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Chromosomal variation in two populations of the genus *Ctenomys* (Rodentia, Octodontidae) from Uruguay

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Abstract

Analysed the karyotypes from two populations of the *Ctenomys pearsoni* complex sensu Altuna and Lessa (1985) with 2n = 70, FN = 80 corresponding to *C. pearsoni* and 2n = 56, FN = 78 corresponding to *C.* sp. aff. *C. pearsoni*, revealed variation in karyotype composition. Of nine specimens of *C. pearsoni* one presented a karyotype with 2n = 68, FN = 80. Of nine specimens of *C.* sp., five presented the same diploid number (2n = 56) but different FN values (FN = 77, 78, 79). C-band staining of the karyotypes with different FN values revealed that, the differences observed in karyotype composition are not due to heterochromatin shifts.

Introduction

Among rodents of the Neotropical region, the subterranean genus *Ctenomys* exhibits extensive karyotypic variability with chromosome number ranging from 2n = 22 to 2n = 70 (Reig and Kiblisky 1969; Kiblisky et al. 1977; Gallardo 1979). In this paper we report intrapopulation chromosome variation in two population of the *C. pearsoni* complex with modal numbers of 2n = 56 and 2n = 70 (Novello and Lessa 1986).

Materials and methods

Animals were captured alive using Oneida Victor traps N° 0 in Carrasco (34° 53′ S, 56° 02′ W, Dpto. de Montevideo) and Autódromo Nacional (34° 25′ S, 56° 26′ W, Dpto. de San José). Two hours prior to sacrifice, the animals were injected i.p. with colchicine (0.1 % colchicine, 0.2 ml/100 g of body weight). Chromosome preparations were obtained from bone marrow cells after hypotonic treatment and ethanol acetic-acid fixation. Chromosome counts were made under the microscope and using enlarged photograph of selected metaphases stained with Giemsa. The Arrighi and Hsu (1971) method was applied to stain C-bands. NOR staining was carried out incubating slides in $AgNO_3$ 50 % in deionized water for 2–3 hours at 60 °C.

The specimens were stored in the collection of the Dpto. de Zoología Vertebrados de la Facultad de Humanidades y Ciencias de Montevideo, Uruguay.

Results

Sample from Carrasco (*C.* sp. 2n = 56, FN = 78)

Of the nine specimens studied four presented the modal karyotype composed by: one subtelocentric pair, 11 metacentric and submetacentric pairs, 15 telocentric pairs, a metacentric X and a subtelocentric Y (Fig. 1a). The remaining specimens presented the same 2n value but variable FN value (Table 1). Three specimens (EL 51, EL 91 and EL 43) presented two unpaired chromosomes: a medium sized submetacentric and a telocentric one (Fig. 1b, 1c). The other two specimens (EL 49 and EL 52) presented two unpaired telocentric chromosomes of short and medium size (Fig. 1d).

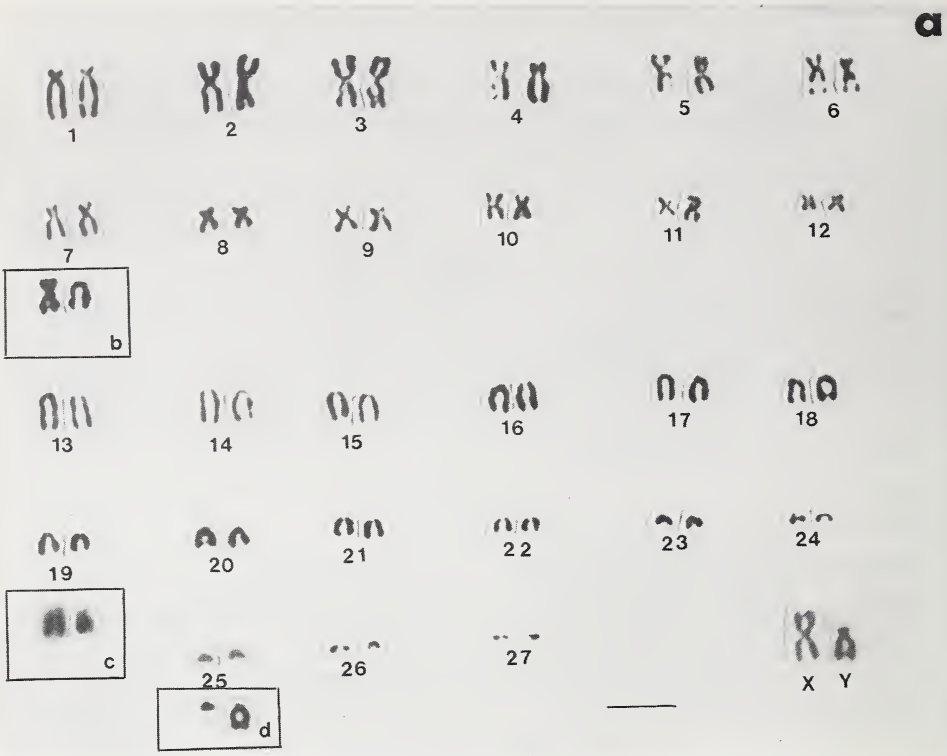

Fig. 1. a. Standard karyotype of *C.* sp. (FN = 78); *b.* Heteromorphic pair present in the specimen EL 43; *c.* Heteromorphic pair present in the specimen EL 51; *d.* Heteromorphic pair present in the specimen EL 52. In all figures bar represents 10 microns

