

CYTOGENETIC ANALYSIS OF *CTENOMYS OPIMUS* (RODENTIA, OCTODONTIDAE) FROM ARGENTINA

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ABSTRACT. Comparison of the normal karyotype, C and G-banding patterns of *Ctenomys opimus* from Argentina, with karyotypes from Chile and Bolivia, do not distinguish Argentinean from Chilean or Bolivian forms of this species.

RESUMEN. Análisis citogenético de *Ctenomys opimus* (Rodentia: Octodontidae) de la Argentina. La comparación del cariotipo normal, las bandas C y G de *Ctenomys opimus* de Argentina, con cariotipos de Chile y Bolivia, no permite distinguir, desde el punto de vista citogenético, las formas argentinas de las bolivianas o chilenas.

Key words: *Ctenomys opimus*, Tuco-tucos, cytogenetics, Argentina.

Palabras clave: *Ctenomys opimus*, Tuco-tucos, citogenética, Argentina.

Subterranean rodents of the genus *Ctenomys*, commonly known as tuco-tucos, are endemic to the southern half of South America. This genus is by far the most speciose group of extant subterranean rodents, with more than 56 recognized living species (Reig et al., 1992; Lacey et al., 2000). The earliest fossils of this genus are known from Pleistocene deposits (Reig, 1989; Cook et al., 2000), and molecular findings suggest an early burst of cladogenesis following the appearance of the genus in the early Pleistocene (Lessa and Cook, 1998; Slamovits et al., 2001).

The subterranean life-style of tuco-tucos is likely to have favoured rapid fixation of chromosomal rearrangements: small, semi-isolated demes constrained by the soils they inhabit, low vagility due to morphological modifications for digging and highly territorial behaviour. It has been suggested that chromosome rearrangements together with population struc-

ture have played an important role in the explosive diversification of *Ctenomys* (Reig and Kiblicky, 1969; Reig, 1989). Diploid numbers for tuco-tucos range between 10 and 70 (Anderson et al., 1987) while the fundamental numbers vary from 16 to 90 (Reig et al., 1992). Interspecific conservation of karyotypes is uncommon (Gallardo, 1979; Cook et al., 1990; Massarini et al., 1991) and most species display karyotypic heterogeneity, polymorphisms and polytipisms (Reig et al., 1990). These characteristics make *Ctenomys* an important model for the study of chromosomal evolution in subterranean rodents and Vrba and Gould (1986) mentioned that tuco-tucos are a relevant model for the analysis of the species selection approach.

Ctenomys opimus is distributed in four countries: Peru, Bolivia, Chile and Argentina (Sanborn and Pearson, 1947; Pearson, 1959; Reig and Kiblicky, 1969; Gallardo, 1979; Cook

et al., 1990; Reig et al., 1990). Three subspecies have been proposed for this species: *C. o. opimus* for Chile and Bolivia (Gallardo, 1979; Cook et al., 1990), *C. o. nigriceps* for Perú (Sanborn and Pearson, 1947; Pearson, 1959) and *C. o. luteolus* for Argentina (Reig and Kiblicky, 1969)

In this study we describe the gross, C and G-banded karyotype of *Ctenomys opimus* from two populations of Salta Province, Argentina, and we compare these results with previous information about the karyotypes of populations belonging to the three recognized subspecies. Moreover, in the present study we test the idea proposed by Reig et al. (1992) about the sub-specific distinction between *C. o. opimus* and *C. o. luteolus*. The sample studied consists of 3 specimens: one female and one male from Las Cuevas (24°18' 66°10'), and one female from Santa Rosa de Tastil (24°23' 66°00'), both localities belonging to Salta Province, Argentina, in the heights of 3,500 and 2,000 meters, respectively. The animals were live-trapped with Oneida Victor Nr. 0 snap traps. Chromosomal preparations were obtained from bone marrow of animals injected with yeast, one day before sacrifice (Lee and Elder, 1980). G-bands and C-bands were obtained by the methods of Seabright (1971) and Hsu (1974), respectively. Chromosomal nomenclature follows Levan et al. (1964) and nomenclature relating to chromosome size and arrangements follows Massarini et al. (1991). Skin and skull voucher specimens were deposited at the Municipal Museum of Natural Sciences of Mar del Plata Lorenzo Scaglia.

The gross morphology of karyotypes for the studied animals is similar to that for specimens of *C. opimus* collected in Tres Cruces, Jujuy Province, Argentina (Reig and Kiblicky, 1969; Reig et al., 1992), as well as for specimens belonging to Chilean populations (Gallardo, 1979) and for Bolivian populations (Cook et al., 1990; Cook and Salazar-Bravo, 2003).

Specimens from both, Santa Rosa de Tastil and Las Cuevas populations, had a fully biarmed karyotype with $2n = 26$ and $FN = 48$. This karyotype consists of three pairs of large metacentric, three pairs of medium-sized submetacentric, three pairs of medium-sized

metacentric, one small submetacentric and two small metacentric autosomes. The X chromosome is a medium-sized submetacentric. This does not agree with the metacentric condition of the X chromosome reported for *C. opimus* by Reig and Kiblicky (1969), but is similar to the submetacentric condition reported by Gallardo (1979) and by Cook et al. (1990). The Y chromosome is a small subtelocentric (**Fig. 1a**). C-band patterns revealed that pairs A1 to A3 showed faintly stained centric C-bands, whereas seven pairs of biarmed autosomes show intense pericentromeric heterochromatin. In pair A-7 and the X chromosome, heterochromatin was absent although the Y has an entire heterochromatic q arm (**Fig. 1b**). The G-band pattern (**Fig. 1c**) is similar to that of *C. o. luteolus* from Tres Cruces, Jujuy, Argentina (Ortells, 1995), the only G-band pattern reported at the present time for this species.

