

A tiny new species of *Sylvisorex* (Mammalia: Soricidae) from the Bamenda Highlands, Cameroon

Rainer HUTTERER¹, Jan RIEGERT² & Ondřej SEDLÁČEK³

¹ Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany;

² University of South Bohemia, České Budějovice, Czech Republic;

³ Charles University, Praha, Czech Republic

Abstract. A new species of shrew, *Sylvisorex silvanorum* n. sp., is described from specimens collected near Lake Bambili in the Bamenda Highlands of North West Cameroon. It is one of the smallest species of the genus occurring in the highlands of Cameroon and may be the sister taxon to *S. vulcanorum* from eastern Africa. Together with the rodents *Colomys eisentrauti* and *Lophuromys eisentrauti*, the new species forms a set of species currently known only from the Lake Bambili area.

Keywords. Africa, Cameroon, Lake Bambili, forest, shrew, *Sylvisorex*, new species.

1. INTRODUCTION

Shrews of the genus *Sylvisorex* Thomas, 1904 are restricted to lowland and montane forests of central Africa, from Cameroon/Nigeria in the northwest to Tanzania in the southeast. Currently 12 extant species are recognized (HUTTERER 2005), but recent fieldwork has yielded further species that will be described in the near future. Other species new to science still rest in museum collections and await formal description, such as the one named and described below. It was recognized as new by the senior author more than 30 years ago but known only from a single incomplete specimen since until additional material became available from owl pellets collected in 2003 by the junior authors which finally enabled us to define the new species.

2. MATERIAL AND METHODS

The holotype of the new taxon was collected during a Museum Koenig expedition to Cameroon from winter 1973 to spring 1974; see BÖHME (1975) for a brief description of the expedition. The participants W. BÖHME and W. HARTWIG visited the Bafut Ngemba Forest Reserve and the adjacent Bambili craters during March 1974. Shrews were collected with snap traps set along creeks and in undergrowth. The few shrews collected were briefly discussed by HEIM DE BALSAC (1975) but never properly documented.

Pellets of the African grass owl *Tyto capensis* were collected during November 2001 in the lower of the two Bambili volcano craters, about 8 km SE from Bamenda city, Bamenda Highlands, Cameroon (5° 55' N, 10° 14' E, 2 400 m a.s.l.) (RIEGERT et al. 2008). Both volcano calderas were flooded by lakes in the past (ANONYMOUS 1972). The lake persists only in the lower crater, the upper one has been gradually covered by wet grasslands.

Skull measurements were taken with an electronic calliper. All measurements are given in millimetres (mm), and body mass in grams (g). The terminology of cranial and dental structures follows MEESTER (1963) and JENKINS (1984); external and cranial measurements are the same as previously defined by STANLEY et al. (2005) and KERBIS PETERHANS et al. (2008). Voucher specimens mentioned in the text are deposited in the Zoologisches Forschungsmuseum Alexander Koenig, Bonn (ZFMK) and in The Natural History Museum, London (BMNH). The taxonomy follows HUTTERER (2005).

3. THE NEW AFRICAN PYGMY SHREW

Sylvisorex silvanorum n. sp.

Holotype and type locality. Skin and partial skull of a young adult female (ZFMK 74.430), collected by W.



Fig. 1. *Sylvisorex silvanorum* n. sp., skin of holotype (ZFMK 74.430) in dorsal and ventral view. Total length is 99 mm.

Paratypes. Two incomplete skulls (ZFMK 2003.1103, 2003.1104) removed from pellets of *Tyto capensis*, collected November 2001 by J. Riegert and O. Sedláček on a slope of the lower Bambili volcano craters (5° 55' N, 10° 14' E, 2 400 m a.s.l.), about 8 km SE of the city of Bamenda, Bamenda Highlands, NW Province, Camty of Bamenda, Bamenda Highlands, NW Province, Cameroon (RIEGERT et al. 2008).

