



A new species of mouse-tailed bat (Chiroptera: Rhinopomatidae: *Rhinopoma*) from Yemen

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ABSTRACT. Based on genetic and morphological comparisons, a new species of the mouse-tailed bat, *Rhinopoma hadramauticum* sp. nov., is here described from south-eastern Yemen. The new species remains known only from the type locality, Ash Sheher, coastal Hadramaut.

KEY WORDS. *Rhinopoma*, taxonomy, new species, Middle East, Arabia

INTRODUCTION

The last comprehensive taxonomic revision of the monotypic family of mouse-tailed bats, Rhinopomatidae Bonaparte, 1838, showed an existence of four species within the genus *Rhinopoma* Geoffroy, 1818 (Van Cakenberghe & De Vree 1994), viz. *Rhinopoma microphyllum* (Brünnich, 1782), *R. hardwickii* Gray, 1831, *R. muscatellum* Thomas, 1903, and *R. macinnesi* Hayman, 1937. This taxonomic opinion was accepted by subsequent authors (Schlitter & Qumsiyeh 1996, Kock et al. 2001, Simmons 2005). With an exception of *R. macinnesi*, whose distribution is restricted to arid areas of East Africa, the ranges of all *Rhinopoma* species meet in the south-eastern part of the Middle East (Hill 1977, Van Cakenberghe & De Vree 1994, Simmons 2005).

In the southern part of the Arabian Peninsula, *R. microphyllum* is known to occur only in western and south-western areas of Saudi Arabia and *R. muscatellum* only in Oman and United Arab Emirates in the easternmost part of the Peninsula, while *R. hardwickii* has been reported from almost the whole area, with records from Yemen, Saudi Arabia, Oman and the UAE (Nader 1990, Harrison & Bates 1991). Therefore Al-Jumaily (1998) reported *R. hardwickii* as the only *Rhinopoma* species known to occur in Yemen. Nevertheless, in the western part of that country the type locality of the nominal species *Rhinopoma*

cystops arabium Thomas, 1913 is situated (Wasil, Yemen, 4000'; Thomas 1913) and this name is considered valid for the subspecies of *R. hardwickii* inhabiting Arabia (Hill 1977, Qumsiyeh & Knox Jones 1986, Nader 1990, Harrison & Bates 1991, Koopman 1994, Van Cakenberghe & De Vree 1994, Al-Jumaily 1998, Kock et al. 2001, Benda et al. 2004, Simmons 2005, etc.).

Recently, Kock et al. (2001) recorded another *Rhinopoma* species from Yemen, *R. muscatellum*. They described a finding of three females at Ash Sheher on the coast of the Hadramaut Province, SE Yemen. Although these specimens were noted to slightly oversize those of the nominotypical subspecies, *R. m. muscatellum* from Oman, UAE and SE Iran, Kock et al. (2001) assigned the newly discovered Yemeni population to the latter form, mainly for geographical reasons.

Hulva et al. (2007) compared partial sequences of the mitochondrial gene for cytochrome *b* from *Rhinopoma* samples covering most of the distribution range of this genus. Among other things, they detected two distinct lineages within the *R. muscatellum* clade: a lineage from Iran, corresponding to the nominotypical population *R. m. muscatellum* (sensu DeBlase et al. 1973, Hill 1977 and Van Cakenberghe & De Vree 1994), and another one from the coastal Hadramaut, Yemen, corresponding to the samples described by Kock et al. (2001). Since these two lineages differed by 8.2–9.0% of uncorrected genetic p-distance from each other (and by 11.9–15.3% from other *Rhinopoma* samples), Hulva et al. (2007) suggested, that bats of the Yemeni lineage belong to a separate species, not to *R. m. muscatellum* as proposed by Kock et al. (2001). Besides that, Hulva et al. (2007) also suggested to split the species rank of *R. hardwickii* (sensu Van Cakenberghe & De Vree 1994 and Simmons 2005) to two separate species; Afro-Arabian *R. cystops* Thomas, 1903 and Irano-Indian *R. hardwickii* s.str., distant from each other by deep genetic divergence of 8.2–9.2%.

During a field trip to Yemen in October 2007, we (PB, AR, AKN) collected a series of *Rhinopoma* individuals from a colony of ca. 150 bats occupying a newly built but uninhabited house in the town of Ash Sheher. From this colony, Kock et al. (2001) and Hulva et al. (2007) reported the unique mouse-tailed bats of the *muscatellum* clade. Here we present detailed data on the morphology of this form, its comparison with other bats of the genus *Rhinopoma*, and conclusions regarding its taxonomic status.

MATERIAL AND METHODS

The morphological analysis was based on museum material of *Rhinopoma* bats from all parts of the distribution range of this genus. The examined specimens are listed in the Appendix. They include type specimens of the following species-group taxa: *arabium* Thomas, 1913, *cystops* Thomas, 1903, *hardwickii* Gray, 1831, *kinneari* Wroughton, 1912, *lepsianum* Peters, 1859, *macinnesi* Hayman, 1937, *microphyllum* Brännich, 1782, *muscatellum* Thomas, 1903, *pusillum* Thomas, 1920, and *seianum* Thomas, 1913 (Brännich 1782, Gray 1831, Peters 1859, Thomas 1903, 1913, 1920, Wroughton 1912, Hayman 1937). The specimens were measured in a standard way using mechanical calliper, the dental measurements are related to the respective cingular margins of teeth. For a list of

the measurements see below. In the statistical comparison we used only the skull data. Statistical analyses were performed using the Statistica 6.0 software. Taxonomy of the compared *Rhinopoma* populations follows Hulva et al. (2007).

MUSEUM ACRONYMS. BCSU – Biological Collection of the Sana'a University, Sana'a, Yemen; BMNH – Natural History Museum, London, United Kingdom; IVB – Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, Brno, Czech Republic; MNHG – Museum of Natural History Geneva, Switzerland; MNHN – National Museum of Natural History, Paris, France; NMP – National Museum (Natural History), Prague, Czech Republic; SMF – Senckenberg Museum and Institute, Frankfurt am Main, Germany; ZFMK – Alexander Koenig Institute and Museum, Bonn, Germany.

EXTERNAL MEASUREMENTS. LC = head and body length; LCd = tail length (taken from the anus to the tail tip); LAt = forearm length; LA = auricle length; LT = tragus length; G = body weight.

