important variation exists between populations.

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