Cytogenet Cell Genet 64:261–263 (1993)

Karyotype of the giant mole-rat, *Cryptomys mechowi* (Rodentia, Bathyergidae)

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Abstract. The karyotype of the giant mole–rat, *Cryptomys mechowi* (Rodentia, Bathyergidae), from Zambia was investigated in one male and one female by means of G-, C-, and AgNOR-banding techniques. The diploid chromosomal set consisted of 40 biarmed chromosomes (2n = 40, NF = 80). A pair of autosomes in the male and the X chromosomes in the female were heteromorphic. The sex chromosomes were unusually large.

The family Bathyergidae includes five genera of subterranean hystricognathous rodents endemic to Africa. The genus *Cryptomys* is particularly interesting for studies dealing with adaptive radiation and speciation involving chromosomal differentiation. Unlike other bathyergid genera, *Cryptomys* is rather eurybiomic, occurring from semi-arid to mesic habitats in different soil types over a wide geographical range from Ghana to the Cape of Good Hope (Honeycutt et al., 1991).

Taxonomic treatment of this genus is made difficult by extreme variation in many morphological traits. From three to 49 species of *Cryptomys* have been named by different authors, the number being stabilized at seven by Honeycutt et al. (1991). We have shown recently that more than seven currently recognized species of *Cryptomys* do exist (Burda et al., 1992; Filippucci et al., 1993). Eight different karyotypes (including the present data) have been reported thus far (Table I).

Among other *Cryptomys* species, the giant mole-rat (*Cryptomys mechowi*, Peters, 1881) is remarkable because of its distinctly larger size, its preference for relatively mesic habitats, and its interesting biology which has been described only recently (Burda and Kawalika, 1992; 1993). Here we present the karyotype of this relatively rare *Cryptomys* species.

Supported in part by Ethologische Gesellschaft e.V. and the A.S.C.R. grant No. 66913.

Received 19 January 1993; revision accepted 15 March 1993.

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Materials and methods

One male and one female of the giant mole-rat (*Cryptomys mechowi*) were karyotyped. The animals were collected at Ndola town periphery (Kangonga) in the Copperbelt Province, Zambia.

Chromosome preparations were obtained directly from bone marrow following the short term cultivation method of Fredga (1987). Chromosomes were differentially stained by G-banding (Seabright, 1971) and C-banding (Sumner, 1972). Nucleolar organizer regions (NORs) were analyzed by the silver-staining method of Howel and Black (1980).

Results and discussion

The diploid chromosome number of *Cryptomys mechowi* was 2n = 40. All the elements of the karyotype were biarmed, the fundamental number thus being NF = 80 (Fig.1). The X chromosome, the longest chromosome in the karyotype (11.5% of the length of the haploid set), was meta/submetacentric with an apparent secondary constriction located on the long arm. The Y chromosome was submetacentric and conspicuously large, representing 9.5% of the haploid set. The two homologues of pair No. 6 in the male were heteromorphic, one metacentric, the other submetacentric (Fig. 1). In the female both homologues were submetacentric.

The G-banding pattern is shown in Fig. 2. The C-banding revealed positive centromeric bands in most chromosomes (Fig. 3). In addition, three pairs of autosomes displayed large blocks of heterochromatin. This was apparent as pericentromeric C-bands in chromosome 6 and as entirely heterochromatic short arms in chromosomes 13 and 14. The X chromosome had a large C-positive block in the paracentromeric region of the long arm. The Y chromosome was characterized