CRANIAL MEASUREMENTS. LCr = greatest length of skull incl. praemaxillae; LCc = condylo-canine length of skull; LaZ = zygomatic width; LaI = width of the interorbital constriction; LaInf = rostral width between foramina infraorbitalia; LaN = neurocranium width; ANc = neurocranium height; ACr = skull height (incl. the tympanic bullae); LBT = largest horizontal length of tympanic bulla; CC = rostral width between canines (incl.); P⁴P⁴ = rostral width between second upper premolars (incl.); M³M³ = rostral width between the third upper molars (incl.); IM³ = length of the upper tooth-row between I¹M³ (incl.); CM³ = length of the upper tooth-row between CM³ (incl.); P⁴M³ = length of the upper tooth-row between P⁴M³ (incl.); M¹M³ = length of the upper molar-row; CP⁴ = length of the upper unicuspid tooth-row; LMd = condylar length of the mandible; ACo = height of coronoid process; IM₃ = length of the lower tooth-row between I₁M₃ (incl.); CM₃ = length of the lower tooth-row between CM₃ (incl.); M₁M₃ = length of the lower molar-row; CP₄ = length of the lower unicuspid tooth-row.

OTHER ABBREVIATIONS. A = alcohol preparation; f = female; M = mean; m = male; min, max = dimension range margins; S = skull; SD = standard deviation.

COMPARISON

The Hadramaut bats of the *muscatellum* lineage (hereafter the Hadramaut bats) are medium-sized *Rhinopoma* bats, being similar to *R. hardwickii* or larger individuals of *R. cystops* (Fig. 1, Table 1). The tail of the Hadramaut bats is relatively short (LCd/LAt 1.00–1.16), similarly as in *R. microphyllum*, but on average shorter than in *R. cystops* and *R. hardwickii* (Table 1; see also Hill 1977, DeBlase 1980 and Van Cakenberghe & De Vree 1994). The noseleaf of the Hadramaut bats is of the *muscatellum* type, as depicted by DeBlase (1980: 47), being elliptic to rhomboidal in shape (Fig. 2) without the pointed upper margin as in the *microphyllum* or *hardwickii* types (DeBlase 1980). Pelage coloration of the examined Hadramaut bats was pale grey with marked yellowish brown collar on the throat and anterior part of the breast (Fig. 2), a feature not observed in other *Rhinopoma* specimens. However, the main portion of the examined material was preserved in alcohol, which may have influenced the color.

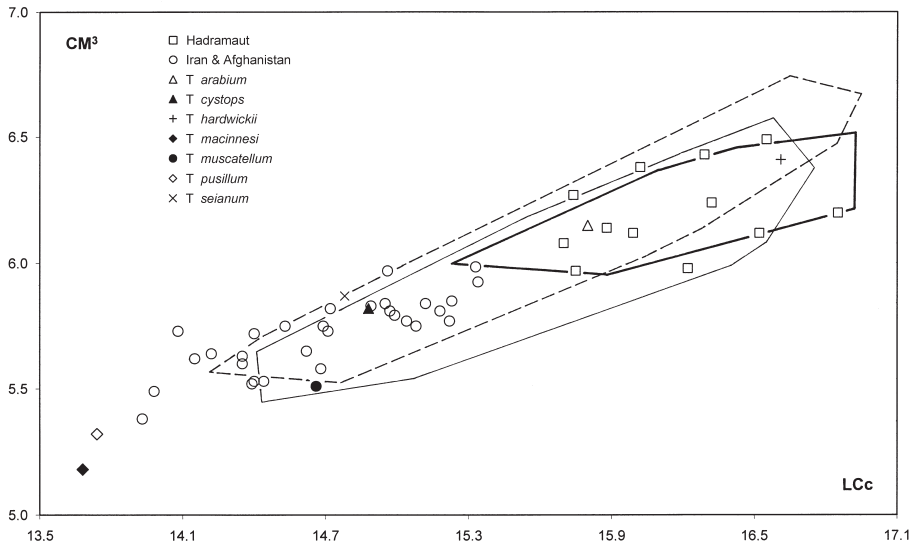


Fig. 1. Relation between condylo-canine length of skull (LCc) and length of the upper tooth-row (CM3) in selected *Rhinopoma* species. Explanations: symbols = type specimens (see legend in the picture) and specimens of the *muscatellum* lineage sensu Hulva et al. (2007); bold-lined polygon = *R. hardwickii*; dashed-lined polygon = *R. cystops cystops*; thin-lined polygon = *R. cystops arabium*.

The extent and proportions of the nasal inflations of the Hadramaut bats are very similar to those of *R. muscatellum* (Figs. 3, 4). The inflations in both forms markedly project anteriorly over the level of the canine roots and laterally over the lateral margins of maxillae, in the Hadramaut bats markedly projecting also dorsally above the rostrum (Fig. 3). In the dorsal view the inflations outline runs over the posterior margin of the intermaxillary notch as well as the lateral maxillary margins in the Hadramaut bats and in *R. muscatellum* (Fig. 4). However, the inflations in the Hadramaut bats are the most projecting among all the compared populations/taxa. The interspace between the inflations in the Hadramaut bats is both relatively and absolutely narrow, narrower than in *R. muscatellum*, *R. cystops* and/or *R. hardwickii*. The posterior projection of the palate in the Hadramaut bats is distinctly behind the level of the upper molars, its medial emargination is rather sharply pointed, both these characters are close to the state in *R. muscatellum*, and differ from *R. cystops* and *R. hardwickii*, where the palate projection is roughly on the level of posterior margins of the third upper molars. Tympanic bullae in the Hadramaut bats are massive but small in relation to the skull size (Fig. 4). The upper canines bear posterior cingular cusps in the Hadramaut bats as well as in *R. muscatellum* (Fig. 3; see also Kock et al. 2001).

However, when compared with other *Rhinopoma* representatives of similar size (*R. muscatellum*, *R. cystops*, *R. hardwickii*, and *R. macinnesi*), the Hadramaut bats resemble in several aspects rather *R. cystops* and *R. hardwickii* than *R. muscatellum*. The longitudinal measures of the skull in Hadramaut bats are much larger than in *R. muscatellum*, although the altitudinal and latitudinal ones are not so markedly large. Therefore,