Table 1. **Karyotypic variation observed in the *C.* sp. (2n = 56) population from Carrasco**

Karyotypes marked with asterisk present heteromorphic chromosomes

Specimen	biarmed	uniarmed	FN
CA 52	24	30	78
EL 43*	23	31	77
EL 51*	25	29	79
EL 52*	24	30	78

Sample from Autódromo Nacional (*C. pearsoni* 2n = 70, FN = 80)

Of the nine specimens analysed eight presented the modal karyotype composed by: one subtelocentric pair, 5 metacentric and submetacentric pairs, 28 telocentric pairs, a metacentric X and a subtelocentric Y (Fig. 2). The remaining specimen had 68 chromosomes and FN = 80. We observed three different features in this karyotype: a) the presence of a long metacentric chromosome absent in the modal karyotype; b) an unpaired short metacentric chromosome; c) heteromorphism of the pair bearing the secondary constriction. This karyotype has only 27 telocentric chromosome pairs (Fig. 3).

After C-banding, the karyotype of *C. pearsoni* showed positive staining in the pericentric region of the pair bearing the secondary constriction and in a medium sized telocentric pair (Fig. 4a). The modal karyotype of *C. sp.* (2n = 56, FN = 78) showed positive C-band staining in the pericentric region of the pair bearing the secondary constriction (Fig. 4b). Both karyotypes presented positive staining of the long arm of the Y chromosome.

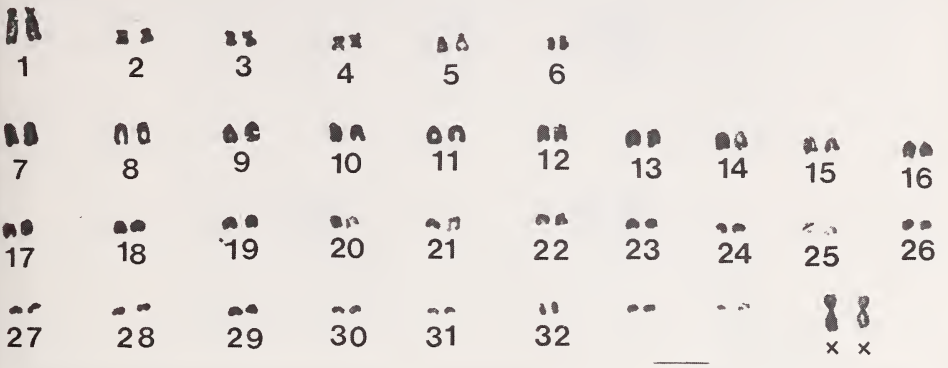

Fig. 2. Standard karyotype of *C. pearsoni* from Autódromo Nacional

Fig. 3. Heteromorphic karyotype of the specimen CA 58 *(C. pearsoni);* Heteromorphic chromosomes marked with arrow

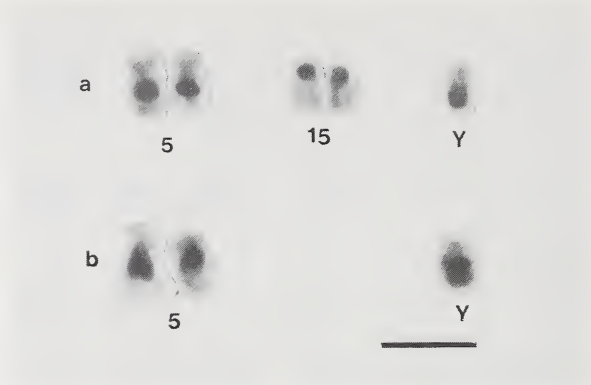

Fig. 4. a. Unique positive C-banded chromosomes of *C. pearsoni; b.* Unique positive C-banded chromosomes of *C.* sp. (2n = 56, FN = 78)

