Z. Säugetierkunde **64** (1999) 36–50

ZEITSCHRIFT FÜR SÄUGETIERKUNDE
INTERNATIONAL JOURNAL OF MAMMALIAN BIOLOGY

The karyotypes of *Cryptomys anselli* sp. nova and *Cryptomys kafuensis* sp. nova: new species of the common mole-rat from Zambia (Rodentia, Bathyergidae)

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Receipt of Ms. 04. 05. 1998
Acceptance of Ms. 19. 10. 1998

Abstract

Two new species of a "small form" (i. e. with body mass of about 90 g) of the African mole-rat *Cryptomys* (Rodentia: Bathyergidae) are described from Zambia: *C. anselli* sp. nova characterized by diploid chromosome number 2n = 68 from Lusaka Province and *C. kafuensis* sp. nova with 2n = 58 chromosomes from Itezhi-Tezhi, Kafue National Park, Southern Province. Conventionally stained, C- and G-banded karyotypes, and localisation of NORs are described for both species. Whereas classical morphological and morphometrical traits cannot be used for diagnosis of *Cryptomys* species, karyotypes and allozymes enable distinction of both new species from each other and from other known *Cryptomys* species. Nevertheless, also the thickness of the external wall of the infraorbital foramen (relative to the breadth of the opening) seems to be species-specific: it is thicker in the examined specimens of *C. anselli* sp. nova but thinner in *C. kafuensis* sp. nova.

Key words: *Cryptomys*, Bathyergidae, chromosome, subterranean mammals, taxonomy

Introduction

African mole-rats of the genus *Cryptomys* Gray, 1864 (Bathyergidae) are subterranean rodents occurring from semi-arid to mesic habitats in different soil types over a wide geographic range from Ghana to the Cape Province in South Africa. Although it is not a problem to recognize *Cryptomys* as *Cryptomys*, extreme variation in many morphological traits (cranial parameters, body size, pelage coloration) traditionally employed in alpha-taxonomy of rodents, makes taxonomic treatment of this genus very difficult. Accordingly, different authors recognize different numbers of species. Thus, for instance, 44 to 49 species of *Cryptomys* have been named by Allen (1939) or Ellermann (1940), respectively, whereas only three have been considered by Nowak (1991). More recently, Honeycutt et al. (1991) recognized seven species: *Cryptomys bocagei* (De Winton, 1897); *Cryptomys damarensis* (Ogilby, 1838); *Cryptomys foxi* (Thomas, 1911); *Cryptomys hottentotus* with subspecies *C. h. hottentotus* (Lesson, 1826), *C. h. natalensis* (Roberts, 1913), *C. h. darlingi* (Thomas, 1895); *C. h. amatus* (Wroughton, 1907), and *C. h. whytei* (Thomas, 1897); *Cryptomys mechowi* (Peters, 1881); *Cryptomys ochraceocinereus* (Heuglin, 1864); *Cryptomys zechi* (Matschie, 1900).

It has been repeatedly demonstrated (Rosevear 1969; Ansell 1978; Williams et al. 1983; Nevo et al. 1986, 1987; Honeycutt et al. 1987, 1991; Janecek et al. 1992) that classi-

0044-3468/99/64/01 – 036 $ 12.00/0

cal morphological qualitative and quantitative traits are not sufficient for the diagnosis of *Cryptomys* species, and additionally, cytology, serology, and molecular genetics should be taken into account. Subsequent karyological studies demonstrated that at least *Cryptomys darlingi* and *Cryptomy amatus* should be considered distinct species (Aguilar 1993; Macholán et al. 1998). In addition, our allozyme and karyotype studies (Filippucci et al. 1994, 1997; Macholán et al. 1993) identified two additional species of the small form of *Cryptomys* in Zambia characterized by karyotypes 2n = 58 (the "Itezhi-Tezhi population") and 2n = 68 (the "Lusaka population").