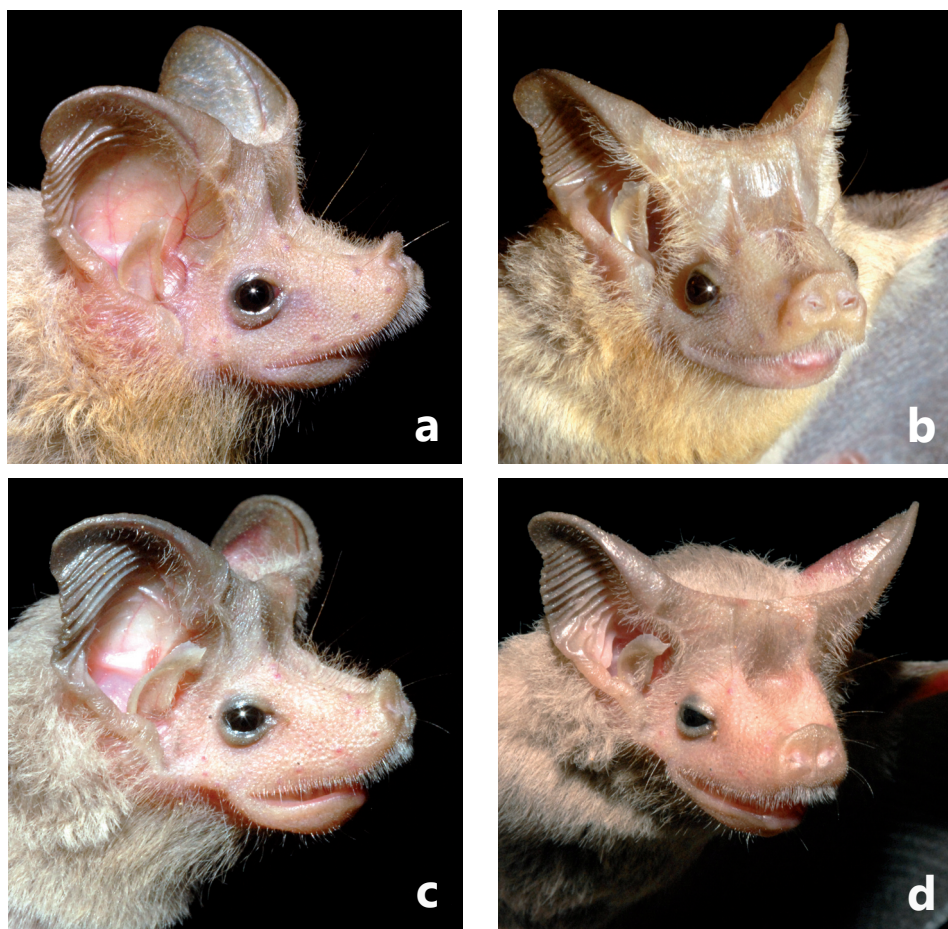


Fig. 2. Portraits of two sympatric mouse-tailed bat species (*Rhinopoma*) from the coastal Hadramaut, south-eastern Yemen. a, b – *Rhinopoma hadramauticum* sp. nov. (Ash Sheher), c, d – *R. cystops* (Shuhayr). Photos by A. Reiter.

the relative width of rostrum (LaInf/LC_c), which is extremely large in *R. muscatellum* (0.32–0.35), is much smaller in the Hadramaut bats (0.28–0.31). Similarly, the relative length of tympanic bullae (LBT/LC_c) is larger in *R. muscatellum* (0.32–0.35) than in the Hadramaut bats (0.28–0.31); see Fig. 5 and Table 1. The comparison of the latter two ratios (Fig. 5) showed that the Hadramaut bats are similar to *R. cystops* and *R. hardwickii*, but that they markedly differ from *R. muscatellum* in the skull shape (see also Fig. 3).

The unique shape of the Hadramaut skull among the skulls of the smaller and medium-sized *Rhinopoma* forms was confirmed by the canonical discriminant analysis of all 23 skull dimensions (see Material and methods for their list). The analysis clearly separated all the already recognized species (*R. hardwickii*, *R. cystops*, and *R. muscatellum*, incl. type specimens – Fig. 6), and also separated the Hadramaut bats from each of these species. However, the genetically well separated subspecies of *R. cystops* (sensu Hulva et

al. 2007), *R. cystops cystops* and *R. c. arabium*, grouped together. These results support the separation of *hardwickii* and *cystops* lineages at the species level, previously indicated by the genetic analysis (Hulva et al. 2007).

In conclusion, the Hadramaut bats resemble in most characters *R. muscatellum* as understood by DeBlase et al. (1973), Hill (1977), and Van Cakenberghe & De Vree (1994), which is in accordance with their assignment to the *muscatellum* lineage suggested by Kock et al. (2001) on morphological grounds and by Hulva et al. (2007) on the basis of molecular data. On the other hand, this population possesses a unique combination of characters, including metrical ones, which supports previous opinion Hulva et al. (2007) that it is taxonomically separate. Hence, we describe it here as a new *Rhinopoma* species.

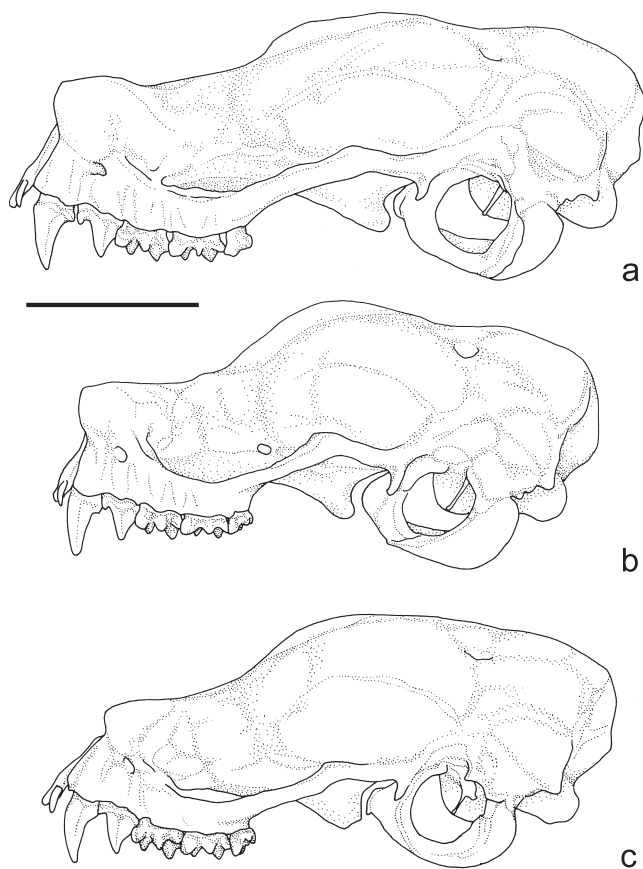


Fig. 3. Skulls of three *Rhinopoma* species from the region of southern Arabia. a – *Rhinopoma hadramauticum* sp. nov. (NMP 92289; Ash Sheher, SE Yemen), b – *R. muscatellum* (NMP 48446; Hormoz I., Persian Gulf, Iran), c – *R. cystops* (NMP pb3766; Shuhayr, SE Yemen). Scale bar = 5 mm.