Diagnosis. A very small and dark species of *Sylvisorex* with a total length below 100 mm, tail 85 % of head and body length; no long bristle hairs on tail.

Description. *Sylvisorex silvanorum* n. sp. is a small terrestrial shrew with dark fur. The hairs on the dorsum are dark brown, between Fuscous (RIDGWAY 1912, plate XLVI) and Chaetura Drab. Ventrally the hairs gradually turn into Hair Brown. Hairs on dorsum are about 3.4 mm in length; ventrally they are slightly shorter. The basal portion of individual hairs is Dark Plumbeous (Plate LII) with tips Drab to Hair Brown (Plate XLVI). The entire body, including head, ears, limbs, and tail have the same dark colour, only the central part of the belly is a bit lighter (Fig. 1). Facial vibrissae reach 14 mm in length. Ear conch is small, round and pocketed, and covered by very short hairs, except for the inner fold which carries a row of long hairs. Hind foot narrow, with elongate digits and short claws. Ventral inner surface of hind foot covered by small granule-like bumps, heel covered by short hairs. Tail of

Table 1. External measurements of *Sylvisorex silvanorum* and other small species of the genus with no long bristle hairs on the tail.

Species	TL	HB	Tail	HF	Ear	Wt	Tail/HB
<i>S. johnstoni</i> ¹	64	39	25	9	–	–	64%
<i>S. silvanorum</i> ¹	99	55	44	10.0	4.8	–	85%
<i>S. vulcanorum</i> ²	95.9	49	46.9	10.4	6.4	3.5	96%
<i>S. camerunensis</i> ¹	122	65	57	12	9	5	87.6%
<i>S. granti</i> ²	114	58	55.9	11.6	7.5	–	96.4%
<i>S. isabellae</i> ¹	119	60	59	13	6	8	98.3%
<i>S. morio</i> ³	119	71	51	13	10	8	72%

¹ holotype; ² means of measurements taken from HUTTERER & VERHEYEN (1985); ³ ZFMK 69.370.

Böhme and W. Hartwig on 07.03.1974 (field no. 98) near Lake Bambili, Mt. Lefo, Bafut Ngemba F. R. (5° 55' N, 10° 14' E), 1 800–1 900 m a.s.l., Bamenda Highlands, North West Province, Cameroon.

Measurements of holotype. Head and body length 52 mm, tail 44 mm, hind foot length 11.5 mm, ear conch 5.0 mm.

medium length (85% of head and body length); colour uniform, no long bristle hairs present.

Skull (Figs. 2, 3) short with a rounded braincase. Dorsal profile (Fig. 3) inflated, rostrum short but slender. Interorbital constriction relatively broad (24.9% of estimated condylo-incisive length). Infra-orbital bridge narrow, lachrymal foramen large.

