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Species of the genus *Otomys* from Cameroon and Nigeria and their relationship to East African forms

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Abstract. Specimens of *Otomys* collected in 1988 in the Gotel Mts represent the first record from Nigeria and the westernmost occurrence of this African genus. They were compared with previous records from West Cameroon. It could be shown that the occurrence of *Otomys irroratus burtoni* appears to be confined to Mt Cameroon, that the specimens of Mt Oku are conspecific with the new ones from Nigeria, and that both represent a new species which is named and described. It seems to be closely related to *O. barbouri* and *O. lacustris*, both species distributed in some East African mountains.

Key words. Mammalia, Muridae, *Otomys*, West Africa, systematics, new species.

Introduction

Organized by the Nigerian Conservation Foundation, an expedition to the mountain rain forests of the Gotel Mts and Mambilla plateau took place in March 1988 (Ash & Dowsett-Lemaire 1989). Small mammals and bats were collected by the German ornithologist Gerhard Nikolaus and housed in the museums of Stuttgart and Bonn. A provisional species list was hastily published by Nikolaus & Dowsett (1989), but without the consent of Nikolaus. In this paper the four specimens of *Otomys* collected were listed as *O. irroratus burtoni*, until then the only West African form of *Otomys*, known from Mt Cameroon and Mt Oku (Eisentraut 1963, 1968, 1973). A more careful examination revealed that the new specimens from Nigeria and those from Mt. Oku all belong to an undescribed species which seems to have a close relationship to *Otomys* forms known from some East African mountains.

Material studied

Nigeria: Chappal Waddi, Gotel Mts (1900 m): SMNS No. 41336, male, skin and skull, 23 March 1988; Gangirwal, Gotel Mts (2300 m): SMNS No. 41335, female, skin and skull, 17 March 1988; ZFMK No. 88.139, female, skin and skull, 18 March 1988; No. 88.140, female, skin and skull, 20 March 1988. All collected by G. Nikolaus.

Cameroon: Mt Oku (2100 and 3000 m): ZFMK No. 69.218, female, skin and skull, 28 January 1967, coll. by M. Eisentraut; MNHN No. 1980-60, female and No. 1981-1370 (could not be retrieved in the collection), both skin and skull, November 1976, coll. by H. Lamotte. All determined as *O. irroratus burtoni*. — Mt Cameroon (2300—4000 m): SMNS Nos 5511 to 5513, 6479/80, all skin and skull, 1954 and 1957/58, coll. by M. Eisentraut. All determined as *O. irroratus burtoni*.

Kenya/Uganda: Mt Elgon (up to 4300 m): MNHN Nos 1933.2758 to 1933.2760, 1933.2762 to 1933.2766, all skin and skull, 1933, all collected by "mission de l'Omo". All determined as *O. tropicalis elgonis*. BMNH No. 10. 4. 1. 83, skin and skull, 23 November 1909, coll. by R. Kemp, determined as *O. tropicalis elgonis*; BMNH No. 66.3813, skin and skull, 22 February 1959, coll. AC Brooks. Determined as *O. barbouri*.

Tanzania: Mbizi forest, Ufipa plateau east of Umbawanga: BMNH No. 58.355, male, 9 July 1957; BMNH No. 58.356, male, 9 July 1957; BMNH No. 58.358, female, 8 July 1956; Poroto