Particularly the Lusaka population (2n = 68) has been subjected to intensive research on various aspects of its biology: reproduction and social behaviour (Burda 1989, 1990, 1995; Begall 1997; Begall and Burda 1998; Willingstorfer et al. 1998), hearing, ear morphology, and vocalization (Müller and Burda 1989; Burda et al. 1992; Müller et al. 1992; Lindenlaub and Burda 1993, 1994; Lindenlaub et al. 1995; Kössl et al. 1996; Brückmann and Burda 1997; Credner et al. 1997), magnetic compass orientation (Burda et al. 1990; Marhold et al. 1997), aspects of neuroanatomy (Oelschläger and Burda 1992; Misek et al. 1996), physiology of metabolism (Marhold and Nagel 1995). Parasites in both species (and *C. mechowi*) have been studied by Scharff et al. (1996, 1997). In the meantime, the Zambian *Cryptomys* has become a well established model in many further biological studies. This fact calls for an unambiguous denomination of this species. While it has been obvious to us (and we have repeatedly stated it in all our publications) that these *Cryptomys* represent species distinctly different from South African *Cryptomys hottentotus* (for which they had been previously taken), a formal description has not been possible until the taxonomic status of neighbouring populations of *Cryptomys amatus* and *C. darlingi* had been clarified (Macholán et al. 1998; Aguilar 1993). While the species status and their distinction from other *Cryptomys* species have been proven in allozyme studies (Filippucci et al. 1994, 1997), in this study we denominate both species and describe their karyotypes in detail.

Material and methods

Altogether nine individuals of the Lusaka population (see below and Tab. 1) and three individuals (one male, two females) of the Itezhi-Tezhi population were karyotyped. Mitotic metaphases were obtained directly from bone marrow. Slides were differentially stained using the trypsin digestion (G-banding) technique by Seabright (1971) and the C-banding technique by Sumner (1972). Nucleolus organizer regions (NORs) were visualized by the silver-staining method of Howell and Black (1980).

Results

Cryptomys anselli sp. nova

Holotype
Adult male, whole body ethanol-preserved, in Senckenberg Museum, Frankfurt am Main, Germany, allocation number SMF 87018 (specimen's field number L-45). Collected on 15. 07. 1996 by Andreas Scharff.

Paratype
Adult female, SMF 87019 (L-46); sample data as in holotype.

Type locality
Court of the Chainama Hills Golf Club in the north-eastern part of Lusaka, Zambia.

Etymology

The species name recalls late Mr. W. F. H. Ansell and his merit in the study of taxonomy and distribution of mammals of Zambia.

Measurements and diagnosis

Body size and cranial measurements in *Cryptomys* have no taxonomic-diagnostic value and are not provided here (for reasoning see Discussion). The body mass of adult wild-caught individuals (which is the best parameter for comparing body size among different *Cryptomys* species) in *C. anselli* sp. nova amounts to 76 ± 12 g (range 65–102 g, n = 66) in females and to 96 ± 13 g (range 80–126 g, n = 20) in males. Pelage coloration is age- and body mass-dependent: it is dark slate grey and metallic black in sucklings, greyish brown in weaned pups, brown in juvenile and subadult animals, and eventually golden ochre in adults. There is a remarkable variation in the size and shape of the white head spot, nevertheless, it is well developed in most individuals. The infraorbital foramen is thick-walled (i. e. the external wall is thicker than the breadth of the opening), elliptical or drop-shaped (reference is made to specimens L6, L13, L15, L25, L48, L50, L54, Kenson 4, Kenson 9, Kenson 10, Kenson x, LX-3, LX6, and LX-13 deposited at the Department of General Zoology, University of Essen). However, it should be noted that lateral asymmetry in the shape of the infraorbital foramen was found in some specimens (L19, L23).

The analysis of allozymic variation allows clear separation of *Cryptomys anselli* sp. nova from *C. kafuensis* sp. nova, *C. mechowi*, *C. damarensis*, *C. h. hottentotus*, and *C. h. natalensis* and warrants attributing of a species status (Filippucci et al. 1994, 1997).

The diploid chromosome number in all the individuals examined (n = 9) is 2n = 68. The proportion of acrocentric and biarmed chromosomes is variable. The karyotype consists of mainly (56–59) acrocentric chromosomes, 2–4 large subtelocentric autosomes, 0–3 submeta- or metacentric autosomes, and 4–6 small biarmed autosomes (cf. Fig. 1, Tab. 1). The X chromosome is variable in size and centromeric position, and the two X chromosomes in female sets are often heteromorphic. The Y chromosome is dot-like, probably uniarmed. Consequently, NF is variable and ranges from 79 to 82. C-positive heterochromatic arms are observed in a varied number of large biarmed autosomes and in a small pair of subtelocentric autosomes. Centromeric dark bands are present in most chromosomes. Distinct telomeric dark C-bands are situated in one large submetacentric chromosome (presumably the X) and in six autosomal pairs. The Y chromosome stains positively in C-banded slides (Fig. 2). G-banding cannot reveal any clear homology among the large biarmed autosomes and the X chromosomes (Fig. 3). Ag-NORs are situated in the telomeric areas of one large biarmed chromosome, two small metacentric, and in about 10 acrocentric autosomes.