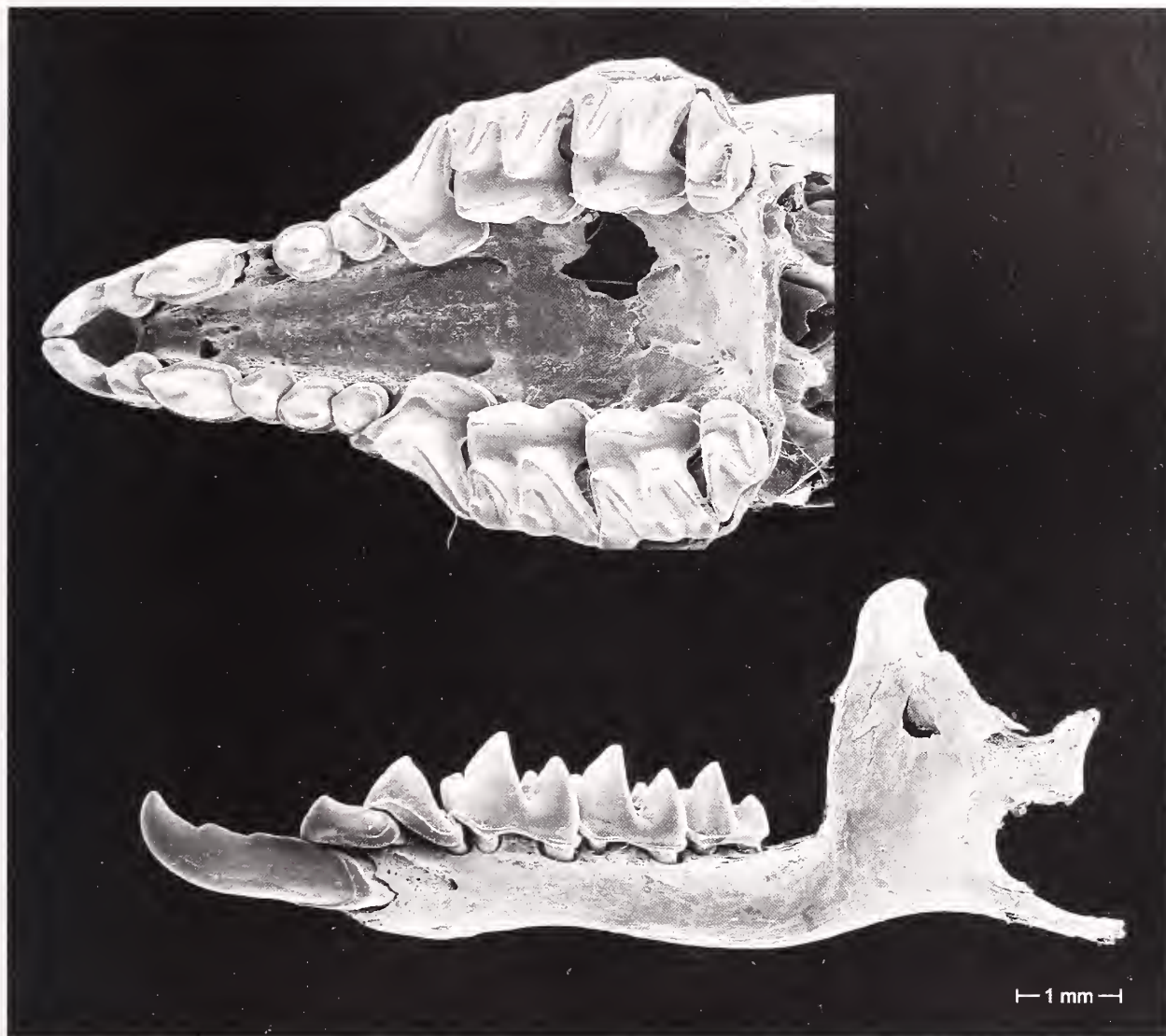


Fig. 2. *Sylvisorex silvanorum* n. sp., skull of holotype; cranium and upper dentition in occlusal view, and left mandible in labial view. Scale 1 mm.

Upper teeth: First upper incisor small, with a sharp anterior tip and a well-developed talon. First upper unicuspid large, second and third unicuspids half and fourth unicuspid a quarter of the length of the first unicuspid. P4 with a small parastyle and a large paracone; the protocone is well expressed. M1-2 square-shaped in occlusal view, protocone strongly developed. M3 relatively large (0.69 x 1.14 mm in the holotype).

Mandible: Slender with thin ramus and weak coronoid process. Foramen mentale below posterior root of lower p4. Condyle small, oblique, and about as wide as high.

Lower teeth: Tip of first incisor curved upwards, with two denticulations on cutting blade. Lower p4 as long as wide

(occlusal view). Lower molars long and slender; third lower molar (1.11 x 0.54 mm) with a deep talonid basin.