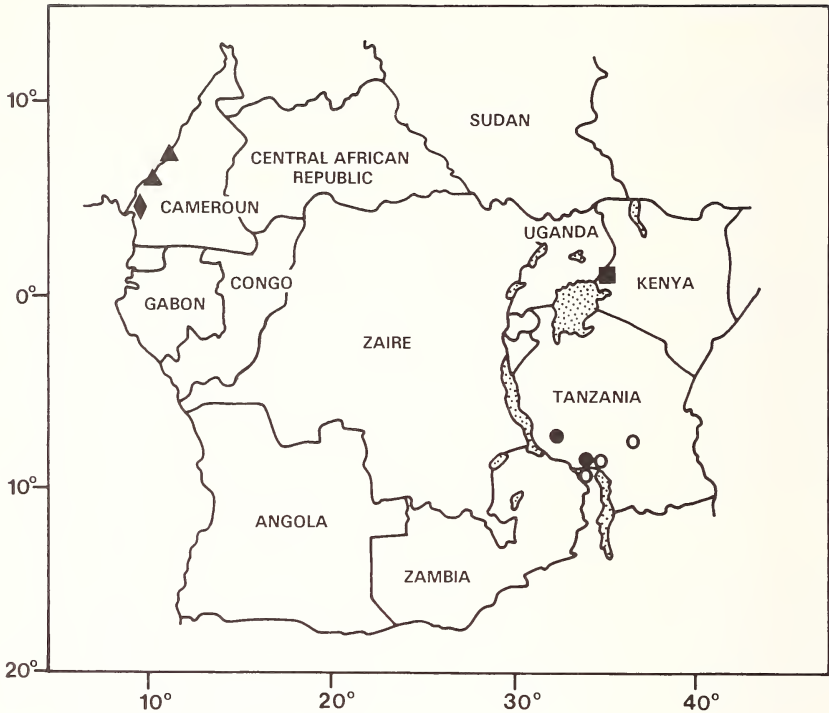


Fig. 1: Distribution map of: ◆ *Otomys irroratus burtoni*, ▲ *Otomys occidentalis*, ■ *Otomys barbouri*, ● *Otomys lacustris* (specimens studied) and ○ *Otomys lacustris* (data from literature).

Locality	Country	Gazetteer of Collecting Places		Altitude (m)
		Coordinates		
Cameroon Mt	Cameroon	04° 04' N	09° 07' E	2260
Chappal Waddi	Nigeria	07° 01' N	11° 41' E	1900
Dabaga	Tanzania	08° 07' S	35° 55' E	1829
Elgon Mt, south face	Kenya	01° 09' N	34° 35' E	3353
Gangirwal	Nigeria	07° 02' N	11° 42' E	2300
Igale	Tanzania	09° 03' S	33° 25' E	1829
Ilolo	Tanzania	09° 10' S	33° 35' E	1402
Kaburomi	Uganda	01° 14' N	34° 31' E	3200
Madangi	Uganda	01° 10' N	34° 29' E	
Madehani	Tanzania	09° 20' S	34° 01' E	2134
Mbizi	Tanzania	07° 52' S	31° 41' E	
Mugesse Hill	Malawi	09° 39' S	33° 33' E	1888
Oku Mt	Cameroon	06° 12' N	10° 32' E	2300/3000
Poroto Mtns	Tanzania	09° 00' S	33° 45' E	2286
Tandala	Tanzania	09° 23' S	34° 14' E	1524

Mts, east of Mbeya (2300 m): BMNH No. 58.363, male, 23 October 1956. All skin and skull, coll. by L. D. Vesey Fitzgerald and determined as *O. anchietae lacustris*.

A list of localities is provided with Fig. 1.

Abbreviations: BMNH: British Museum (Natural History), London; MCZ: Museum of Comparative Zoology, Cambridge/Mass.; MNHN: Muséum National d'Histoire Naturelle, Paris; SMNS: Staatliches Museum für Naturkunde, Stuttgart; ZFMK: Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn.

Results

The first examination of some tooth characters of the Nigerian specimens (and those from Mt Oku) proved a deeply grooved I¹ and I₁ besides laminae number of eight (5 skulls) and seven (one skull) in M³. So they were provisionally considered as *O. irroratus burtoni* following Eisentraut (1963, 1973), although the M₁ was not examined. In *O. irroratus*, the most widespread species (Cameroon to South Africa) of the genus, this molar constantly has four laminae. Van der Straeten examining the M₁ of the Mt Oku specimens somewhat later, noticed five laminae (in one mandible even six), a number which was already mentioned by Petter (1982) and which then also could be confirmed for the specimens from Nigeria.

The laminae number of the first lower molar — together with the tooth characters already mentioned and some others — is one of the most important and constant characters of the genus *Otomys* and of fundamental importance for identification. Thomas (1918) created the subgenera *Anchotomys* and *Lamotomys* because of their laminae numbers in M₁. So our finding that the specimens from Mt Oku and Gotel Mts could not be *O. irroratus* led to the conclusion that a second species occurs in Cameroon and Nigeria.

