

## New data on the distribution of bats (Chiroptera) in Morocco

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**Abstract.** New records of 24 bat species from Morocco are presented, including *Rhinopoma microphylum*, *Rhinopoma hardwickii*, *Nycteris thebaica*, *Rhinolophus ferrumequinum*, *Rhinolophus mehelyi*, *Rhinolophus blasii*, *Hipposideros caffer*, *Asellia tridens*, *Myotis punicus*, *Myotis nattereri*, *Myotis mystacinus*, *Eptesicus isabellinus*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Pipistrellus kuhlii*, *Pipistrellus (kuhlii) deserti*, *Pipistrellus rueppellii*, *Nyctalus leisleri*, *Otonycteris hemprichii*, *Barbastella barbastellus*, *Plecotus teneriffae*, *Miniopterus schreibersii*, *Tadarida teniotis*, and *Tadarida aegyptiaca*, some of which are only rarely mentioned in the literature. Previously, *O. hemprichii* and *T. aegyptiaca* were known from Morocco only from bone remnants. Here, these species are documented from this country for the first time by records of live individuals. *P. (k.) deserti* is reported from Morocco for the first time.

**Bats, distribution, Maghreb, North Africa**

### Introduction

Among North African faunas, the mammalian fauna of Morocco is relatively well studied (Aulagnier & Thévenot 1986a). However, the Moroccan bat fauna remains still rather poorly known, although several authors aimed their research activities directly on bats from this country (Aulagnier 1991). Many bat species are known from few records (Aulagnier & Thévenot 1986a) and thus their known distribution in Morocco remains quite fragmentary.

In the first review of the mammalian fauna of Morocco, Cabrera (1932) mentioned eight bat species of three families. Almost twenty years later, Panouse (1951) reported twice more species belonging to five families. He reviewed occasional records made in the previous period (Carpentier 1932, Morales Agacino 1933, 1943, Laurent 1937a, b, c, Heim de Balsac 1948) but also suggested possible Moroccan occurrence of some other North African or Iberian species. Within subsequent years, a number of reports appeared (Strinati 1951, 1953, Panouse 1953, 1955, 1958, 1959, Aellen 1955, Brosset 1955, 1958, 1963, Brossed & Caubère 1960, Dorst & Panouse 1957a, b, Hill 1964, etc.) that brought new data on the distribution of bats in Morocco, including records of eight new species and two new families. As Aulagnier (1991) pointed out, bat research was suspended for almost twenty years in Morocco after publication by Hill (1964). However, in the 1980s new bat research was carried out in Morocco and the occurrence of three more bat species was confirmed (Palmeirim 1982, Aulagnier & Destre 1985, Aulagnier & Mein 1985, Kock 1987, Arlettaz & Aulagnier 1988). In the comprehensive atlas of Moroccan mammals that appeared in this period, Aulagnier & Thévenot (1986a) summed up the distribution records of 26 species of bats including many new data.

Within the last 20 years, several new papers on bats in Morocco have been published (Ibañez 1988, Denys et al. 1995, Fonderflick et al. 1998, Aulagnier & Denys 2000). These contributions reported also first records of three species and of one family in Morocco. Until now, the occurrence of 29 bat species has been confirmed in Morocco.

In the present contribution, we mainly report on some records of bats from Morocco made during two field trips in 1989 and 2003. Most bats were netted and occasionally also found during the visual inspection of underground shelters. Collected specimens are deposited in the collection of the Department of Zoology, National Museum (Natural History), Prague, Czech Rep. (NMP) or in the collection of the Natural History Museum, Geneva, Switzerland (MHNG). We also report on several records from owl pellets that are deposited in personal collections (DB, SA).

## Species List

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

RECORD. Tisbalbat, near the reserve of the Oued Dadès (ca. 35 km E of Ouarzazate, 30° 58' N, 6° 40' W), 16 February 1988, one mandible (DB 43) found in a pellet of *Bubo ascalaphus*, leg. D. Barreau & A. Rocher.

In Africa, the Greater mouse-tailed bat, *Rhinopoma microphyllum*, is mostly distributed in the margins of the Sahara (Kock 1969, Le Berre 1990, Van Cakenberghe & De Vree 1994). In North Africa it is reported from Egypt, along the Nile Valley (Qumsiyeh 1985), and Morocco, south of the Haut Atlas Mts. (Aulagnier & Thévenot 1986a).