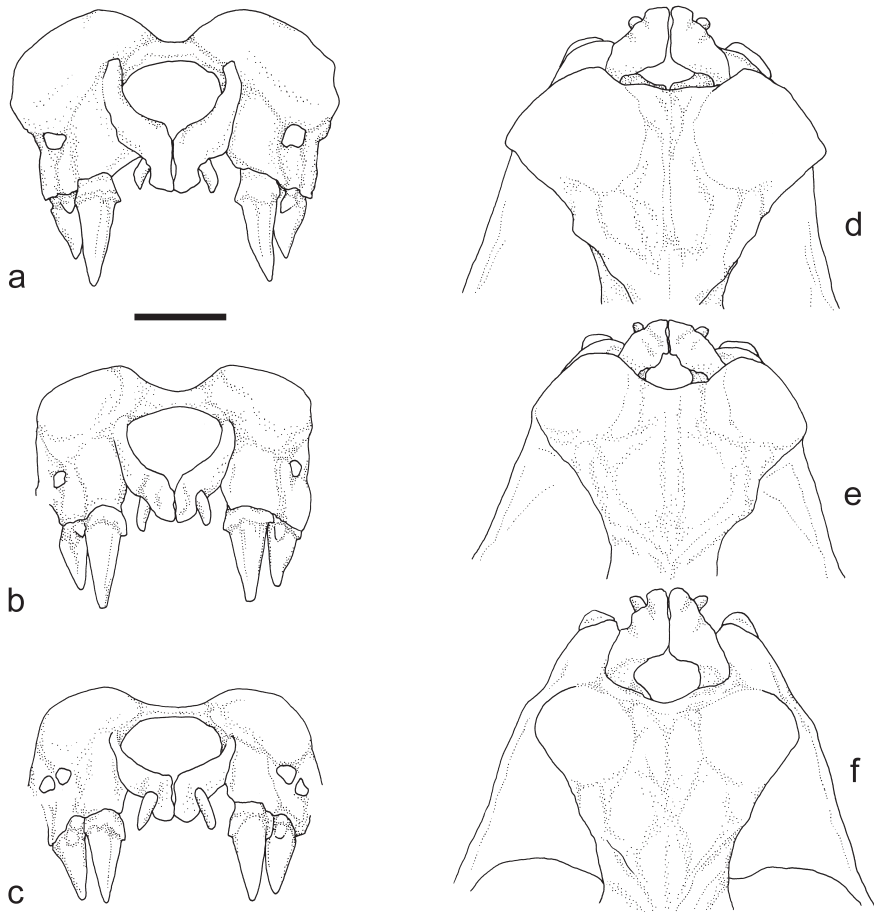


Fig. 4. Nasal inflations (a–c – frontal views, d–f – dorsal views) of three species of *Rhinopoma* from the region of southern Arabia. a, d – *Rhinopoma hadramauticum* sp. nov. (NMP 92289; Ash Sheher, SE Yemen), b, e – *R. muscatellum* (NMP 48446; Hormoz I., Persian Gulf, Iran), c, f – *R. cystops* (NMP pb3766; Shuhayr, SE Yemen). Scale bar = 2 mm.

TAXONOMY

Rhinopoma hadramauticum Benda, sp. nov.

TYPE MATERIAL. **Holotype:** adult male (NMP 92282 [S+A]), Ash Sheher (Hadramaut), 6 November 2007, leg. P. Benda, A. K. Nasher & A. Reiter. **Paratypes** (19): nine males (six adult and three subadult) and ten females (seven adult and three subadult) (NMP 92281, 92283–92285, 92287–92289 [S+A], NMP 92280, 92286 [A], BCSU 193, 194, 197, 225 [S+B], BCSU pb3787, pb3788, pb3795, pb3798–3800 [A]), identical site as in the holotype, 22 February 2001, leg. D. Basuwayd, and 6 November 2007, leg. P. Benda, A. K. Nasher & A. Reiter.

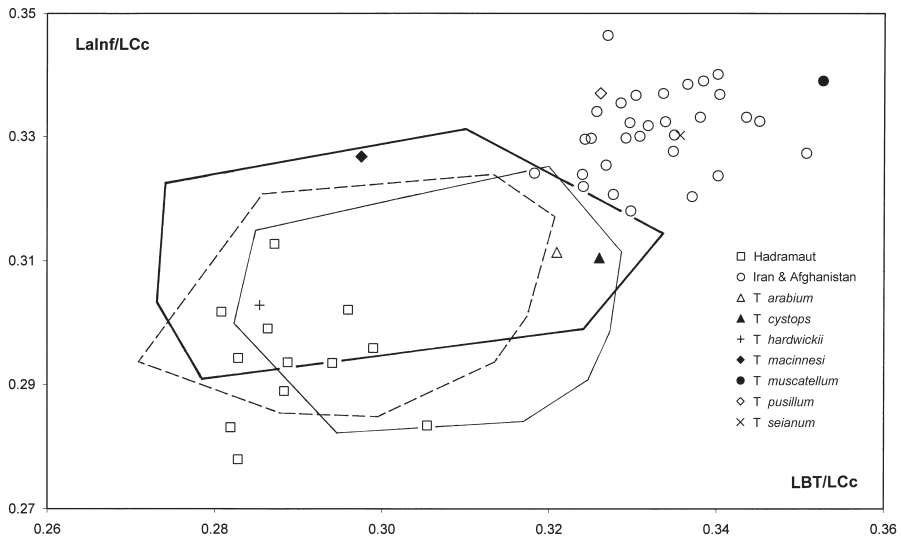


Fig. 5. Relation between the relative length of tympanic bulla (LBT/LCc) and the relative rostrum width (LaInf/LCc) in selected *Rhinopoma* species. For explanations see Fig. 1.

TYPE LOCALITY. Republic of Yemen, coastal part of the Hadramaut Province, town of Ash Sheher, 14° 46' N, 49° 36' E, ca. 65 m a. s. l., uninhabited house on the northern outskirts of the town.

DESCRIPTION. *Rhinopoma hadramauticum* sp. nov. is a medium-sized mouse-tailed bat (LAt 52.0–55.7 mm, LCc 15.7–16.9 mm) with a relatively short tail (LCd 54–62 mm; LCd / LAt 1.00–1.16). Noseleaf is relatively high, trapezoid-shaped in frontal view (Fig. 2). Skull is elongated, relatively low and long, maxilla is relatively long and narrow. Sagittal crest is rather low and relatively short. Nasal inflations are large, very markedly projecting anteriorly (over the level of the canine alveoli), dorsally and laterally (Fig. 4), their rhomboid outline in dorsal view runs over the posterior margin of the intermaxillar notch and of the lateral margins of maxilla (Fig. 4). The interspace between the narial inflations is very narrow. Posterior projection of the palate is distinctly behind the level of the upper molars, its medial emargination is rather sharply pointed. Tympanic bullae are large and broad (Fig. 4), but relatively small. Tragi are broad and blunt two-pointed, posterior margin in its distal portion bears several emarginations. Both dorsal and ventral pelage colorations are greyish to greyish brown, in adult individuals with a broad yellowish brown collar on the throat and anterior part of the breast (Fig. 2). Skin in face, ears, belly and extremities is almost unpigmented or pale grey. Wing membranes, fingers, tail and distal parts of ears are grey.