Petter (1982) considered the specimens from Mt Oku as *O. irroratus* and as further evidence for a polymorphic species. Of the six specimens whose molars are shown in his fig. 1 only two belong to *O. irroratus* (D and F), one (E) to *O. barbouri* and three (A, B, C) to the new species described below. Besides, in his fig. 1A he drew a specimen from Mt Oku (ZFMK 69.218) which was erroneously labelled as collected on Mt Cameroon. Before we describe the new species and compare it with other *Otomys* forms we like to point out the relationship of East African *O. lacustris* and *O. barbouri*.

O. lacustris from southwest Tanzania was described by Allen & Loveridge (1933) as a subspecies of the Angolan *O. anchietae*, Bocage 1882. The determining factor was the first lower molar, showing five laminae in both forms. *O. anchietae*, however, is much bigger, the biggest species of the genus, having different proportions than *lacustris*. Due to its M₁-structure it could have close relationship to *lacustris*, and so Thomas' (1918) integration of both species in the subgenus *Anchotomys* could be justified.

After examination of specimens in the British Museum, Van der Straeten came to the conclusion that *O. lacustris* must be considered as a separate species and no longer as a subspecies of *anchietae*. Another form from Mt Elgon whose M₁ consists of five laminae was described as *O. barbouri* by Lawrence & Loveridge (1953). These authors already drew attention to the great differences between *O. anchietae* and *O. barbouri*. Misonne (1974) considered *lacustris* and *barbouri* as subspecies of *O. anchietae*. With the discovery of a further form with five laminae in M₁ in Cameroon



Fig. 2: *O. occidentalis*, holotype (left) and *O. irroratus* showing the different size of skulls and difference in breadth and angle of nasals.

and Nigeria the question arises whether it is closely related to *O. lacustris* and *O. barbouri*.

Description

Otomys occidentalis n. sp.

Holotype: SMNS 41336, skin and skull of an adult male, collected 23 March 1988 by Gerhard Nikolaus at Chappal Waddi, Gotel Mts, southeast Nigeria.

Etymology: Because of the extreme western distribution the name *occidentalis* appears well-fitting.

Diagnosis: Till now smallest species of the genus. Colouration of dorsal side brown (Mt Oku) to blackish brown (Gotel Mts). Nasals small with a distinct angle and relatively small surface in the rostrate part. Laminae number in M_1 five, in M^3 mostly eight.

Description: Pelage: In both localities colouration of the upper side is different. Those from Mt Oku are slightly reddish over a brown ground colouration. The sides are somewhat lighter due to more yellowish-tipped hairs. The underfur is silky glossy and of blackish grey colouration. Specimens of Mt Gotel are clearly darker with only a few reddish hairs among the blackish-brown ground colouration which is a little bit lightened up by yellowish-tipped hairs. Length of hairs in the middle of the back