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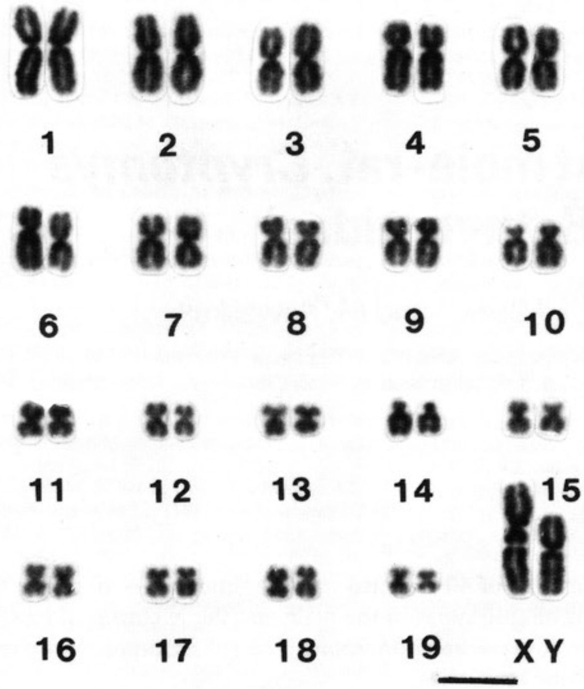

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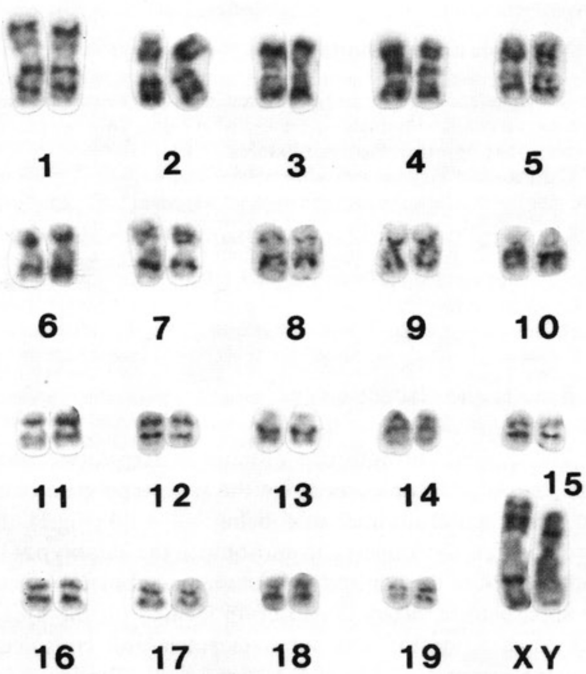

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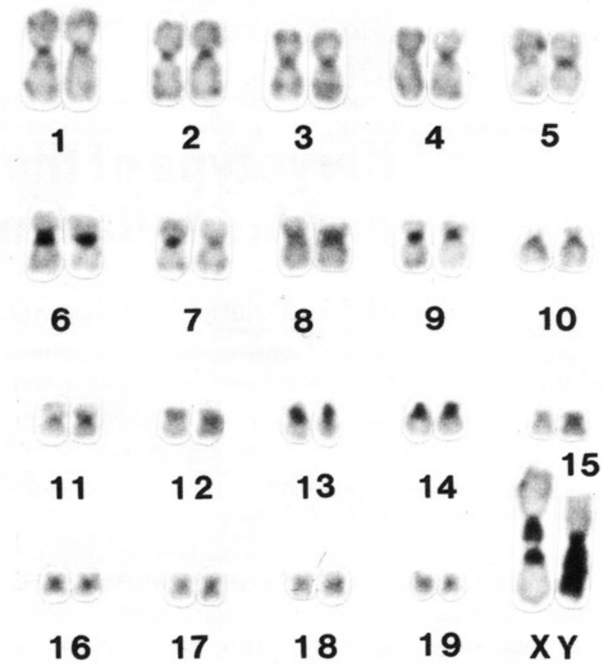

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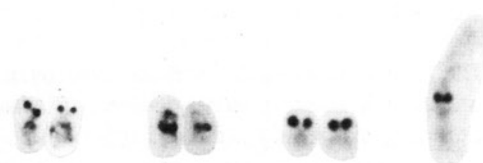

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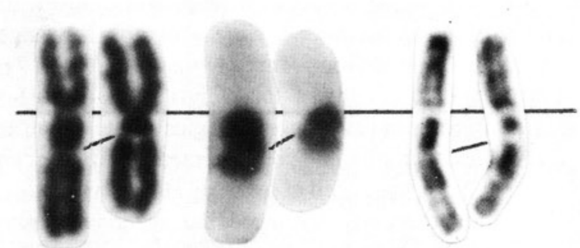

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Fig. 1. Conventionally stained karyotype of a male *C. mechowi*. Bar = 10 μm.