In Morocco, *R. microphyllum* has been found in two regions, viz., in the area S of the Anti-Atlas Mts. near Foum el Hassan, and in the region of Tafilalt (Heim de Balsac 1948, Aulagnier & Destre 1985, Aulagnier & Thévenot 1986a). The present record falls between these two regions, in the same semi-desert biotic zone, near cliffs providing cracks usually occupied by this species in the area.

### ***Rhinopoma hardwickii* Gray, 1831**

RECORD. Kef Azigza, near Tazouguerte (ca. 20 km N of Boudenib, 32° 5' N, 3° 47' W), 13 October 1989, one sexually mature male examined and released, leg. M. Ruedi.

In Africa, the Lesser mouse-tailed bat, *Rhinopoma hardwickii*, is distributed throughout the Sahara, mostly to the north of 15° N (Van Cakenberghe & De Vree 1994, Benda et al. 2004a). In the proper Maghreb, it occurs in the belt to the south of the Haut Atlas Mts. in Morocco (Aulagnier & Thévenot 1986a) and of the Saharan Atlas Mts. in Algeria and Tunisia (Aellen & Strinati 1969, Kowalski & Rzebik-Kowalska 1991).

In Morocco, *R. hardwickii* is a rather uncommon bat. It has been found in two regions, viz., in the area SE of the Anti-Atlas Mts. between Tata and Ouarzazate, and in the region of Tafilalt (Panouse 1951, Aulagnier & Destre 1985, Aulagnier & Thévenot 1986a). From the Kef Azigza, N of Boudenib, where the presented record comes from, this bat was reported already by Aulagnier & Destre (1985). This place represents the northernmost site of occurrence of *R. hardwickii* in Morocco.

### ***Nycteris thebaica* Geoffroy, 1818**

RECORDS. Marrakech palm-grove (31° 40' N, 8° 5' W), 16 May 1988, one individual (DB 36) found in a pellet of *Tyto alba*, leg. D. Barreau & A. Rocher. – Oued Massa, abandoned canalisation near Massa (30° 4' N, 9° 37' W), 6 October 1989, several individuals observed, one adult male examined and released, leg. M. Ruedi.

The Egyptian slit-faced bat, *Nycteris thebaica*, is distributed principally in the sub-Saharan part of Africa, with an exception of the rain forest zone (Hayman & Hill 1971, Van Cakenberghe & De Vree 1998). Its distribution ranges continuously from this extensive area into Egypt and SW Arabia via the eastern Sahara. Nevertheless, its distribution in Morocco is obviously isolated from other populations, both in the eastern Sahara or in the sub-Saharan part of West Africa. However, the Moroccan population probably extends its Senegalese distribution (Van Cakenberghe & De Vree 1998, Gray et al. 1999).

In Morocco, *N. thebaica* was recorded for the first time in the Oued Cherrate near Rabat (Panouse 1958). Subsequently, this bat was found in Goulimine on the western margin of the Anti-Atlas Mts. (Panouse 1959). These two early findings demarcated the whole presently known distribution range of *N. thebaica* in north-western Africa. Several other records of this bat were made in the vicinity of Rabat and in the broader area between Agadir and Chichaoua (Aulagnier & Thévenot 1986b, Arletta & Aulagnier 1988, Van Cakenberghe & De Vree 1998).

Our first record of *N. thebaica* extends slightly the latter area towards the north-east. The second record comes from an abandoned canalisation in the Oued Massa, where this bat was observed several times before, at least in April 1985 and January 1987 (Aulagnier & Thévenot 1986b, Arletta & Aulagnier 1988).

### ***Rhinolophus ferrumequinum* (Schreber, 1774)**

RECORDS. Sefrou, three small caves ca. 200 m SE of the village (33° 49' N, 4° 50' W), 28 September 1989, one individual observed in each, leg. M. Ruedi. – Oued Tessaoud, 1 km N of Talkount (ca. 70 km E of Marrakech, 31° 41' N, 7° 17' W, ca. 770 m a. s. l.), 30 August 2003, a colony of ca. 30 individuals observed in an irrigation canal, an adult female (NMP 90035 [S+A]) collected, leg. P. Benda.