GENETICS. In the examined partial sequence of the mitochondrial gene for cytochrome *b* (Hulva et al. 2007), *R. hadramauticum* sp. nov. shows five unique positions within the compared five *Rhinopoma* species (see Table 2): 47 (a→g), 243 (c→t), 282 (t/g/

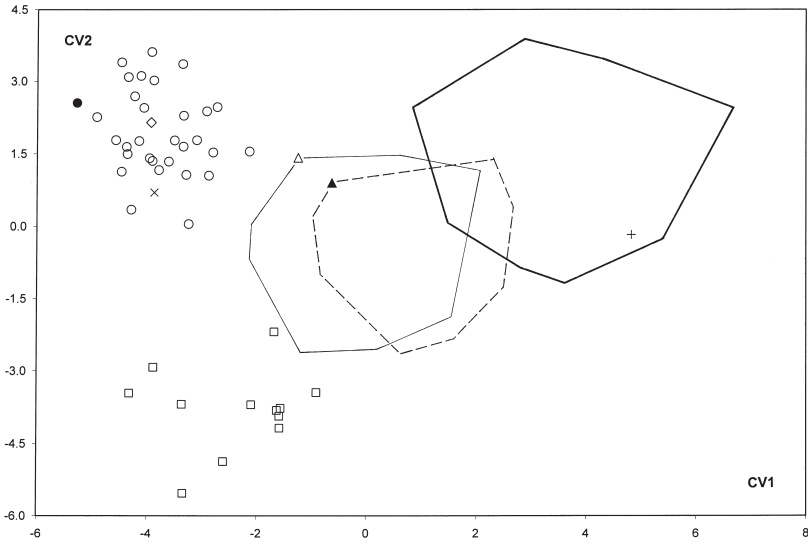


Fig. 6. Relation between first two canonical factors from a canonical discriminant analysis of 23 skull dimensions of selected *Rhinopoma* species. For explanations see Fig. 1.

a→c), 312 (c→t), and 393 (t→c). Partial sequence of *R. hadramauticum* sp. nov. from a paratype (BCSU 197; 402 bp, 5' end; haplotype YE4 sensu Hulva et al. 2007; NCBI Accession Number DQ337495): atg acc cac atc cga aag tcc cac ccc cta ttt aaa att atc aat agc tea ttc atc gac ctc cca gcc cct tea aat atc tea tcc tga tga aac ttc gga tcc ctc cta ggt atc tgt tta gcc gta caa atc tta aca gga cta ttc cta gca ata cat tac aca tcc gac acc aca acc gct ttc tac tcc gtc acc cac atc tgc cga gat gtt aat tac ggc tga atc tta cgt tat ctt cat gcc aat gga gca tcc ata ttc ttt atc tgc ctc ttc cta cac gtc gga cgg ggc att tac tat gga tea tat ata ttc aca gaa aca tga aac atc ggc ttt atc ctc tta ttc gcc gta ata gca aca gca ttc ata ggc tac gta ctc cca.

Another haplotype obtained by Hulva et al. (2007), YE5, differs from YE4 in substitution in the position 349 (t→a).

MEASUREMENTS OF THE HOLOTYPE (in millimetres, G in grams). **External:** LC 64; LCd 61; LA_t 55.7; LA 21.6; LT 7.4; G = 10.0. **Cranial:** LC_r 17.98; LC_c 16.29; La_Z 9.84; La_L 2.07; La_{Inf} 4.82; La_N 7.04; AN_c 4.95; AC_r 7.02; LBT 4.87; CC 4.18; P⁴P⁴ 5.71; M³M³ 7.47; IM³ 7.12; CM³ 6.43; P⁴M³ 5.14; M¹M³ 3.92; CP⁴ 2.66; LM_d 12.41; AC_o 4.13; IM₃ 7.42; CM₃ 6.96; M₁M₃ 4.47; CP₄ 2.51.

DIFFERENTIAL DIAGNOSIS. *Rhinopoma hadramauticum* sp. nov. differs clearly from *R. microphyllum*, *R. muscatellum* and *R. macinnesi* in external dimensions and skull size (Table 1), from the *Rhinopoma* species other than *R. microphyllum* it differs in the relative length of tail. It differs from all *Rhinopoma* species in the skull shape, particularly as regards the nasal inflations (see Comparison and Figs. 3–5). For specific substitutions in the examined 402 bp portion of the mitochondrial gene for cytochrome *b* in the genus *Rhinopoma* (according to Hulva et al. 2007) see Table 2.

Table 1. Biometry of *Rhinopoma* bats (longitudinal dimensions in millimetres, weight in grams, ratios non-dimensional), including three dimensional ratios compared. External measurements other than LAt were taken only from freshly collected bats. For abbreviations see text.

	<i>R. hadramauticum</i> sp. nov.					<i>R. muscatellum</i>				
	n	M	min	max	SD	n	M	min	max	SD
LC	16	64.0	58	68	2.921	27	59.1	53	64	2.708
LCd	16	58.3	54	62	2.380	27	64.7	56	75	4.350
LAt	20	53.35	52.0	55.7	0.967	25	52.08	48.5	55.4	1.544
LA	16	20.55	19.6	21.6	0.533	27	20.09	18.3	22.4	1.090
LT	16	7.61	6.6	8.8	0.604	27	6.79	5.0	7.9	0.722
G	16	9.99	7.0	11.2	1.096	27	8.36	4.6	14.0	2.796
LCr	12	17.76	16.93	18.27	0.363	33	16.46	15.25	17.48	0.478
LCc	12	16.15	15.70	16.85	0.368	33	14.67	13.74	15.34	0.429
LaZ	11	10.05	9.48	10.34	0.239	33	9.58	8.99	10.17	0.288
LaI	12	2.20	2.07	2.46	0.130	33	2.20	1.97	2.49	0.119
LaI _{nf}	12	4.75	4.50	5.01	0.146	33	4.86	4.58	5.20	0.159
LAN	12	7.16	6.65	7.43	0.228	33	6.91	6.50	7.34	0.177
AN	12	5.10	4.78	5.56	0.201	33	4.98	4.67	5.17	0.136
ACr	12	7.20	6.94	7.48	0.150	33	7.03	6.75	7.29	0.166
LBT	12	4.68	4.42	4.87	0.158	33	4.89	4.48	5.25	0.182
CC	12	4.20	3.85	4.46	0.154	32	4.06	3.65	4.51	0.223
M ¹ M ²	12	7.57	7.32	7.77	0.151	33	7.25	6.75	7.98	0.235
CM ³	12	6.20	5.97	6.49	0.167	33	5.71	5.32	5.99	0.162
M ¹ M ³	12	3.77	3.68	3.92	0.083	33	3.52	3.33	3.74	0.107
CP ⁴	8	2.65	2.51	2.88	0.124	33	2.61	2.33	2.94	0.130
LMd	12	12.26	11.85	12.64	0.243	33	11.17	10.37	11.82	0.375
ACo	12	4.26	3.98	4.41	0.129	33	3.96	3.52	4.53	0.240
CM ₃	12	6.59	6.35	6.96	0.192	33	6.09	5.64	6.49	0.201
M ₁ M ₃	12	4.22	4.14	4.47	0.103	33	3.86	3.60	4.20	0.143
CP ₄	8	2.47	2.32	2.66	0.105	33	2.38	2.08	3.82	0.324
LaI _{nf} /LCc	12	0.294	0.278	0.313	0.010	33	0.331	0.318	0.346	0.007
LBT/LCc	12	0.289	0.281	0.305	0.008	33	0.333	0.318	0.353	0.008
LCd/LAt	16	1.090	0.996	1.161	0.045	25	1.244	1.096	1.418	0.085

DERIVATIO NOMINIS. The specific name *hadramauticum* is a noun in apposition; it refers to Hadramaut, a province and historical territory in the eastern part of Yemen, where the new species was found for the first time.