According to Reig et al. (1992), the main difference between the karyotypes of *C. o. opimus* and *C. o. luteolus* is the amount of heterochromatin in pairs A1 to A3, which show faintly stained centric C-bands in *C. o. luteolus* and heavily stained pericentromeric blocks in *C. o. opimus*.

The location and the amount of heterochromatin from the Salta population karyotypes reported here agree with the C-bands patterns reported for *C. o. luteolus* (Reig et al., 1992) and with those reported by Cook et al. (1990) for the Bolivian populations of *C. o. opimus*. No qualitative differences were found when C-band patterns of the populations studied here were compared with those of Chilean populations. Moreover, in this study a low number of metaphases showed stronger signals in the pairs A1 to A3.

A comparative analysis of our results and previous data suggest that the C-band patterns of the two subspecies do not differ and that previously described differences may be artefacts rather than consistent chromosomal differences. In this sense, we stand that cytogenetic evidences do not support the sub-specific distinction proposed by Reig et al. (1992).

The karyotypes of Peruvian populations of *C. opimus* are still unknown. The only studies

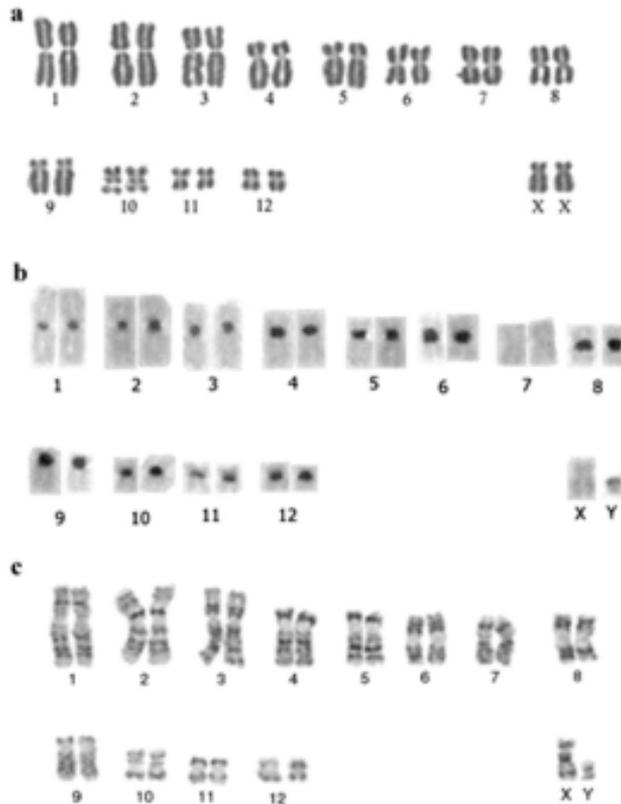


Fig. 1. Karyotype of *Ctenomys opimus*. **a)** Standard karyotype of a female from Santa Rosa de Tastil; **b)** C-bands of a male from Las Cuevas; **c)** G-bands of a male from Las Cuevas.

Cariotipo de Ctenomys opimus. a) Cariotipo estándar de una hembra proveniente de Santa Rosa de Tastil. *b)* Bandas C de un macho proveniente de Las Cuevas. *c)* bandas G de un macho proveniente de Las Cuevas.

of Peruvian populations of *Ctenomys opimus nigriceps* showed that some morphological characters were similar to those reported for *C. o. opimus* and *C. fulvus* from Chile (Sanborn and Pearson, 1947; Pearson, 1959). Pearson (1959) referred to these populations as *Ctenomys opimus* excluding the sub-specific classification and suggesting that additional studies are necessary to assign sub-specific status to Peruvian tuco-tucos. Cook et al. (1990) studied the cytogenetics and morphology of six different populations of *C. opimus* from Bolivia and concluded that, among these populations, is not possible to recognize Bolivian subspecies. At the same time, this author suggests that the subspecies *C. o. luteolus* from

Argentina, *C. o. opimus* from Chile, and *C. o. nigriceps* from Peru need to be added to an integrated analysis in order to evaluate the status of subspecies throughout the species range.

It is remarkable that the karyotypes of previously studied populations of *Ctenomys opimus* were identical in number, gross morphology and C- band pattern to those belonging to *Ctenomys fulvus* from Chile (Gallardo, 1979; Gallardo, 1991; Reig et al., 1992). In addition, *C. opimus* and *C. fulvus* show karyotypic similarities (Gallardo, 1979; Reig et al. 1992), belong to a well-supported clade in phylogenetic trees based on cytochrome b, and also share patterns and low copy number of satDNA (RPCS) (Slamovits et al., 2001). All these facts

suggest that these two taxa may be conspecific. Gallardo (personal communication) has mentioned that the main morphological differences between these two species are based on the pelage coloration, which can vary considerably within and between species.

The description and the comparison of new populations of *Ctenomys opimus* and *Ctenomys fulvus* involving cytogenetic, morphology and molecular studies will help us to solve the status of subspecies and species in this lineage of subterranean rodents.

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