In Africa, the Greater horseshoe bat, *Rhinolophus ferrumequinum*, occurs only in the Maghreb (Hayman & Hill 1971). In Maghrebian countries, this species is one of the most common bats (Allen & Strinati 1969, Aulagnier & Thévenot 1986a, Kowalski & Rzebik-Kowalska 1991). In Morocco, *R. ferrumequinum* is distributed in the whole Mediterranean biotic zone, extending downward the southern slopes of the Haut Atlas Mts. (Aulagnier & Thévenot 1986a). Both current findings fall into the range of the previously described distribution area for this species.

### ***Rhinolophus mehelyi* Matschie, 1901**

RECORDS. Oued Khanoussa, near Azzhiliga (33° 20' N, 6° 35' E), 20 May 1986, one skeleton (SA 007), leg. B. Cahuzac. – Oued Nfiss, old gold mine, ca. 8 km SW of Asni (31° 9' N, 8° 5' W), 2 October 1989, a group of 10 individuals observed, one sexually active male examined, leg. M. Ruedi.

The Mehely's horseshoe bat, *Rhinolophus mehelyi*, is a bat species with a strictly Mediterranean type of distribution (Gaisler 2001). In the supra-Saharan part of Africa, *R. mehelyi* has the widest distribution of all horseshoe bats (Hayman & Hill 1971). It occurs in all Mediterranean habitats of the Maghreb, Cyrenaica and in north-eastern Egypt (Kahmann 1958, DeBlase 1972, Hanák & Elgadi 1984, Qumsiyeh 1985).

In Morocco, *R. mehelyi* was for the first time identified by Laurent (1937c), based on material from Tanger. Later, this species was found in several other places along the Atlantic coast between Rabat and Safi and in the Beni Snassen area (Panouse 1951, 1953, Brosset 1955). Finally, Aulagnier & Thévenot (1986a) reported occurrence of *R. mehelyi* in a large part of the Mediterranean biotic zone in Morocco, mainly at lower altitudes in the north-western portion of the country. The southernmost record of this species in Morocco and also in the whole Maghreb was made

from Asni in the Haut Atlas Mts. (Felten et al. 1977). Our second record confirmed a permanent distribution of *R. mehelyi* in this region.

### ***Rhinolophus blasii* Peters, 1866**

RECORD. Kef Azigza, near Tazouguerte (ca. 20 km N of Boudenib, 32° 5' N, 3° 47' W), 13 October 1989, 19 individuals observed, five males and three females examined and released, leg. M. Ruedi.

The Blasius' horseshoe bat, *Rhinolophus blasii*, is distributed in the Mediterranean and Afrotropical regions (Kock & Howel 1988). In the western part of the Mediterranean, it occurs exclusively in the Maghreb.

In Morocco, *R. blasii* was initially reported by Aellen (1955) and Brosset (1955), who documented two records in the eastern part of the country (Beni Snassen region and Figuig) (Fig. 1). Felten et al. (1977) mentioned a specimen coming from Asni (Haut Atlas Mts.). One specimen of *R. blasii* deposited in the Smithsonian Institution originated from the region of Ouarzazate (Aulagnier & Thévenot 1986a). Benda et al. (in press) mentioned a set of specimens collected in the Kef Azigza near Tazouguerte, and deposited in the Natural History Museum of Vienna. The present record comes from the same cave and further documents this well established colony. Although Aulagnier & Destre (1985) mentioned high number of other bat species observed in