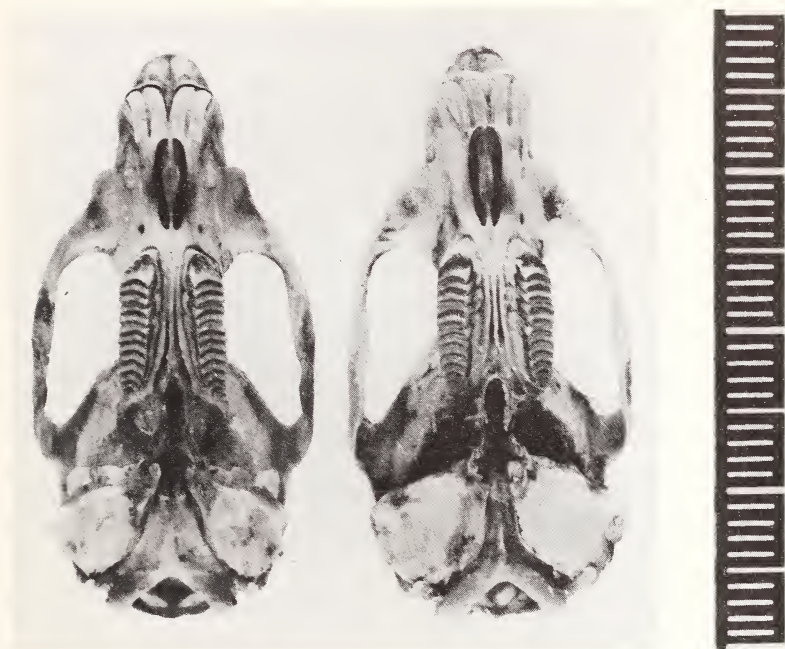


Fig. 3: *O. occidentalis*, holotype (left) and *O. irroratus*. Both skulls of same total length showing the difference in size of the auditory bullae and breadth of the basioccipital.

is between 20–27 mm (20–35 mm in *barbouri*). Ventral pelage: Here as well specimens from Mt Oku are lighter and more brownish than the darker ones from the Gotel Mts. In both localities the tails are bicoloured, above darker, below lighter. Hindfeet: Mt Oku specimens show a brownish ground colouration with a fine lighter speckling; Gotel Mts specimens show a blackish ground colouration with a fine lighter speckling.

Comparisons of pelage: *O. occidentalis* vs. *O. barbouri*: The *barbouri* type series described in detail by Lawrence & Loveridge (1953) and specimens in the Paris Museum correspond in their dark colouration with those of the Gotel Mts. Hair length is longer in *barbouri* (20–35 mm). *O. occidentalis* vs. *O. irroratus burtoni*: the upper side of the latter is much lighter due to the greater number of hairs with yellowish or light brown tips. The same is true when the colouration of the ventral pelage and the hindfeet is compared.

External and skull measurements and other characters (see Tables 1 and 2): As far as can be concluded from measurements of only five adult specimens, *O. occidentalis* appears to be the smallest species of the genus. *O. irroratus burtoni* is clearly bigger and has larger ears than *O. occidentalis* (24 vs. 20 mm).

Skull: Apart from the (overlapping) skull measurements there are some distinctive characters:

1. The number of laminae in M_1 : five in *occidentalis* (as in *barbouri* and *lacustris*), see fig. 4, and four in *irroratus*.

2. M^3 has mostly eight laminae in *occidentalis*, in *barbouri* eight and seven, in *irroratus burtoni*, however, mostly seven and never eight (Fig.3).

3. The nasals (Fig. 2) are essentially smaller in *occidentalis* than in *irroratus*, particularly because of their lower breadth (6.35 vs. 6.98) and their smaller surface in the distal part. Another difference can be seen from above at the outline of the nasals: in *occidentalis* the narrow posterior part of the nasals changes into the broader anterior part with a distinct angle. In *irroratus*, however, there is a gradual transition from narrow to broad. This character also exists in *O. barbouri* and was emphasized by Lawrence & Loveridge (1953): "the anterior half of the nasals is scarcely bent down and moderately broad with a distinct angle from broad to narrow parts". So the shape of the nasals is evidently a character of the *lacustris* species-group. The greatest breadth of nasals in *barbouri* (6.71 mm) is relatively low when compared to skull length.

4. The bullae in *occidentalis* are remarkably smaller and less voluminous than in *irroratus burtoni*. *O. barbouri* and *O. lacustris* also have relatively small bullae (Table 3 and Fig. 3).

Table 1: Measurements and characters of all available specimens of *O. occidentalis*. MNHN 1980-1371 and ZFMK 88.140 are subadult and were not included for calculation of average measurements.