Comparisons. The species is not easily recognized in the field. HEIM DE BALSAC (1975) identified all three specimens of *Sylvisorex* collected in 1974 near the Bambili crater as belonging to "*Sylvisorex granti* Thomas, 1907", but a subsequent inspection of the same material by the senior author revealed that one (field no. 98) represented the new *S. silvanorum*, another (field no. 106) *S. camerunensis*, and a third (field no. 113) a new species (not yet described) related to *S. morio*, a species restricted to Mount Cameroon. *S. silvanorum* is smaller in external and cranial measurements (Tables 1, 2) than most other species of *Sylvisorex*, with the exception of *S. jolm-*

Table 2. Cranio-dental measurements of *Sylvisorex silvanorum* and allies.

Species	CI	PL	UTR	IO	MB	GW	PGL	HCC	LTR	COR
<i>S. johnstoni</i> ¹	15.0	6.1	6.4	3.8	4.7	7.1	-	3.8	5.9	3.5
<i>S. silvanorum</i> ²	-	5.80	6.36	3.99	4.61	-	-	-	5.92	3.45
<i>S. silvanorum</i> ³	c.15.6	5.90	6.72	3.82	5.13	7.94	5.57	5.20	-	-
<i>S. silvanorum</i> ⁴	-	-	7.20	3.83	-	-	-	-	5.80	3.74
<i>S. vulcanorum</i> ⁵	15.8	5.90	6.6	4.0	5.0	7.8	5.28	4.90	6.1	3.6
<i>S. camerunensis</i> ⁶	17.14	6.85	7.46	4.12	5.13	8.50	5.75	4.77	6.81	3.89
<i>S. granti</i> ⁷	16.60	6.68	7.19	3.99	5.28	8.12	5.42	4.41	6.48	3.96
<i>S. isabellae</i> ⁸	18.81	7.55	8.14	4.43	5.72	9.30	6.08	5.41	7.48	4.42
<i>S. morio</i> ⁹	19.63	8.22	8.55	4.50	5.56	9.38	6.22	5.44	7.87	4.30

¹ holotype BMNH 87.11.26.1; ² holotype ZFMK 74.430; ³ paratype ZFMK 2003.1103; ⁴ paratype ZFMK 2003.1104; ⁵ average measurements of type series (n=6) from HUTTERER & VERHEYEN (1985); ⁶ holotype ZFMK 69.358; ⁷ ZFMK 68.538; ⁸ holotype ZFMK 69.365; ⁹ ZFMK 69.370; all measurements taken by RH.



Fig. 3. *Sylvisorex silvanorum* n. sp. (upper figure, combined drawing taken from holotype and paratype). lateral view of the skull compared to *Sylvisorex vulcanorum* (lower figure, holotype from HUTTERER & VERHEYEN 1985); scale 1 mm.

Table 3. Species of small mammals recorded from the Bambili area in 1974 and 2001.

Species	1974* Traps, shotgun	2001** <i>Tyto capensis</i>	2001** <i>Bubo</i> <i>cinerascens</i>	Species endemic to Bamenda Highlands	Species endemic to Cameroon Mountains
<i>Sylvisorex silvanorum</i> n. sp.	1	2		X	X
<i>Sylvisorex</i> cf. <i>morio</i>	1			X	X
<i>Sylvisorex camerunensis</i>	1	16	2	X	X
<i>Myosorex okuensis</i>	3	10	3	X	X
<i>Crocidura olivieri</i>	1	2	1		
<i>Crocidura virgata</i>		5			
<i>Crocidura attila</i>			1		
<i>Paraxerus cooperi</i>	11				X
<i>Graphiurus lorraineus</i>	6				
<i>Lophuromys eisentrauti</i>	2			X	X
<i>Lophuromys sikapusi</i>			1		
<i>Hybomys eisentrauti</i>	4			X	X
<i>Colomys eisentrauti</i>	3			X	X
<i>Dasymys rufulus</i>		1	9		
<i>Hylomyscus aeta</i>	1				
<i>Lemniscomys striatus</i>		2	1		
<i>Praomys hartwigi</i>	1	2	2	X	X
<i>Otonomys occidentalis</i>		3	5		X
<i>Mastomys</i> sp.		10	4		
<i>Mus musculooides</i>		1	4		
<i>Mus setulosus</i>		4			
Muridae indet.		5			
Totals	35	63	33	8	10