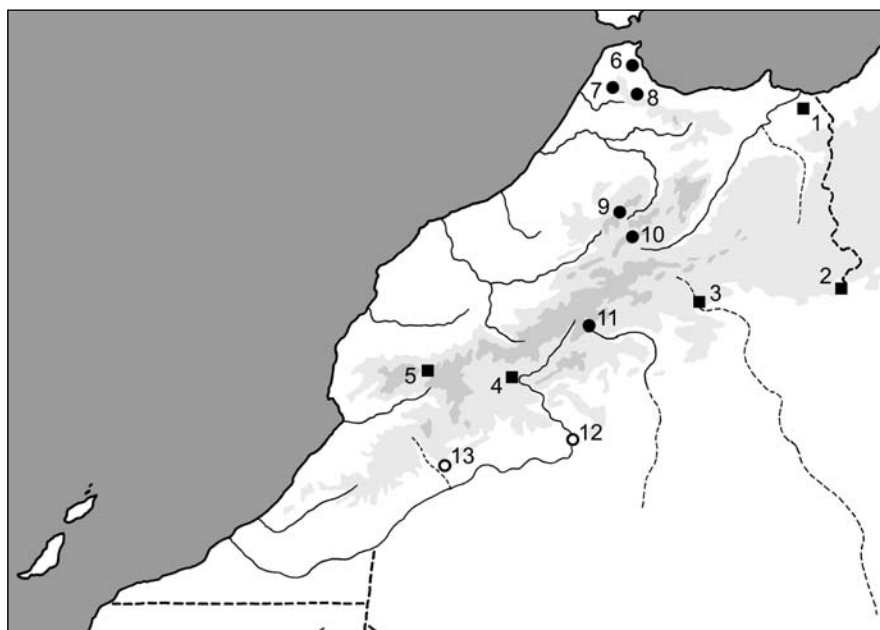


Fig. 1. Records of Blasius' horseshoe bat (*Rhinolophus blasii*) (squares), Western barbastelle (*Barbastella barbastellus*) (closed circles) and Egyptian free-tailed bat (*Tadarida aegyptiaca*) (open circles) in Morocco. Obr. 1. Nález vrápence Blasiova (*Rhinolophus blasii*) (čtverce), ďasika černého (*Barbastella barbastellus*) (plné kroužky) a morouse jižního (*Tadarida aegyptiaca*) (prázdné kroužky) v Maroku.

Sites / lokality: 1 – Beni Snassen, 2 – Figuig, 3 – Kef Azigza, 4 – Ouarzazate, 5 – Asni, 6 – Tetouan, 7 – Souk-Khémis-des-Beni-Arouss, 8 – Chefchaouen, 9 – Azrou, 10 – Col du Zad, 11 – Gorges du Todra, 12 – Anagam, 13 – Tata.

this cave, they did not report *R. blasii*, as the result of a misidentification supported by finger measurements.

Among three medium-sized horseshoe bats, *R. blasii* is the rarest species in Morocco, while *R. euryale* Blasius, 1853 is apparently the most common one (Aulagnier & Thévenot 1986a) and the same ratio was reported for Tunisia (Aellen & Strinati 1969). It is in contrast with the status of these rhinolophids noted in Algeria (Kowalski & Rzebik-Kowalska 1991), where the records of *R. blasii* are most numerous and *R. euryale* is the least frequently found. This state is similar to the situations found in south-eastern Europe and the Levant, other areas of sympatric occurrence of all three species (Hanák et al. 2001, Benda et al. in press). Thus, the situation described from Morocco and Tunisia probably results from rather poor knowledge of fauna in these countries and/or due to possible identification errors (see e.g., Deleuil & Labbe 1955, Aellen & Strinati 1970, Cockrum 1976, Kowalski 1979, etc.).

### ***Hipposideros caffer* (Sundevall, 1846)**

RECORD. Oued Massa, abandoned canalisation near Massa (30° 4' N, 9° 37' W), 6 October 1989, group of ca. 50 individuals observed, one adult male examined and released, leg. M. Ruedi.

The Sundevall's leaf-nosed bat, *Hipposideros caffer*, is mostly an Afrotropical species (Hayman & Hill 1971, Horáček et al. 2000). In the Palaearctic region it reaches only marginally Morocco, where only few records have been made (Arlettaz & Aulagnier 1988).

*H. caffer* was recorded in Morocco for the first time by Cabrera Latorre (1906), who described a specimen from Mogador (= Essaouira region) as a new species *Hipposideros tephrus* (= *H. caffer tephrus*). Cabrera (1932) added two other individuals originating from Tagüidert, Haha region. He mentioned Tanger as the northern margin of Moroccan distribution range of this species, presumably on the basis of one specimen preserved in the collection of Madrid Natural History Museum (Ibáñez & Fernández 1989). However, the centre of distribution of *H. caffer* in Morocco lies in the area close to the westernmost part of the Haut Atlas Mts., where majority of records have been made.

More than half a century after Cabrera's (1932) records, *H. caffer* was found again at two new sites, viz., Oukaïmeden and the estuary of the Oued Massa (Aulagnier & Thévenot 1986a, Arlettaz & Aulagnier 1988). The latter site is an abandoned canalisation where several individuals of *H. caffer* were observed in April 1985, April 1986 and January 1987 (Arlettaz & Aulagnier 1988); the group of about 50 individuals mentioned here was observed in the same place. *H. caffer* lived together with some *Nycteris thebaica*, their joint occurrence was recorded at this place at least twice. This locality is the southernmost known site of occurrence of *H. caffer* in Morocco, its closest records in West Africa come from the Mauritanian-Senegalese border, some 1600 km to the south-west (Qumsiyeh & Schlitter 1981).