Table 1. Composition of individual karyotypes in the examined specimens of *Cryptomys anselli* sp. nova.

No.	protocol	sex	NF	NFa	large ST	large M/SM	small M/SM	a
1	MM240	M	79	75	3	0	6	57
2	MM241	F	79	75	3	0	6	57
3	MM242	F	80	76	4	1	5	56
4	MM243	M	79	75	2	1	6	57
5	JZ1051	F	80	76	2	2	6	56
6	MM329	F	81	77	4	1	6	55
7	MM870	F	81	77	4	2	5	55
8	MM871	M	82	78	3	3	6	54
9	MM872	F	80	76	4	2	4	56

Fig. 1 a.

Chromosomal slides are deposited in the Institute of Vertebrate Biology, Academy of Sciences CR, Brno, Czech Republic.

Distribution and habitat
The animals of this species were collected in cultivated fields, gardens, golf courses, and savannah-bushland habitats in Lusaka, Zambia, and its north-eastern suburbs (within and near the University of Lusaka campus), in Ngwerere (10 km north of Lusaka), Mungule (about 30 km north-west of Lusaka) and Chinunyu (about 90 km east of Lusaka), i. e., within the degree squares 1528 A1, 1528 A4, and 1529 A1 (following the mapping of Ansell 1978). The collecting sites are characterized by the mean annual rainfall of 822 mm (monthly precipitation amounts to 68 ± 81 mm, range 0–207 mm).

Cryptomys kafuensis sp. nova

Holotype
Adult female, whole body ethanol-preserved, in Senckenberg Museum, Frankfurt am Main, Germany, allocation number SMF 87124. Collected on 27. 05. 1991 by Jiří Kočka.

Paratype
Adult females, SMF 87125 and SMF 87126; sample data as in holotype.

Fig. 1 b.

Fig. 1. Conventionally stained karyotypes of *Cryptomys anselli* sp. nova. a = individual No. 5 in table 2, b = individual No. 6.

Type locality
"Hot Springs" in Itezhi-Tezhi, Kafue National Park, Southern Province, Zambia, within the degree square 1526 C1 (following the mapping of Ansell 1978).

Etymology
The name of the species refers to the locality, the Kafue National Park in Zambia.

Measurements and diagnosis
The body mass of adult wild-caught individuals in *C. kafuensis* sp. nova amounts to 73 ± 9 g (range 61–77, n = 10) in females and to 113 ± 28 g (range 84–139, n = 3) in males. Pelage coloration and its age-dependent changes correspond to the situation described above for *C. anselli* sp. nova. The white head spot is well developed in most individuals and tends to be more prominent than in *C. anselli* sp. nova; nevertheless, its size and shape are individually very variable. The infraorbital foramen is thin-walled (i. e. its external wall is thinner than the breadth of the foramen), drop-like to elliptical (reference is made to specimens K6, K8, K10, K14 deposited at the Department of General Zoology, University of Essen).

The analysis of allozymic variation allows clear separation of *C. kafuensis* sp. nova from *Cryptomys anselli* sp. nova, *C. mechowi*, *C. damarensis*, *C. h. hottentotus*, and *C. h. natalensis* and warrants allocation of a species status (Filippucci et al. 1994, 1997).