DISTRIBUTION AND THREATS. *Rhinopoma hadramauticum* sp. nov. is known only from the type locality. The known population is limited to a single colony of ca. 150 individuals occupying a new but uninhabited building in the outskirts of the continuously growing Ash Sheher town, continuously spreading its territory. Such a roost is very

Table 1. (Continued.)

	<i>R. arabium</i>					<i>R. cystops</i>				
	n	M	min	max	SD	n	M	min	max	SD
LC	51	62.4	52	72	3.757	52	60.9	53	72	5.341
LCd	51	70.2	60	77	4.130	49	68.1	54	82	6.824
LA _t	54	56.65	50.5	62.9	2.980	58	57.36	50.0	62.6	3.609
LA	51	20.64	18.5	22.8	0.913	52	19.66	16.0	23.7	2.179
LT	51	7.19	5.3	8.3	0.588	52	7.33	5.5	8.6	0.654
G	51	11.23	6.8	16.7	2.321	52	10.01	6.5	14.1	2.018
LCr	67	17.65	16.37	19.10	0.623	62	17.59	15.76	18.94	0.858
LCc	68	15.61	14.41	16.79	0.571	63	15.57	14.21	16.94	0.726
LaZ	67	10.16	9.41	10.91	0.331	62	10.29	9.31	11.28	0.520
Lal	70	2.55	2.22	2.84	0.144	63	2.48	2.22	2.77	0.142
Laln _f	70	4.68	4.24	5.25	0.249	63	4.78	4.21	5.43	0.275
LAN	70	7.45	6.75	8.11	0.267	63	7.44	6.83	7.95	0.299
AN	68	5.58	5.04	6.26	0.271	63	5.62	5.08	6.33	0.269
ACr	62	7.54	5.78	8.34	0.425	62	7.54	6.80	8.32	0.389
LBT	65	4.80	4.52	5.25	0.167	57	4.66	4.08	5.29	0.288
CC	70	4.29	3.88	4.83	0.205	62	4.31	3.68	5.08	0.311
M ³ M ³	70	7.78	7.15	8.37	0.308	62	7.81	7.19	8.58	0.374
CM ³	70	5.97	5.47	6.57	0.260	63	6.03	5.53	6.74	0.298
M ¹ M ³	70	3.74	3.29	4.64	0.231	62	3.71	3.31	4.08	0.175
CP ⁴	70	2.63	2.27	2.95	0.168	63	2.69	2.30	3.18	0.201
LMd	70	11.98	11.06	13.11	0.490	62	11.96	10.61	13.19	0.591
ACo	70	4.51	3.95	5.06	0.237	63	4.62	4.08	5.26	0.301
CM ₃	70	6.42	5.96	6.93	0.257	63	6.51	5.98	7.18	0.297
M ₁ M ₃	70	4.12	3.54	4.56	0.180	63	4.18	3.86	4.48	0.144
CP ₄	70	2.45	2.17	2.76	0.140	63	2.48	2.13	2.96	0.180
Laln _f /LCc	68	0.300	0.276	0.325	0.010	63	0.307	0.280	0.326	0.010
LBT/LCc	63	0.308	0.282	0.329	0.011	57	0.300	0.271	0.326	0.011

vulnerable, as it can be quickly changed into a residential house. To be able to assess potential threats of the species, more detailed study of its distribution as well as ecology is needed. Considering the known limits of its distribution, we expect that *Rhinopoma hadramauticum* sp. nov. represents an endemic form of the southern Yemen, with a sparse islet-like distribution (regarding habitat patchiness in the region). Hence, it may rank among the most threatened bat species in the Middle East or even in the World.

Table 1. (Continued.)

	<i>R. hardwickii</i>					<i>R. microphyllum</i>				
	n	M	min	max	SD	n	M	min	max	SD
LC	3	61.3	56	66	5.033	1	88			
LCd	3	71.0	67	75	4.000	1	68			
LAt	25	59.02	53.7	62.3	2.411	20	66.36	62.5	71.1	2.480
LA	3	21.50	21.0	22.3	0.700	1	22.5			
LT	3	7.03	6.6	7.3	0.379	1	7.3			
G	3	9.90	9.5	10.5	0.529	1	29.7			
LCr	30	18.33	16.31	19.47	0.639	40	20.77	19.72	22.29	0.568
LCC	32	16.27	15.23	17.62	0.480	40	18.64	17.74	19.92	0.563
LaZ	29	10.77	9.81	11.58	0.390	38	12.19	11.40	13.08	0.460
Lal	32	2.85	2.50	5.27	0.466	42	2.64	2.28	3.02	0.178
Laln ^f	32	5.05	4.70	5.54	0.173	42	5.42	4.76	5.93	0.285
LAN	32	8.06	7.32	8.77	0.321	40	8.85	8.28	9.48	0.331
AN	32	5.94	5.40	6.45	0.257	39	7.23	6.32	8.27	0.560
ACr	31	7.86	7.14	8.54	0.336	38	9.15	8.24	10.23	0.479
LBT	26	4.86	4.39	5.38	0.278	24	4.94	4.40	5.26	0.228
CC	32	4.68	4.16	5.16	0.275	42	5.32	4.75	6.12	0.302
M ³ M ³	30	7.88	7.33	8.47	0.280	42	9.20	8.47	9.82	0.347
CM ³	31	6.29	5.95	6.81	0.179	42	7.52	7.07	7.95	0.214
M ¹ M ³	30	3.90	3.60	4.19	0.136	42	4.58	4.18	4.83	0.170
CP ⁴	31	2.82	2.48	3.82	0.234	42	3.32	2.89	3.61	0.168
LMd	32	12.48	11.68	13.27	0.384	41	14.68	13.75	15.78	0.472
ACo	32	4.70	4.09	5.22	0.249	41	5.59	4.75	6.33	0.300
CM ₃	32	6.80	6.38	7.21	0.187	40	8.18	7.51	8.73	0.257
M ₁ M ₃	32	4.39	4.03	4.53	0.110	41	5.21	4.78	5.43	0.140
CP ₄	31	2.56	2.33	2.88	0.128	40	3.17	2.76	3.54	0.192
Laln ^f /LCC	32	0.310	0.286	0.331	0.009	37	0.293	0.274	0.316	0.010
LBT/LCC	22	0.299	0.273	0.334	0.017	24	0.266	0.242	0.285	0.010
LCd/LAt	3	1.236	1.199	1.261	0.032	1	0.991			