### ***Asellia tridens* (Geoffroy, 1813)**

RECORDS. Koudiat M'Douara, ca. 20 km SW of Erfoud (31° 20' N, 4° 20' E), 18 April 1986, one skull (DB 38) found in a pellet of *Tyto alba*, leg. D. Barreau & A. Rocher. – Jbel Hamar Laghdad, ca. 20 km SE of Erfoud (31° 20' N, 4° 5' W), 13 February 1988, four mandibles (DB 37) extracted from owl pellets, leg. D. Barreau & A. Rocher. – Jorf, ca. 15 km NW of Erfoud (31° 28' N, 4° 22' W), 14 February 1988, skull remains (DB 40) found in an owl pellet, leg. D. Barreau & A. Rocher.

In Africa, the Trident leaf-nosed bat, *Asellia tridens*, is distributed throughout the Sahara, extending south to the Gambia in the west and to northern Somalia in the east (Kock 1969, Hayman

& Hill 1971, Owen & Qumsiyeh 1987, Le Berre 1990, Jones et al. 1993). In the proper Maghreb, as well as *Rhinopoma hardwickii*, it occurs in the belt to the south of the Haut Atlas Mts. in Morocco (Aulagnier & Thévenot 1986a) and of the Saharan Atlas Mts. in Algeria and Tunisia (Aellen & Strinati 1969, Kowalski & Rzebik-Kowalska 1991).

In Morocco, *A. tridens* was recorded for the first time in the city of Figuig (Foley 1922). Subsequently, Laurent (1937a) described a pale specimen collected in 1930 in the region of Oued Tatta (= Tata) as a new subspecies, *A. tridens pallida*. Then Panouse (1951) found a colony in Assa, in a rhattara (an underground watermain), the same habitat that was occupied by a colony in Figuig, later studied by Brosset & Caubère (1960). Several other records of this bat were made in the Tafilalet region (Aulagnier & Destre 1985), as well as in the vicinity of Ouarzazate and in the south-eastern Anti-Atlas Mts. around Tata (Aulagnier & Thévenot 1986b). Current findings confirm the occurrence of this species in two localities where it was previously reported, and fall into the range of the described distribution area for the third one.

### *Myotis punicus* Felten, 1977

RECORDS. Jorf, ca. 15 km NW of Erfoud (31° 28' N, 4° 22' W), 31 December 1986, one skull (DB 35) extracted from an owl pellet, leg. D. Barreau & A. Rocher. – Bir Tam Tam, ca. 40 km SE of Fès (33° 58' N, 4° 38' W), 14 May 1987, one specimen (DB 45) found in a pellet of *Tyto alba*, leg. R. Chalot & D. Barreau. – Near

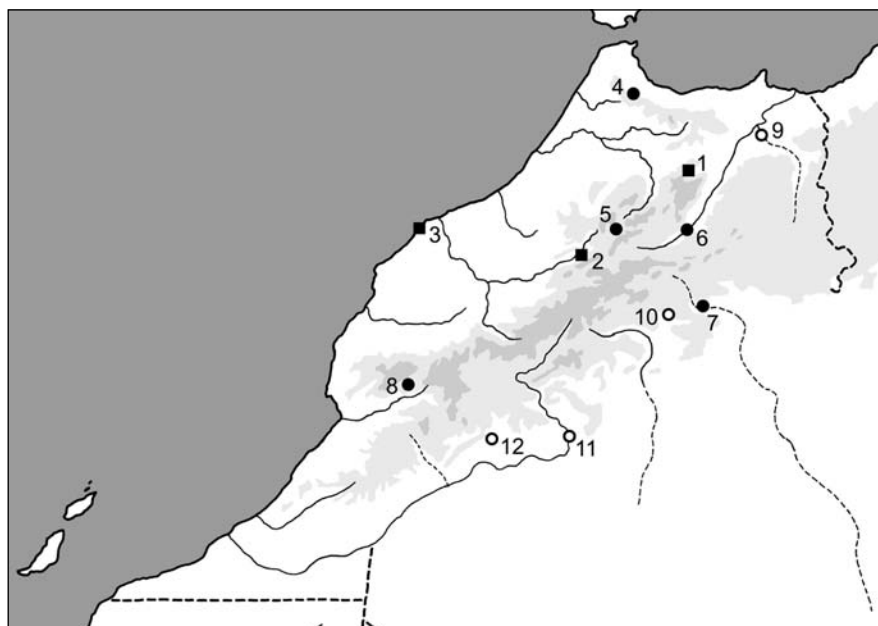


Fig. 2. Records of Natterer's bat (*Myotis nattereri*) (squares), Whiskered bat (*Myotis mystacinus*) (closed circles) and Rüppell's bat (*Pipistrellus rueppellii*) (open circles) in Morocco.