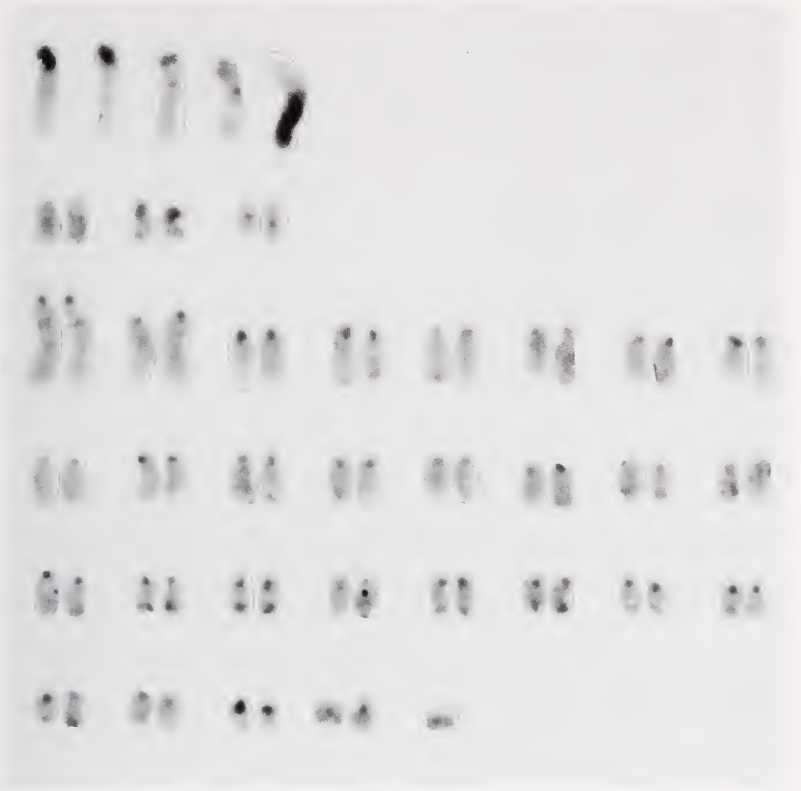

Fig. 2 a.

The diploid chromosome number in all the individuals (n = 3) examined is 2n = 58, NF = 82. The karyotype consists of 11 biarmed and 17 acrocentric autosomal pairs. Four biarmed (one metacentric, two submetacentric, and one subtelocentric) autosomal pairs can be distinguished according to their larger size. The other biarmed (six meta- or submetacentric and one subtelocentric) pairs of autosomes are distinctly smaller. The two largest acrocentric pairs are approximately as large as the largest biarmed autosomes. One of these large acrocentric pairs possesses very short second arms. The other acrocentric autosomes are distinctly smaller and they form a continuum of decreasing sizes. The X chromosome is metacentric and its size is similar to the largest autosomes. The Y chromosome is dot-like, probably uniarmed (Fig. 4 a). The C-banded karyotype reveals considerable amounts of positively stained heterochromatin. One arm and the broad pericentromeric area of the largest metacentric autosome are completely heterochromatic. A heterochromatic small arm is visible also in the small subtelocentric pair. Centromeric dark bands are found in certain biarmed and in most of the acrocentric chromosomes. A telomeric C-positive band in one arm is situated in three pairs of biarmed and five pairs of acrocentric autosomes. Intercalary dark bands are situated in two acrocentric autosomes. The X chromosome is not positively stained in C-banded preparations, whereas the Y chromosome has a prominent dark band in the pericentromeric area (Fig. 4 b). The large metacentric autosome with the C-heterochromatic arm stains mainly negatively in G-banded preparations, and it possesses only one large dark band situated in the euchromatic arm. The G-banding pattern enables identification of most of the homologous chro-

Fig. 2 b.

Fig. 2. C-banded karyotype of *Cryptomys anselli* sp. nova. a = individual No. 5, b = individual No. 3.

mosomes (Fig. 4 c). The Ag-NORs positive signals are observed in the telomeric areas of several (10–12) small metacentric and acrocentric autosomes.

Chromosomal slides are deposited in the Institute of Vertebrate Biology, Academy of Sciences CR, Brno, Czech Republic.

Distribution and habitat

The animals of this species were collected in grassland habitats at the locality Hot Springs and cultivated fields of nearby villages, in Itezhi-Tezhi, Kafue National Park, Zambia, within the degree square 1526 C1 (following the mapping of Ansell 1978). The collecting site is characterized by the mean annual rainfall of 787 mm (monthly precipitation amounts to 66 ± 78 mm, range 0–199 mm).

Discussion

Morphology and morphometry

As stated earlier *Cryptomys* mole-rats are remarkably polymorphic, so that it is not possible to provide unambiguous diagnostic morphological traits or measurements. As in other rodents, *Cryptomys* is characterized by indeterminate growth. However, the growth is not continuous and its rate is subjected to accelerations and periods of stasis depending on di-