* HEIM DE BALSAC (1975), DIETERLEN (1979, 1983), HUTTERER et al. (1992), VAN DER STRAETEN & HUTTERER (1984), HUTTERER (unpublished); ** RIEGERT et al. (2008).

stoni (Dobson, 1888). The latter has a much shorter tail, shorter hind feet, and a shorter skull (HUTTERER & VERHEYEN 1985). There is only one species which is similar in size and form: *Sylvisorex vulcanorum* Hutterer & Verheyen, 1985, a species known only from high elevations (1900–3000 m) of the Albertine Rift, separated from the Bamenda Highlands by some 2000 km of lowland forest and savannah. *S. silvanorum* n. sp. differs from *S. vulcanorum* by a shorter tail (44 versus 46.9 mm), and by cranial details. In *S. silvanorum* n. sp., the lachrymal foramen is large (small in *S. vulcanorum*), the first upper incisor is pointed (short and rounded in *S. vulcanorum*), and the second and third upper unicusps are about equal in size (second smaller than third in *S. vulcanorum*). The few available measurements may also indicate that the upper tooth row is slightly shorter in *S. vulcanorum*. It is probable that both species represent sister taxa, a hypothesis which will have to be tested with genetic data in the future.

Some other small species of *Sylvisorex*, such as *S. konganensis* Ray & Hutterer, 1996, *S. pluvialis* Hutterer & Schlitter, 1996, or *S. akaibe* Mukinzi, Hutterer & Barriere, 2009, were not considered because they are easily distinguished, even in the field, by their hairy tails; they also have very different skulls (RAY & HUTTERER 1996, HUTTERER & SCHLITTER 1996, MUKINZI et al. 2009). Small and dark-furred species of *Suncus* which occur in Central African lowland and mountain forest, e.g. *S. infinitimus* (Heller, 1912), *S. renyi* Brosset, Dubost & Heim de Balsac, 1965, *S. hututsi* Kerbis Peterhans & Hutterer, 2009, are all smaller in external and cranial dimensions, and have shorter tails covered with long and numerous bristle hairs (KERBIS PETERHANS & HUTTERER 2009).

Habitat. The holotype specimen was collected in dense undergrowth along a stream running down from the relict montane forest of the reserve towards the Bambili crater



Fig. 4. Lower Bambili crater showing relict montane forest on the slopes and montane grassland along the shore of the lake. Photograph taken in 2001.

(W. BÖHME, field notes). The slopes of the lower Bambili crater are covered by a mosaic of montane forest, *Lasiotiphon* and bamboo woods and grassland. The slopes are partly rocky (Fig. 4). The surroundings of the craters are covered mainly by extensive pastures, *Pteridium* fern growth and open *Lasiotiphon* woods. It is not known where the owls picked up the shrews but the slope forest and the wet grassland bordering the lake may constitute suitable habitats.

Etymology. Derived from *silvanus* (Latin, meaning forest god). We dedicate this cryptic pygmy shrew to the sylvans, small and invisible forest creatures occurring in the beliefs, mythologies, and fairy tales of Africans, Europeans, and many other peoples on earth. As a common name we suggest “Bamenda pygmy shrew”.

DISCUSSION

The forests around Mt. Lefo are still full of mysteries. During their field work in 1974, BÖHME and HARTWIG collected 35 specimens, representing 12 species of shrews and rodents (Table 3). Four of the species were subsequently described as new taxa: *Colomys (goslingi) eisentrauti* Dieterlen, 1983, *Lophuromys (sikapusi) eisentrauti* Dieterlen, 1979, *Hybomys eisentrauti* Van der Straeten & Hutterer, 1986 (tentatively assigned to *Hybomys cf. badius* by MUSSEY & CARLETON 2005), and *Sylvisorex silvanorum* n. sp. (see DIETERLEN 1979, 1983, VAN DER STRAETEN & HUTTERER 1986). A further species of *Sylvisorex* still awaits description. HUTTERER et al. (1992) proposed full species rank for *Lophuromys eisentrauti*, and further but yet unpublished research suggests that *Colomys eisentrauti* and *Hybomys eisentrauti* may deserve species status as well. The forests around Mount Lefo (including the Bambili craters) apparently house a number of local endemic