Obr. 2. Nálezny netopýrce řasnatého (*Myotis nattereri*) (čtverce), netopýrce vousatého (*Myotis mystacinus*) (plné kroužky) a netopýra Rüppellova (*Pipistrellus rueppellii*) (prázdné kroužky) v Maroku.

Sites / lokality: 1 – Gouffre du Friouato, 2 – Khenifra, 3 – Doukkala Region, 4 – Chefchaouen, 5 – Bekrite, 6 – Missouri, 7 – Boudenib, 8 – Oued Nfiss, 9 – Cascades Bou Mazouz, 10 – Aoufouss, 11 – Anagam, 12 – Fom Zgouid.

Guemassa (31° 25' N, 8° 20' W), 25 June 1987, one specimen (DB 31) found in a pellet of *Bubo ascalaphus*, leg. D. Barreau & A. Rocher. – Unnamed vertical cave, ca. 2 km E of the Gouffre du Friouato (ca. 20 km SW by road of Taza, 34° 3' N, 4° 5' W), 15 October 1989, seven males netted, five released and two collected (MHNG 1805.85, 1805.97 [S+A]), leg. M. Ruedi. – Kef Azigza, near Tazouguerte (ca. 20 km N of Boudenib, 32° 5' N, 3° 47' W), 13 October 1989, a male examined and released, leg. M. Ruedi. – Oued Nfiss, old gold mine, ca. 8 km SW of Asni (31° 9' N, 8° 5' W), 2 October 1989, many harems observed in the mine, one sexually mature male captured and released, leg. M. Ruedi. – Oued Tessaoud, 1 km N of Talkount (ca. 70 km E of Marrakech, 31° 41' N, 7° 17' W, ca. 770 m a. s. l.), 30 August 2003, a colony of ca. 400 ind. observed in an irrigation canal, nine adult males and an adult female (NMP 90036 [A], 90037–90045 [S+A]) collected, leg. P. Benda. – Oued el Ammar, 1 km N of Sebt-es-Âit-Serhrouchèn (ca. 40 km E of Fès, 34° 2' N, 4° 33' W, ca. 320 m a. s. l.), 9 September 2003, an adult male (NMP 90092 [S+A]) netted, leg. P. Benda.

The Maghrebian mouse-eared bat, *Myotis punicus*, is distributed mainly in the Maghreb, but it also reaches Tripolitania (Libya) and several Mediterranean islands (Felten et al. 1977, Arlettaz et al. 1997, Castella et al. 2000, Topál & Ruedi 2001, Beuneux 2004). In the Maghreb, *M. punicus* is one of the most common bat species (Allen & Strinati 1969, Kowalski & Rzebik-Kowalska 1991), but has been reported either under the name *M. myotis* or *M. blythii* by various authors (see Felten et al. 1977). In Morocco, Aulagnier & Thévenot (1986a) found that this bat was the most frequent species. They mentioned it from 36 mapping squares 0.5°×0.5° (the other presumably very common bat *Pipistrellus kuhlii* was found in 32 of these squares only). The eight present records fall into the previously described distribution range.

### ***Myotis nattereri* (Kuhl, 1817)**

RECORD. Unnamed vertical cave, ca. 2 km E of the Gouffre du Friouato (ca. 20 km SW by road of Taza, 34° 3' N, 4° 5' W), 15 October 1989, one adult female netted and released, leg. M. Ruedi.

The Natterer's bat, *Myotis nattereri*, reaches the southernmost points of its distribution range in the Maghreb and in Palestine (Horáček & Hanák 1984). Its known Maghrebian range includes only few records made in Morocco and Algeria (Aulagnier & Thévenot 1986a, Kowalski & Rzebik-Kowalska 1991). *M. nattereri* has been recorded in Aokas and Yakouren, in north-eastern Algeria (Gaisler 1983, 1984) and a nursery colony has been found in Ain Fezza, in western Algeria (Kowalski et al. 1986).