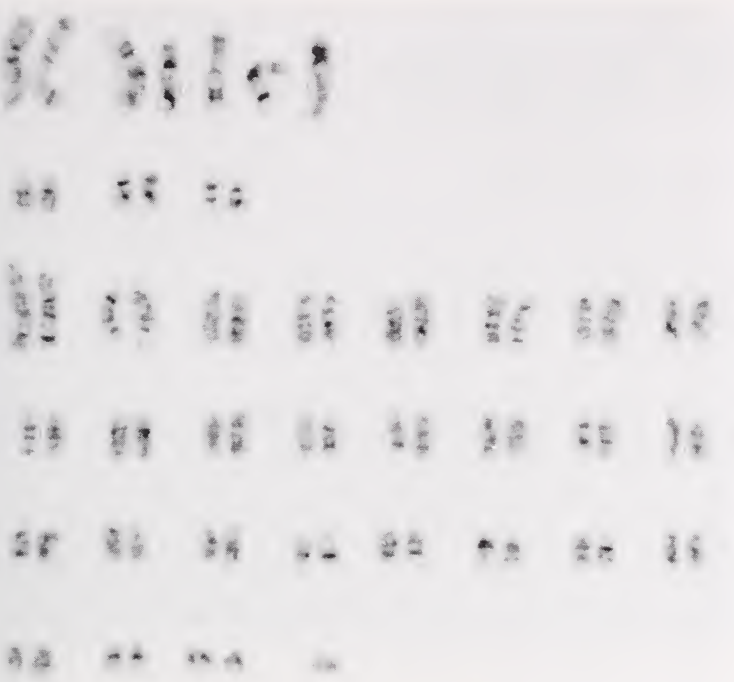

Fig. 3. G-banded karyotype of *Cryptomys anselli* sp. nova individual No. 5.

verse factors (reproductive and social status, age, and unknown factors). Due to these facts, the generally slow growth rate, and remarkable longevity (15 years and more), the body size and form and consequently also cranial proportions are subject to progressive and regressive changes (i. e. they fluctuate) during individual life (cf. Begall and Burda 1998). For counting the mean adult body mass we selected individuals from our sample which weighed at least 60 g in females and 80 g in males. This arbitray limit is based on our long-term observation (Burda 1989; 1990; Begall and Burda 1998) of the lowest body mass of breeding animals in captivity. Whereas there is significant sexual dimorphism in body mass in both species, there is no significant difference in body mass of males or females between both species.

Whereas in all the examined skulls (n = 14, juveniles and adults, females and males being represented in the sample) of *C. anselli* sp. nova, the external wall of the foramen infraorbitale was relatively thick, all the examined skulls (n = 4, 2 adult males, 2 adult females) of *C. kafuensis* sp. nova were characterized by a thin-walled foramen. Honeycutt et al. (1991) considered thick-walled outer foramina to be characteristic of the *C. damarensis*, *C. mechowi*, and *C. bocagei* group (and west and central African species), while thin-walled foramina should characterize the *C. hottentotus* group. Consequently, *C. anselli* sp. nova should be grouped with *C. damarensis* and *C. mechowi*, whereas *C. kafuensis* sp. nova should be closer related with *C. hottentotus*. However, the results of allozymic studies (Filippucci et al. 1994, 1997) do not support such distinction. Moreover, it should be noted that our specimens of *C. mechowi* from Ndola exhibit the thin-walled condition.

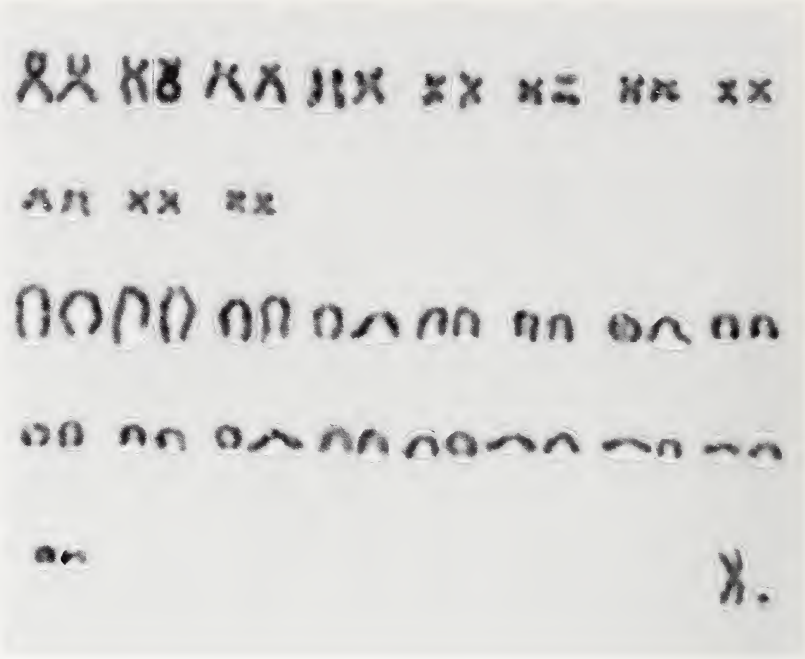

Fig. 4 a.

Fig. 4 b.