mammals, some of which may be threatened with extinction. The local *Colomys eisentrauti* and *Lophuromys eisentrauti* have not been found again since their discovery in 1974. At least four mammal species are only known from the Lefo Mountains, 8 from the Bamenda Plateau, and more than 10 are endemic to the Cameroon Mountains chain (HUTTERER et al. 1992). STAGER & ANFANG-SUTTER (1999) provided evidence from lake sediment cores of pronounced climatic changes in the West Cameroon Highlands since 24,000 years BP, particularly in the Lake Bambili area. It is probable that such climatic fluctuations triggered speciation in the Bambili area and other highlands in NW Cameroon (EISENTRAUT 1973).

Acknowledgements. We wish to thank GAČR (206/03/H034), MSM (LC 06073, 6007665801 and 0021620828) and GAAV (IAA601410709 and KJB601110703) for financial support of the research of JR and OS in Cameroon. We further thank A. Riegertová, D. Sedláčková, Š. Janeček and P. Janečková for assistance in the field. RH thanks Paulina D. Jenkins for access to the collections of the British Museum. Karin Ulmen assisted with the SEM graphs, and Uwe Vaartjes mounted figure 2.

Zusammenfassung. Eine neue Spitzmausart, *Sylvisorex silvanorum* n. sp., wird nach Material, das am Bambili-Kratersee im Bamenda Hochland Nordwest-Kameruns gesammelt wurde, beschrieben. Es handelt sich um eine der kleinsten Arten der Gattung, die vermutlich die Schwesterart zu *S. vulcanorum* aus Ostafrika ist. Wie die Nagerarten *Colomys eisentrauti* und *Lophuromys eisentrauti* ist die neue *Sylvisorex*-Art bisher nur aus der Umgebung des Bambili-Kraters bekannt.

REFERENCES

- ANONYMOUS (1972): Baffousam NB-32-XI. Carte du Cameroun. L'Institut Géographique National, Yaoundé.
- BÖHME, W. (1975): Zur Herpetofaunistik Kameruns, mit Beschreibung eines neuen Scinciden. Bonner zoologische Beiträge **26**: 2–48.
- DIETERLEN, F. (1979): Zur Kenntnis der Gattung *Lophuromys* (Muridae; Rodentia) in Kamerun und Gabun. Bonner zoologische Beiträge **29**: 287–299.
- DIETERLEN, F. (1983): Zur Systematik, Verbreitung und Ökologie von *Colomys goslingi* Thomas & Wroughton, 1907 (Muridae; Rodentia). Bonner zoologische Beiträge **34**: 73–106.
- EISENTRAUT, M. (1973): Die Wirbeltierfauna von Fernando Poo und Westkamerun unter besonderer Bedeutung der pleistozänen Klimaschwankungen für die heutige Faunenverteilung. Bonner zoologische Monographien **3**: 1–428.
- HEIM DE BALSAC, H. (1975): Nouvelles données sur la faune soricidienne du Cameroun. Bonner zoologische Beiträge **26**: 94–99.
- HUTTERER, R. (2005): Order Soricomorpha. In: WILSON, D. E. & REEDER, D. A., eds, Mammal species of the world: A taxonomic and geographic reference. Third edition. Johns Hopkins University Press, Baltimore.
- HUTTERER, R., DIETERLEN, F. & NIKOLAUS, G. (1992): Small mammals from forest islands of eastern Nigeria and adjacent Cameroon, with systematical and biogeographical notes. Bonner zoologische Beiträge **43**: 393–414.