	Mount Oku (Cameroon)			Gotel Mountains (Nigeria)			
	ZFMK 69.218	MNHN 1980-60	MNHN 1981-1370 (Petter 1982)	SMNS 41335	SMNS 41336 Holotype	ZFMK 88.139	ZFMK 88.140
HBL (Head and body length)	141			131	160	138	127
TL (Tail length)	68.5			88	80	75	69
TL in %	49			67	50	54	54
HFL (Hindfoot length) + claw	24	25.1		28	29	26	28
EL (Ear length)	20			18	22	19	20
Weight (g)	88			69	74	78	55
Gr. length of skull	36.0	34.1	28.2	34.3	36.9	—	32.7
Interorbital breadth	4.32	4.02	4.3	4.41	4.43	4.35	4.38
Nasalia, greatest breadth	6.18	6.00		6.25	6.57	6.39	6.17
Upper Molar row	8.50	8.31		8.76	9.62	8.75	8.45
M^3 length	4.90	4.6		5.01	5.11	4.7	4.5
Lower molar row	8.3	7.90		7.94	8.70	7.75	7.50
Bullae length	7.4	7.3		—	7.5	—	7.5
gr. breadth	14.4	15.5		14.1	15.0	—	14.3
M^1 breadth	2.25	2.40		2.30	2.40	2.35	2.30
I^1/I_1 (grooves)	1/1	1/1		1/1	1/1	1/1	1/1
M_1 (laminae)	5/6	5	5	5	5	5	5
M^3 (laminae)	8	8	7	8	8	7	8



Fig. 4: Right lower molar row of *O. occidentalis*, holotype (left) and of *O. irroratus*. M_1 has five laminae in *occidentalis* and four in *irroratus*.

5. Seen from the side the skull is flattened and slightly depressed in the posterior frontal region, both in *occidentalis* and *barbouri*. In *irroratus*, however, it is evenly arched.

Ecological notes: The specimen collected by Eisentraut (1968, 1973) lived in a sparse mountain forest (lockerer Montanwald) on Mt Oku. Petter (1982) gives "prairie d'altitude (3000 m)" for the specimens collected by M. Lamotte on Mt Oku. G. Nikolaus noted in his collecting list for the three Gangirwal specimens "Farn-Grasland" (grassland with ferns) and for the fourth specimen from Chappal Waddi "Grasige Lichtung im Wald" (grassy clearing in forest). A female from Gangirwal had two embryos (1/1) in March 1988.

Discussion

Together with the material from the Gotel Mts the specimens from West Cameroon were re-examined and the existence of two good species could be shown. Eisentraut (1968, 1973) who collected and recorded the first specimens of the new taxon, already noticed differences but provisionally allocated them to the form known from Mt Cameroon.

Table 2: Comparison of external and skull measurements and of tooth characters of adults of the three species probably closely related: *O. lacustris*, *O. barbouri* and *O. occidentalis*. Further the differences between both species occurring in Cameroon and/or Nigeria *O. occidentalis* and *O. irroratus burtoni* can be seen. All skull measurements were taken by the authors. External measurements were made by the collectors. Measurements of hindfeet in *lacustris*, some *barbouri* and *irroratus burtoni* were made by the authors on the dry skin because of lacking or evidently wrong notes on the labels.