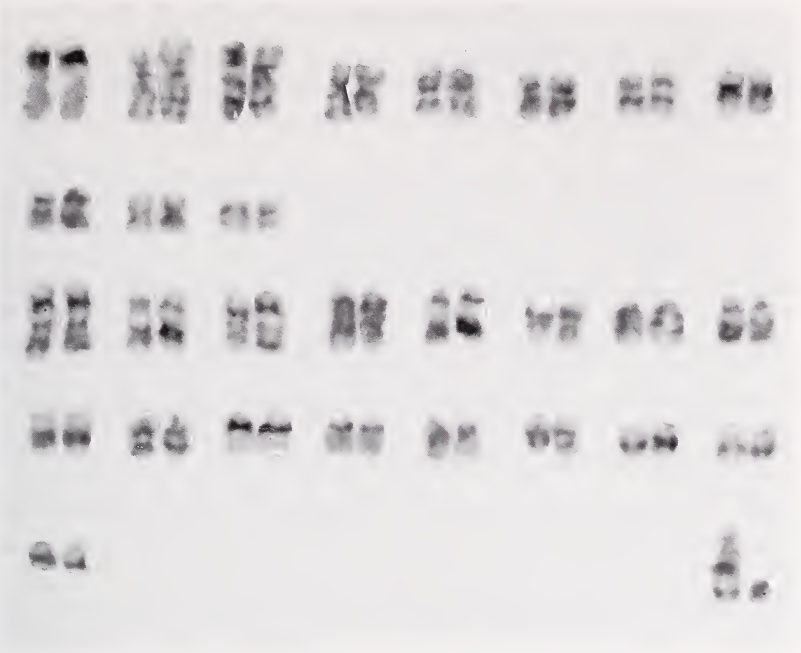

Fig. 4 c.

Fig. 4. Karyotypes of a male of *Cryptomys kafuensis* sp. nova. a = conventional staining, b = C-banding, c = G-banding.

Table 2. Characteristics of known karyotypes (representing different species) of *Cryptomys*. M – metacentric, SM – submetacentric, ST – subtelocentric, A – acrocentric, NF – fundamental number of chromosome arms in a female karyotype.

Species	Occurrence	Karyotype (2 n)	Autosomes			Sex chromosomes		Arms (NF)	Reference
			M, SM	ST	A	X	Y		
C. mechowi	Zambia (Copperbelt Province)	40	38			M/SM	SM	80	Macholán et al. (1993)
C. amatus	Zambia (Central Province)	50	42	2	4	M	A	96	Macholán et al. (1998)
C. h. hottentotus	South Africa (Transvaal)	54	50		2	SM	?	106	Nevo et al. (1986)
C. h. natalensis	South Africa (Natal)	54	48		4	SM	A	104	Nevo et al. (1986)
C. darlingi	Zimbabwe (Harare)	54	28		24	A	M	82	Aguilar (1993)
C. kafuensis	Zambia (Southern Province)	58	18	4	34	M	dot	82	present study
C. foxi	Cameroon	66 (70)	58		6	SM	M	130 (138)	Williams et al. (1983)
C. anselli	Zambia (Lusaka Province)	68	6–9	2–4	56–59	M	dot	79–82	present study
C. damarensis	Botswana (Kalahari)	78	16		60	M	SM	96	Nevo et al. (1986)

Karyotype

In addition to the results of allozymic studies (Filippucci et al. 1994, 1997), also distinct numbers and morphology of the chromosomes substantiate distinguishing of *Cryptomys anselli* sp. nova and *C. kafuensis* sp. nova from other species of the genus and from each other.

The variation in the number of biarmed autosomes in *Cryptomys anselli* sp. nova is presumably due to changes in the number of heterochromatic arms. Regarding the difficulty in establishing homologies between the affected pairs according to the G-banding pattern, it is probable that also other unknown mechanisms were involved. Differences in the number of biarmed autosomes probably result from additions and/or deletions of the C-heterochromatic arms. The variation is interindividual and no consistent differences were found between the specimens collected in different localities. The G-banding pattern in the metacentric autosome with the whole-heterochromatic arm in *Cryptomys anselli* sp. nova seems similar to the analogous chromosome in *C. kafuensis* sp. nova.

The similar fundamental numbers of chromosomal arms found in *Cryptomys anselli* sp. nova, *C. kafuensis* sp. nova, *C. darlingi*, and *C. mechowi* (cf. Tab. 2) suggest Robertsonian rearrangements as a possible mechanism of chromosome speciation and indicate that different chromosomal fusions might have taken place in the evolution of individual lineages. Quantitative heterochromatin changes certainly played an important role in karyotype differentiation in this group. This is demonstrated also by an unusual extent of interindividual heterochromatin variation within the *Cryptomys anselli* sp. nova populations. A large metacentric autosome with the whole-heterochromatic arm is apparently stable in the 2n = 58 karyotype; however, its presumable homologue in the 68-chromosome karyotype is polymorphic.