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Appendix. List of the comparative material examined

Rhinopoma muscatellum Thomas, 1903

Afghanistan: 4 inds. s.i. (ZFMK 96.458, 96.459, 96.461, 96.463 [S]), Shamshir Gor bei Kandahar, 31° 36' N, 65° 47' E, 28 February 1965, leg. J. Niethammer. – **Iran:** 3 m, 1 f (NMP 48443–48446 [S+A]), Hormoz I., Hormozgan, 17 April 2000, leg. P. Benda & A. Reiter; – 1 m, 1 f (NMP 48463, 48464 [S+A]), Pol-e-Tang, Lorestan, 11 April 1977, leg. B. Pražan; – 8 m, 1 f (NMP 48164–48172 [S+A]), Izeh, Khuzestan, 12 October 1998, leg. A. Reiter & M. Uhrin; – 7 m, 2 f (NMP 48387–48395 [S+A]), Kahiri, Sistan-ve-Baluchestan, 11 April 2000, leg. J. Obuch & A. Reiter; – 1 m, 1 f (NMP 48421, 48422 [S+A]), Pir Sohrab, Sistan-ve-Baluchestan, 12 April 2000, leg. A. Reiter; – 1 ind. s.i. (BMNH 6.1.2.2. [S+B]); holotype of *Rhinopoma muscatellum seianum* Thomas, 1913), Seistan, ded. Calcuttahues; – 1 f (BMNH 20.1.19.3. [S]); holotype of *Rhinopoma pusillum* Thomas, 1920), Sih, Pers. Baluchestan, leg. J. E. B. Hotson; – 1 f (NMP 48423 [S+A]), Tis, Sistan-ve-Baluchestan, 13 April 2000, leg. J. Obuch. – **Oman:** 1 m (BMNH 94.3.9.17. [S+A]); holotype of *Rhinopoma muscatellum* Thomas, 1903), Wadi Bani Ruha, near Muscat, leg. Jayaker.

Rhinopoma hardwickii Gray, 1831

Afghanistan: 2 m, 2 f (IVB AF586, 596, 624, 644 [S+B]), Chak-Naur, 12 March & 2 May, leg. J. Gaisler; – 2 m, 4 f (IVB AF675–678, 682, 683 [S+B]), Darunta Hills, 12 April 1967, leg. J. Gaisler; – 4 m, 2 f (IVB AF398, AF1009–AF1013 [S+B]), between Darunta and Bisut, cave near the Kabul river, 12 March & 2 May 1967, leg. J. Gaisler; – 2 f, 2 inds. s.i. (ZFMK 96.452, 96.453 [S+B], 96.466, 96.474 [S]), ca. 8 km N of Jalalabad, 34° 26' N, 70° 25' E, 1 July 1966, 23 March 1972, leg. J. Niethammer. – **India:** 2 f (MNHN 1985-1386, 1387 [S]), Badami, November 1960, leg. A. Brosset; – 2 m, 1 f (ZFMK 96.449–96.451 [S+B]), Bhubaneswar, 20° 13' N, 85° 50' E, 23 January 1965, leg. J. Niethammer; – 1 m (MNHN 1902-502a [S]), Genji Coromandel, August–September 1901, leg. M. Maindron; – 1 f (MNHN 1985-1388 [S]), Hampi, November 1960, leg. A. Brosset; – 1 m (BMNH 1.e. [S]); holotype of *Rhinopoma hardwickii* Gray, 1831), India [Bengal], leg. Hardwicke; – 1 m (MNHN 1962-343b [S]), Vigayunagar, October 1960, leg. A. Brosset. – **Iran:** 2 f (NMP 48162, 48163 [S+A]), Izeh, 12 October 1998, leg. A. Reiter & M. Uhrin; – 1 m (NMP 48157 [S+A]), Jejiugir, 11 October 1998, leg. J. Obuch.

Rhinopoma cystops cystops Thomas, 1903

Egypt: 2 m, 7 f (IVB E23, E24, E26, E27, E34–36, E38 [S+B]), Cairo, Bar Kouky mosque, 21 April 1969, leg. J. Gaisler; – 2 m, 10 f (IVB E135–144, E146, E147 [S+B]), Dandara, Temple of Hathor, 27 April 1969, leg. J. Gaisler; – 1 m, 3 f (ZFMK unnumbered [S]), Dendera, date and collector unlisted; – 1 m, 2 f (IVB E81, E82, E84 [S+B]), Karnak, Temple, 26 April 1969, leg. J. Gaisler; – 1 f (BMNH 2.1.17.2. [S+B]); holotype of *Rhinopoma cystops* Thomas, 1903), Luxor, leg. N. C. Rothschild; – 1 m (IVB E199 [S+B]), Luxor, Valley of Kings, tomb, 30 April 1969, leg. J. Gaisler; – 4 m, 4 f (IVB E40–42, E49, E050, E55–57 [S+B]), Sakkara, Prison of Joseph, 23 April 1969, leg. J. Gaisler. – **Libya:** 7 m, 5 f (NMP 49864–49869, 49872–49877 [S+A]), Al Jaghhub, fortress, 13 May 2002, leg. M. Andreas, P. Benda, V. Hanák, A. Reiter & M. Uhrin. – **Mauritania:** 2 m (MHNG 1878.054, 1878.055 [S+B]), Atar, Grotte du Lapin, 1 March 1951, P. L. Dekeyser & A. Villiers; – 1 f (MNHN 1995-1825 [S+B]), Guelb Moghrein, October 1968, collector unlisted. – **Morocco:** 2 f (MNHN 1954-360a, 360e [S]), Tata, 25 April 1954, leg. J. Dorst; – 8 m (NMP pb3888–3893, 3934 [S+A], pb3894 [A]), Tazouguerte, Azigza Cave, 26 April 2008, leg. P. Benda, J. Červený, A. Konečný & P. Vallo. – **Sudan:** 1 m (ZFMK 96.455 [S+B]), 6th Katarakt, ca. 100 km N Khartoum, 15° 33' N, 32° 32' E, 7 March 1986, leg. J. Niethammer; – 1 m (ZFMK 96.456 [S+Sk+B]), Djebel, ca. 30 km NW Khartoum, 15° 33' N, 32° 32' E, 18 March 1986, leg. J. Niethammer.