Fig. 2. G-banding pattern of the karyotype of a male *C. mechowi*.

Fig. 3. C-banded karyotype of a male *C. mechowi*.

Fig. 4. Nucleolar chromosomes of a male *C. mechowi*.

Fig. 5. Heteromorphic pair of the X chromosomes of a female *C. mechowi*. From left to right: conventional staining, C-, and G-banding.

by a very dark long arm and a small heterochromatin block on the short arm near the centromere. The remaining major portion of the Y short arm was C-negative.

Both G- and C-banding indicate that the heteromorphism of the sixth autosomal pair may be due to a pericentric inversion of a small chromosomal segment, probably linked with loss of part of the heterochromatin.

Three pairs of autosomes possessed NORs (the short arm of a medium sized subtelocentric chromosome, presumably No. 10, at the intercalary position of pair No. 14, and in the telomeric regions of a pair of small metacentrics [Fig. 4]). The X chromosomes had NORs in the large secondary constrictions.

In the female, the X chromosomes were heteromorphic: the longer X was submetacentric whereas the smaller one was

Table 1. Basic characteristics of known karyotypes of *Cryptomys*

Species	Locality	2n	Autosomes (NF)			X	Y	Ref.
			M + SM	A + ST	Arms			
mechowi	Zambia (Ndola)	40	18	1	76	M/SM large!	SM large!	P
natalensis	South Africa (Natal)	54	24	2	100	SM large	A small	N
hottentotus	South Africa (Cape)	54	25	1	102	SM large	?	N
unnamed	Zambia (Itezhi-Tezhi)	58	9	19	74	M medium	dot-like	B
unnamed	Zambia (Lusaka)	68	5	28	76	M medium	A small	B
foxi	Cameroon (Ngaoundere)	66 (70)	26 (28)	6	116 (124)	SM large	M small	W
damarensis	Namibia (Otjiwarongo)	74	?	?	?	?	?	N
damarensis	Botswana (Kalahari)	78	8	30	92	M large	SM small	N

2n = diploid number, NF = *nombre fondamental*, M = metacentric, SM = submetacentric, A = acrocentric, ST = subtelocentric, X = chromosome X, Y = chromosome Y, Ref. = reference, exclamation mark (!) stands for extraordinarily, P = present paper, N = Nevo et al., 1986, B = Burda et al., 1992, W = Williams et al., 1983.

metacentric. This phenomenon was obviously caused by varying amounts of constitutive heterochromatin between the centromere and the secondary constriction (Fig. 5).

The striking size of both the X and Y chromosomes raises a question as to their origin. Basically, two possible explanations are suggested: (i) an increase in the heterochromatin or (ii) a translocation of a pair of autosomes to the sex chromosomes. Considering the size and G- and C-banding patterns of the Y short arm and the distal part of the X long arm, the second possibility or a combination of both possibilities seems to be most likely.

The karyotype of *Cryptomys mechowi* represents the lowest diploid number among all the *Cryptomys* species and all the bathyergids examined thus far (Table I). The size of both sex chromosomes of *C. mechowi* is exceptional; in all other *Cryptomys* species studied, the X chromosomes are of a standard length (representing about 5% of the female haploid set). The large heterochromatic segments in the X chromosomes of *C. mechowi* resemble those described earlier in *C. hottentotus* (Nevo et al., 1986); yet they are more than twice as large.

This study provides further evidence that the genus *Cryptomys*, like that of some other subterranean rodents (spalacids, ctenomyids, and geomyids, Nevo et al., 1986), is characterized by extraordinarily extensive karyotype variation. To understand mechanisms of the chromosomal evolution in the Bathyergidae in general and in *Cryptomys* in particular, comparative studies of chromosomal banding patterns are needed. To date, however, *Cryptomys mechowi* is the only species for which a complete banded karyotype is available.

Acknowledgements

We thank Dr. J. Kocka for assistance in the field.

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