Unfortunately, the high chromosome number and low G-band resolution level achieved in the preparations studied do not allow direct comparison between both karyotypes, or between them and other karyotypes known to date in the genus *Cryptomys*.

Taxonomy of Zambian *Cryptomys*

Following species and subspecies of *Cryptomys* have been formally described and named by previous authors from (what is now) Zambia and across borders (cf. Allen 1939, and see Fig. 5):

1. *Cryptomys darlingi* (Thomas, 1895) from surroundings of Harare (Salisbury), Zimbabwe, reference grid 1731-C. *Cryptomys darlingi* was considered a subspecies of *C. hottentotus* by Honeycutt et al. (1991). Although having the same chromosome number (2n = 54), composition of its karyotype is distinctly different (cf. Tab. 2) and warrants a species status (Aguilar 1993). The karyotype is distinct from karyotypes of Zambian *Cryptomys* studied to date.

2. *Cryptomys micklemi* (Chubb, 1909) from the Kataba river region, reference grid 1523-A, was considered a subspecies of *C. damarensis* by all subsequent authors. The animals from the type locality should be examined to check their taxonomic status.

3. *Cryptomys molyneuxi* (Chubb, 1908) from Luano Valley. This is a valley through which the combined Lunsemfwa and Mulungushi rivers flow after breaking through the Muchinga Escarpment (reference grids 1429-C to 1430-C, the exact type locality remains unknown – cf. Ansell 1978). A. Scharff (1996 unpubl. results) has found no evidence of *Cryptomys* in the reference grid 1429, where *Cryptomys* is obviously replaced by *Heliophobius* (cf. also Ansell 1978). This would imply that the type locality has to be searched for in the eastern part of the Valley, actually nearer to the type locality of *C. amatus* than to *C. anselli* sp. nova. It should be noted that all the subsequent authors have considered *C. molyneuxi* a synonym of *C. amatus*.

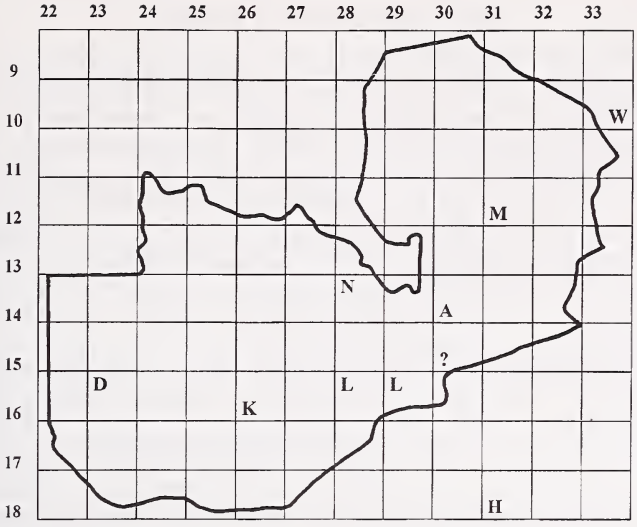

Fig. 5. Type localities of *Cryptomys* taxa described from (what is now) Zambia and extralimitally. H = *C. darlingi*, D = *C. damarensis micklemi*, K = *C. kafuensis* sp. nova, L = *C. anselli* sp. nova, ? = *C. hottentotus molyneuxi* = *C. amatus*, A = *C. amatus*, N = *C. mechowi* (2 n = 40, from Ndola), M = *C. mechowi mellandi*, W = *C. whytei.*

4. *Cryptomys amatus* (Wroughton, 1907) from the Alala Plateau (reference grid 1330-C) was considered a subspecies of *C. hottentotus* by subsequent authors. Faulkes et al. (1997) and Bennett and co-authors in their studies on *Cryptomys* contributed to the puzzle in calling *Cryptomys* from Lusaka *C. h. amatus*, even when citing our studies, implying that this is a name used by us to denominate Lusaka populations. This is, however, not true as we have reported these mole-rats as *Cryptomys* sp. (2 n = 68, Lusaka population) and always mentioned the taxonomic and nomenclature problems. Recently, we have collected mole-rats from the type locality of *C. amatus* and showed that they are different from *Cryptomys* from Lusaka and from *C. hottentotus* and deserve a species status of their own (Macholán et al. 1998).