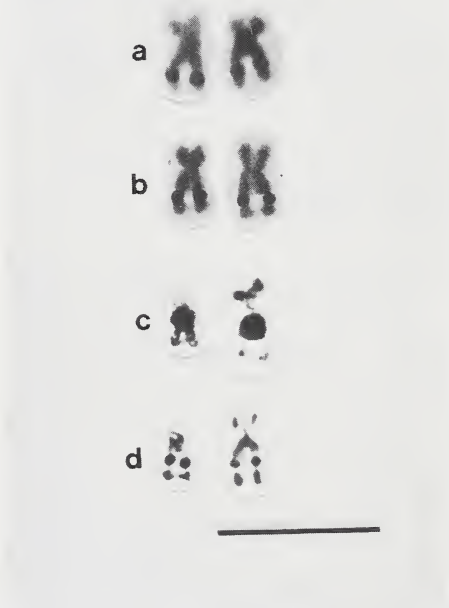

Fig. 5. a. Unique positive silver stained chromosomes in the *C. pearsoni* karyotype. *b.* Unique positive silver stained chromosomes in the *C.* sp. (2n = 56, FN = 78) karyotype; *c.* heteromorphic chromosomes of the specimen CA 58 after C-banding; *d.* heteromorphic chromosomes of the specimen CA 58 after silver staining

After silver staining the karyotype of *C. pearsoni* showed positive staining in the area of the secondary constriction of the pair N° 5 (Fig. 5a). In the *C. sp.* (2n = 56, FN = 78) karyotype, positive silver staining was observed in the secondary constriction presents in the pair N° 6 (Fig. 5b).

The heteromorphic chromosomes of the specimen CA 58 (*C. pearsoni*) presented positive C-band staining in the pericentric region of the two homologous chromosomes (Fig. 5c), and positive silver staining in the secondary constriction of the same chromosome pair (Fig. 5d).

Discussion

The specimens of *C.* sp. EL 49 and EL 52 have the same 2n and FN values as the modal karyotype (2n = 56, FN = 78). A plausible explanation for the difference in size of the two telocentric chromosomes could be the loss or addition of chromatin. The remaining karyotypes of this population showed a different pattern of karyotypic variation. The change in the FN value without a corresponding change in the 2n value suggests whole arm pericentric inversion. In specimen EL 43 pericentric inversion could be causing the transition from a biarmed to a uniarmed chromosome. In EL 51 and EL 91 karyotypes the same change

in opposite direction could be postulated. The heteromorphic karyotype of *C. pearsoni* presents a complex picture. The variation of the 2n value can be due to a Robertsonian translocation resulting in the long metacentric absent in the modal karyotype. In spite of the heteromorphism observed in the pair bearing the secondary constriction neither the C-band nor the nucleolar organizing region are implicated in karyotype variation in *C. pearsoni* nor *C.* sp. (FN = 77, 78, 79). This fact leads us to propose that in karyotypes EL 49 and EL 52 the difference in length of the telocentric chromosomes is due to a euchromatin shift. A similar phenomenom was reported by Gallardo (1983) in *Thomomys bottae*.

Chromosome variation within population of *Ctenomys* has been reported by Reig and Kiblisky (1969) in Argentina and Gallardo (1979) in Chile. In the later animals with heteromorphic chromosomes inhabit a peninsular zone isolated from the remaining territory by absence of vegetation and water. In our case, individuals of the *C.* sp. population with heteromorphic chromosomes (FN = 77, 78, 79) were collected in an area less than 2500 m^2 without visible barriers from specimens with modal karyotypes.

The variation observed in these populations is difficult to explain. The chromosomal variation observed in the FN values of the *C.* sp. population suggests that these chromosome rearrangements do not cause severe negative heterosis. This could be due, at least in karyotypes with heterocygotic whole arm inversion (EL 43, EL 51, EL 91), to pairing at meiosis without the presence of inversion loops. According to Ford (1969), inversion loops were never observed in meiosis in mammals, not even in man.

High amount of variation in *C.* sp. can be due to diverse factors associated with subterranean life such as: low vagility, solitary occupation of the burrow, high inbreeding and the effect of drift (Patton 1983). The populations surveyed here share all these characteristics (Altuna 1985). Unfortunately, the populations studied were destroyed by severe damage of their habitat by man before G-band analysis could be performed. Work is in progress to etablish the existence of chromosome variation in neighbouring populations.

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Zusammenfassung

Chromosomale Abweichungen bei zwei Populationen des Genus Ctenomys (Rodentia, Octodontidae) aus Uruguay

Die Karyogramme aus zwei Populationen von Kammratten *(Ctenomys)* der *C. pearsoni*-Gruppe aus Uruguay werden beschrieben. In der einen Population besaßen 8 von 9 Exemplaren 2n = 70 Chromosomen. Das neunte Tier hatte bei gleicher FN 80 nur 68 Chromosomen. In der zweiten Population hatten alle 9 untersuchten Kammratten 2n = 56 Chromosomen. FN war in 6 Fällen 78, einmal 77 und zweimal 79. Bei zwei der sechs Tiere mit FN 80 war je ein Autosom im Vergleich zu Normaltieren größer.

Eine C-Bandenfärbung ergab, daß Heterochromatin an den geschilderten Unterschieden nicht beteiligt war.

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