- HUTTERER, R. & VERHEYEN, W. (1985): A new species of shrew, genus *Sylvisorex*, from Rwanda and Zaire (Insectivora: Soricidae). *Zeitschrift für Säugetierkunde* **50**: 266–271.
- HUTTERER, R. & SCHLITTER, D. A. (1996): Shrews of Korup National Park, Cameroon, with the description of a new *Sylvisorex* (Mammalia: Soricidae). Pp. 57–66, In: Contributions in Mammalogy: A Memorial Volume Honoring Dr. J. Knox Jones, Jr. Museum of Texas Tech University, ii + 315 pp.
- JENKINS, P. D. (1984): Description of a new species of *Sylvisorex* (Insectivora: Soricidae) from Tanzania. *Bulletin of the British Museum of Natural History (Zoology)* **47**: 65–76.
- KERBIS PETERHANS, J. C. & HUTTERER, R. (2009): The description of a new species of *Simcus* (Soricidae, Mammalia) from central Africa. Pp. 141–150 in: THORN, E. & KERBIS PETERHANS, J. (eds), Small mammals of Uganda. *Bonner Zoologische Monographien* **55**: 1–164.
- KERBIS PETERHANS, J. C., HUTTERER, R., KALIBA, P. & MAZIBUKO, L. (2008): First record of *Myosorex* (Mammalia: Soricidae) from Malawi with description as a new species, *Myosorex gnoskei*. *Journal of East African Natural History* **97**: 19–32.
- MEESTER, J. (1963): A systematic revision of the shrew genus *Crocidura* in southern Africa. *Transvaal Museum Memoir* **13**: 1–127.
- MUKINZI, I., HUTTERER, R. & BARRIERE, P. (2009): A new species of *Sylvisorex* (Mammalia: Soricidae) from lowland forests north of Kisangani, Democratic Republic of Congo. *Mammalia* **73**: 130–134.
- RAY, J. C. & HUTTERER, R. (1996): Structure of a shrew community in the Central African Republic based on the analysis of carnivore scats, with the description of a new *Sylvisorex* (Mammalia: Soricidae). *Ecotropica* **1**: 85–97.
- RIDGWAY, R. (1912): Color standards and color nomenclature. Washington, D. C., published by the author.
- RIEGERT, J., SEDLÁČEK, O. & HUTTERER, R. (2008): Diet of sympatric African grass owl (*Tyto capensis*) and Spotted eagle owl (*Bubo africanus*) in Bamenda Highlands, NW Cameroon. *African Journal of Ecology* **46**: 426–431.
- STAGER, J. C. & ANFANG-SUTTER, R. (1999): Preliminary evidence of environmental changes at Lake Bambili (Cameroon, West Africa) since 24,000 BP. *Journal of Paleolimnology* **22**: 319–330.
- STANLEY, W. T., ROGERS, M. A. & HUTTERER, R. (2005): A new species of *Congosorex* from the Eastern Arc Mountains (Tanzania), with significant biogeographical implications. *Journal of Zoology* **265**: 269–280.
- VAN DER STRAETEN, E. & HUTTERER, R. (1986): *Hybomys eisentrauti*, une nouvelle espèce de Muridae du Cameroun (Mammalia: Rodentia). *Mammalia* **50**: 35–42.

Authors' addresses: Dr. Rainer HUTTERER, Zoologisches Forschungsmuseum Alexander Koenig, Section of Mammals, Adenauerallee 160, D-53113 Bonn, Germany, e-mail: r.hutterer.zfmk@uni-bonn.de; Jan RIEGERT, University of South Bohemia, Faculty of Biological Sciences, Department of Zoology, Branišovská 31, CZ-370 05 České Budějovice, Czech Republic, e-mail: honza@riegert.cz; Ondřej SEDLÁČEK, Charles University in Prague, Faculty of Science, Department of Ecology, Viničná 7, CZ-128 44 Praha, Czech Republic, email: zbrd@email.cz.

Received: 15.12.2008

Accepted: 30.03.2009