	<i>O. lacustris</i>		<i>O. barbouri</i>		<i>O. occidentalis</i>		<i>O. irroratus burtoni</i>	
HBL (Head and body length)	158	(150 — 165) n4	166	(138 — 190) n6	143	(131 — 160) n4	156.5	(145 — 167) n6
TL (Tail length)	102.5	(90 — 110) n4	85	(76 — 99) n5	78	(68.5 — 88) n4	78	(75 — 84) n6
TL in %	65		51		56		50	
HFL (Hindfoot length) + claw	30.6	(30 — 31) n4	28.6	(26 — 30.5) n5	28	(24 — 29) n4	30.5	(29 — 32) n4
EL (Ear length)	21	(20 — 22) n4	20.7	(19 — 23) n4	19.8	(18 — 22) n5	24	(22 — 26) n6
Weight (g)	—		—		77	(69 — 88) n4	90	(71 — 105) n3
Gr. length of skull	38.3	(36.8 — 39.85) n2	37.0	(35.0 — 39.0) n5	35.7	(34.3 — 36.9) n3	37.2	(35.9 — 38.3) n5
Interorbital breadth	4.35	(4.05 — 4.75) n4	4.27	(4.00 — 4.65) n6	4.38	(4.32 — 4.43) n4	4.35	(4.2 — 4.7) n6
Nasalia, greatest breadth	6.35	(5.75 — 7.0) n4	6.71	(6.1 — 7.4) n6	6.35	(6.18 — 6.57) n4	6.98	(6.61 — 7.30) n4
Upper molar row	8.50	(8.40 — 8.70) n4	8.77	(8.30 — 9.20) n6	8.88	(8.50 — 9.62) n4	9.06	(8.9 — 9.2) n4
M ² length	4.4	(4.3 — 4.5) n4	4.76	(4.50 — 5.05) n6	4.93	(4.7 — 5.1) n4	4.60	(4.4 — 4.7) n4
Lower molar row	8.20	(8.00 — 8.40) n3	8.13	(8.00 — 8.40) n6	8.17	(7.75 — 8.70) n4	8.22	(8.1 — 8.3) n4
Bullae length	7.0	n1	6.92	(6.65 — 7.35) n6	7.45	(7.4 — 7.5) n2	8.9	(8.7 — 9.1) n4
gr. breadth	14.6	(14.5 — 14.65) n2	14.5	(13.95 — 15.05) n6	14.5	(14.1 — 15.0) n3	14.4	(14.0 — 14.9) n5
M ¹ breadth	2.23	(2.20 — 2.30) n4	2.43	(2.20 — 2.60) n6	2.33	(2.25 — 2.40) n6	2.42	(2.34 — 2.49) n4
I ¹ /I ₁ (grooves)	1/1	n11	1/1	n8	1/1	n6	1/1	n5
M ₁ (laminae)	5	n11	5	n8	5 (6)	n7	4	n5
M ² (laminae)	6 (n8); 7 (n3)		8 (n3); 7 (n5)		8 (n5); 7 (n2)		7 (n4); 6 (n1)	

Petter (1982) also observed the differences in the number of laminae but interpreted this as polymorphism within one species: *O. irroratus*. It was already mentioned that Petter must have confounded some skulls. In his figs 1 and 2 he combined the molars of three different species to prove the variability of *O. irroratus*. For this purpose he used skulls of *O. irroratus* collected by Dieterlen in the Kivu highland west of Lake Kivu and quoted a "Mont Kivu" and a locality of 4000 m altitude (instead of 3000 m), both not existing. In fig. 1 D he depicted an M³ with nine laminae, without testing whether this number could be typical for *O. irroratus* from Kivu. In fact Dieterlen (1968) did not find this character when examining 34 skulls; in another recent examination of 126 skulls from the same region he found only 3 specimens (2 %) with a ninth lamina, but 113 (90 %) had eight and 10 (8 %) had seven laminae.

Verschuren et al. (1983), examining 104 skulls from the Parc National des Virungas (Zaire), could not find a single specimen with nine laminae and only 18 with eight laminae, but 86 (85 %) with seven laminae.

O. irroratus surely is a widely distributed species with many geographical forms and with certain variable characters according to locality and population. But in the absence of exact knowledge of its forms little can be said about its taxonomic status.

The record of the new species *O. occidentalis* from Mt Oku and the Gotei Mts and its close relationship to East African forms, *O. barbouri* from Mt Elgon and *O. lacustris* from some Tanzanian mountains, is another proof of the disjunctive montane distribution in tropical Africa. The distribution pattern of this "*lacustris*-group" is comparable to that of *O. irroratus* and *O. typus* and another indication of a continuous occurrence of these forms during a former climatic period.

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Zusammenfassung

Die 1988 in den Gotei Mts/Nigeria gesammelten Stücke von *Otomys*, die gleichzeitig den Erstnachweis für dieses Land und das westlichste Vorkommen der Gattung darstellen, wurden mit den früheren Funden aus West-Kamerun verglichen. Es zeigte sich, daß die Verbreitung von *O. irroratus burtoni* auf den Kamerunberg beschränkt zu sein scheint und daß die Stücke vom Mt Oku mit den neuen Funden aus Nigeria konspezifisch sind und einer neuen Art, *O. occidentalis*, angehören, die in dieser Arbeit beschrieben wird. Sie scheint mit *O. barbouri* und *O. lacustris* aus Gebirgen Ostafrikas näher verwandt zu sein.

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Artikel/Article: [Species of the genus Otomys from Cameroon and Nigeria and their relationship to East African forms 383-392](#)