Rhinopoma cystops arabium Thomas, 1913

Israel: 1 f (SMF 19596 [S]), Galilee, ded. Z. Lev; – 1 m (SMF 18985 [S]), Israel (undef.), ded. Z. Lev. – **Jordan:** 9 m (NMP 47966–47974 [S+A]), Tabaqat Fal, 4 July 1997, leg. P. Benda. – **Saudi Arabia:** 4 m, 3 f

(SMF 60891–60894, 60896–60898 [S]), bei Medina, 19 November 1971, leg. I. Nader; – 2 m, 2 f (BMNH 48.351–48.354. [S+B]), W Arabia, Al Bada, 300 mts, 28° 30' N, 35° 05' E, 25 March 1947, leg. G. B. Popov. – **Syria**: 2 m (NMP 48268, 48269 [S+A]), Nimrud Fortress, Golan Heights, 18 July 1999, leg. P. Benda. – **Yemen**: 2 m, 6 f (NMP pb2947–pb2951, 2953, 2954 [S+A], pb2952 [A]), Al Azhlaniya, Wadi Hadramaut, 10 October 2005, leg. P. Benda; – 2 m (SMF 91021, 91022 [S+B]), Al Dimnah, Najd Khamran, Lahej, 29 March 1999, leg. E. Sadik & I. Al Qubati; – 1 m, 1 f (NMP pb3672, 3673 [S+A]), Al Makha, Taiz, 29 October 2007, leg. P. Benda & A. Reiter; – 2 m, 2 f (NMP pb3622, 3623, 3625 [S+A], 3624 [A]), Am Rija', Wadi Am Rija', Lahj, 25 October 2007, leg. P. Benda & A. Reiter; – 4 m, 4 f (NMP pb2920–pb2927 [S+A]), Ma'arib, 8 October 2005, leg. P. Benda; – 1 m, 1 f (BMNH 99.11.6.29., 99.11.6.32. [S+B]), Myba, near Aden, leg. W. Dodson; – 3 m, 5 f (NMP pb3763, 3765, 3766 [S+A], pb3764, 3767–3770 [A]), Shuhayr, Hadramaut, 6 November 2007, leg. P. Benda & A. Reiter; – 1 f (SMF 91017 [S]), Samha Is., Socotra Archipelago, 15 February 1999, leg. M. Al-Jumaily; – 1 m (NMP pb2744 [S+A]), Socotra, Desmoiten, Wadi Darho, 13 May 2004, leg. P. Benda & A. Reiter; – 1 m, 1 f (SMF 91018, 91019 [S]), Socotra, Diksam Plateau, Sirhin, 24 February 1999, leg. M. Al-Jumaily; – 1 f (NMP pb2752 [S+A]), Socotra, Keisu, 22 May 2004, leg. P. Benda & A. Reiter; – 3 m (NMP pb2728 [A], pb2729, 2730 [S+A]), Socotra, Timre, 6 May 2004, leg. P. Benda & A. Reiter; – 6 m (NMP bp1, pb2739–2742 [S+A], pb2738 [A]), Socotra, Wadi Zerig, cave, 12 May 2004, leg. P. Benda & A. Reiter; – 5 m, 2 f (BMNH 13.6.19.1.–13.6.19.5., 13.6.19.7., 13.6.19.8. [S+B]); including the holotype of *Rhinopoma cystops arabium* Thomas, 1913), Wasil, 4000 ft., 6 March 1913, leg. G. W. Bury.

***Rhinopoma macinnesi* Hayman, 1937**

Kenya: 1 m (BMNH 36.11.4.45. [S]); holotype of *Rhinopoma cystops macinnesi* Hayman, 1937), Bat Island, near Central Island, Lake Rudolf, date and collector unlisted.

***Rhinopoma microphyllum* (Brünnich, 1782)**

Afghanistan: 1 m (ZFMK 96.448 [S+B]), 8 km N of Jalalabad, 34° 26' N, 70° 25' E, 23 March 1972, leg. J. Niethammer; – 1 m (MHNG 952.82 [S+A]), Farah, Grande Grotte Moumlai, 26 April 1958, leg. K. Lindberg; – 1 ind. (ZFMK 96.454 [S+B]), Kandahar, 31° 36' N, 65° 47' E, 6 August 1966, leg. J. Niethammer; – 1 m (MHNG 952.77 [S+A]), Kandahar, Grotte Chamchir, 4 December 1957, leg. K. Lindberg; – 6 m, 4 f (IVB AF582, AF606, AF633, AF634, AF638–AF641, AF643, AF645 [S+B]), Chak-Naur, cave, 7 April 1967, leg. J. Gaisler. – **Egypt**: 4 inds. s.i. (SMF 11946–11949 [S]), Ägypten, before 1822, leg. E. Rüppell; – 2 inds. s.i. (SMF 1316, 1325 [S+Sk]), Ägypten, before 1831, leg. E. Rüppell; – 1 ind. s.i. (SMF 25800 [S]), südlich Cairo, 1955, leg. E. Kulzer; – 1 ind. s.i. (MHNG 683.31 [S+B]), Theben, 1905, collector unlisted. – **India**: 1 m (BMNH 11.12.11.1 [S+B]); holotype of *Rhinopoma kinneari* Wroughton, 1912), Bhuj, Cutch, 28 August 1911, collector unlisted; – 3 f (MNHN 1985-1390, 1392, 1393 [S]), Fathepur Sikri (Aqra), March 1961, leg. A. Brosset; – 3 inds. s.i. (MNHN 1985-1963–1965 [S]), Orcha, May 1961, leg. A. Brosset; – 1 f (MNHN 1985-1391 [S]), Saneni, March 1961, leg. A. Brosset; – 1 ind. s.i. (MHNG 913.8 [S]), Ssanchi, Bhopal, October 1955, leg. Pittet. – **Jordan**: 1 f (NMP 47965 [S+A]), Tabaqat Fal, 4 July 1997, leg. P. Benda. – **Lebanon**: 1 ind. s.i. (MNHN 1983-1632 [S]), Grotte de Litani, 30 July 1962, leg. A. Khaikallah. – **Mauritania**: 1 f (MNHN 1995-1824 [S+B]), Guelb Moghrein, October 1968, collector unlisted; – 1 ind. s.i. (MNHN 1995-3142 [S]), Fourt de Mondjeria, 30 December 1994, leg. F. Colas. – **Pakistan**: 4 f (MNHN 1983-1630, 1631, 1997, 1999 [S]), Karachi, 21 June 1965, leg. M. A. El Hussein. – **Senegal**: 1 f (MNHN 1995-1823 [S+B]), Dakar, 2 December 1971, leg. R. Taufflieb. – **Sudan**: 1 f (ZFMK 96.457 [S+Sk+B]), Djebel, ca. 30 km NW of Khartoum, 15° 33' N, 32° 32' E, 18 March 1986, leg. J. Niethammer; – 1 m (ZMB 2578 [S+A]); lectotype of *Rhinopoma lepsianum* Peters, 1859), Weisser Nil, leg. Lepsius.