5. *Cryptomys mellandi* (Thomas, 1906) from Mpika (reference grid 1131-C) was considered a subspecies or synonym of the giant mole-rat, *C. mechowi.* We have collected *C. mechowi* in Ndola (refrence grid 1328-B). It has still to be checked whether the Ndola giant mole-rats and *C. (mechowi) mellandi* are taxonomically identical. Giant mole-rats are not only morphologically (body size) but also karyologically (Macholán et al. 1993), though less allozymatically (Fillippucci et al. 1997), distinct from the smaller forms of *Cryptomys.*

6. *Cryptomys whytei* (Thomas, 1897) from Karonga, Malawi (reference grid 0933-D) was considered a subspecies of *C. hottentotus* by subsequent authors. Although we have not examined mole-rats from the type locality, we have studied karyotypes of single individuals from Kasama (ref. grid 1031-A) (Burda and Kawalika unpubl.) and from Malawian Nyika (1033-B) (Burda and Chitaukali unpubl.). Animals from both localities are chromosomally clearly distinct from each other and from all other *Cryptomys* studied to date.

Based on these facts we can exclude the possibility that *Cryptomys anselli* sp. nova from Lusaka and *Cryptomys kafuensis* sp. nova from Itezhi-Tezhi would represent just synonyms of already described species or subspecies.

Speciation "hotspot" in Zambia?

The earlier studies of karyotypes in bathyergids indicated, in contrast to the situation in many other subterranean rodents (particularly spalacids and ctenomyids) remarkable chromosome stability and conservatism. Thus, only one karyotype (2 n = 60, George 1979) was described in the eusocial naked mole-rat (*Heterocephalus glaber*), distribution of which covers 14 latitude degrees; two karyotypes (2 n = 60, George 1979; 2 n = 62, own unpubl. data) are known in solitary *Heliophobius argenteocinereus*, distributed across 18 latitude degrees, and three chromosome species of *Cryptomys* were defined in the Southern African subregion, covering about 17 latitude degrees: 2 n = 78 (or 74) in *C. damarensis* and 2n = 54 in *C. hottentotus* (Nevo et al. 1986); and 2 n = 54 in *C. darlingi* (Aguilar et al. 1993).

Contrary to those earlier findings on bathyergids from other regions of Africa, only in Zambia, within a relatively narrow belt covering 3 degrees of latitude, we have identified already four distinct karyotypes, representing four different species of *Cryptomys*: 2 n = 40 (Macholán et al. 1993), 2 n = 50 (Macholán et al. 1998), 2 n = 58, and 2 n = 68 (present study). Since only few populations were studied within the given belt and since Zambia itself extends from north to south over ten latitudes, many more karyotypes are expected to occur there (and our pilot studies confirm this prediction). Systematic faunistic, taxonomic, and ecological study of *Cryptomys* in Zambia (and neighbouring Malawi) will be of high interest for assessment of chromosomal evolution in this "hotspot" region and its historical/ecological causes, compared to relative stability in the Southern Africa subregion.

Acknowledgement

We thank D. Kock for his comments on the manuscript and his advice. Assistance in the field by J. Kočka and late S. Krunič is highly appreciated. This study was partly supported by a travel grant from the DAAD to A. S., the grant (no. VS97102) of the Ministry of Education of the Czech Republic to J. Z. and M. M., and the grant from the research pool of the University of Essen to H. B.

Zusammenfassung

Die Karyotypen von Cryptomys anselli sp. nova und Cryptomys kafuensis sp. nova: neue Arten des Graumull von Sambia (Rodentia, Bathyergidae)

Zwei neue Arten von Graumullen, *Cryptomys* (Rodentia: Bathyergidae), der „Kleinform" (um ca. 90 g) werden von Sambia beschrieben: *C. anselli* sp. nova, charakterisiert durch die diploide Chromosomenzahl 2 n = 68 von der Lusaka-Provinz, und *C. kafuensis* sp. nova mit 2 n = 58 Chromosomen von Itezhi-Tezhi, Kafue-Nationalpark, Süd-Provinz. Konventionell gefärbte Karyotypen, einschließlich der C- und G-Bänderungsmuster, als auch die Lokalisation der NORs werden für die beiden Arten beschrieben. Während die klassischen morphologischen und morphometrischen Merkmale eine Artdiagnose bei der Gattung *Cryptomys* nicht ermöglichen, unterscheiden die Karyotypen und Allozyme die beiden neuen Arten voneinander und von anderen bekannten Arten der Gattung *Cryptomys*. Die Dicke der Außenwand (verglichen mit der Breite der Öffnung) des Foramen infraorbitale scheint artspezifisch zu sein: die Wand ist dicker bei allen untersuchten Exemplaren von *C. anselli* sp. nova und dünner bei *C. kafuensis* sp. nova.

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