In Morocco, this bat was reported for the first time by Brosset (1963). He re-identified a specimen collected in the region of Khenifra (Moyen Atlas Mts.) by Carpentier (1932) who reported on it as *M. capaccinii* (Bonaparte, 1837). Aulagnier & Thévenot (1986a) mentioned an additional specimen of *M. nattereri* that was captured in the Doukkala region and deposited in the Smithsonian Institution. Thus, the present record from the Tazzeka Mts. represents the third finding of this species in Morocco (Fig. 2). The total number of sites for *M. nattereri* in Africa has increased to six but this species still remains one of the rarest African bats.

### ***Myotis mystacinus* (Kuhl, 1817)**

RECORDS. Oued Nfiss, between Mzouzite and Idni (30° 55' N, 8° 22' W), 3 October 1989, an adult male and an adult female netted over the river and released, leg. M. Ruedi. – Oum er Rbia, 5 km SW of Bekrite (ca. 40 km S of Azrou, 33° 2' N, 5° 14' W, ca. 1780 m a. s. l.), 28 August 2003, an adult female (NMP 90031 [S+A]) netted, leg. P. Benda.

The Whiskered bat, *Myotis mystacinus*, is generally considered as a rather boreal species, but within Africa it occurs only in Morocco (Hayman & Hill 1971). *M. mystacinus* was first mentioned by Panouse (1953) in Morocco from near Missouri, which lies in a fairly arid landscape. The second

Tab. 1. Basic biometric data on the selected rather uncommon bat species collected in Morocco, deposited in the collection of the National Museum, Prague. For details on the specimens see text, for abbreviations see Appendix  
 Tab. 1. Základní biometrické údaje vybraných vzácněji nacházených druhů netopýřů z Maroka, dokladovaných ve sbírce Národního muzea v Praze.  
 Údaje o dokladových jedincích jsou uvedeny v textu, zkratky jsou vysvětleny v appendixu

No.	sex	LC	LCd	LA	LTr	G	LCr	LCc	LaZ	Lal	LaN	AN	CC	M <sup>3M</sup>	CM <sup>3</sup>	LMD	ACo	CM <sub>3</sub>	
<i>Myotis mystacinus</i>																			
NMP 90031	f	44	44	35.1	15.9	7.7	4.4	14.03	13.19	8.40	3.38	6.92	4.69	3.37	5.35	5.22	10.08	2.75	5.48
<i>Hypsugo savii</i>																			
NMP 90070	m	49	39	35.3	15.5	6.0	5.1	13.88	13.37	8.68	3.54	6.82	4.43	4.44	5.75	4.92	9.92	2.94	5.30
<i>Pipistrellus pipistrellus</i>																			
NMP 90033	f	46	34	31.0	11.6	4.8	3.7	11.74	11.34	7.34	3.19	6.11	4.41	3.43	4.75	4.03	8.18	2.34	4.33
NMP 90069	m	42	36	30.0	11.8	4.8	3.7	11.74	11.26	7.24	2.92	6.01	4.16	3.52	4.65	4.12	8.14	2.39	4.29
NMP 90073	f	42	36	28.5	12.0	5.5	4.1	—	—	—	—	—	—	—	—	—	—	—	—
NMP 90074	f	42	36	29.7	12.0	4.0	3.7	11.67	11.24	7.18	3.08	5.95	4.03	3.53	4.84	4.19	8.14	2.24	4.31
NMP 90075	m	42	34	29.6	11.8	5.4	2.9	11.18	10.74	7.07	3.00	5.77	4.10	3.17	4.51	3.96	7.83	2.16	4.11
NMP 90076	m	39	37	29.7	12.7	5.3	3.1	11.88	11.34	7.01	2.97	5.85	4.18	3.39	4.64	4.19	8.02	2.24	4.35
NMP 90077	f	42	36	30.5	12.1	5.4	3.5	11.48	11.02	7.30	3.21	6.12	4.22	3.50	4.93	4.15	7.92	2.22	4.34
<i>Pipistrellus (kuhlii) deserti</i>																			
NMP 90058	m	40	42	33.0	14.1	5.6	4.0	12.17	11.86	7.68	2.88	6.23	4.47	3.80	5.13	4.56	8.87	2.62	4.88
NMP 90059	m	45	39	31.4	14.2	5.9	3.8	12.08	11.75	7.98	3.07	6.31	4.28	3.95	5.37	4.67	8.84	2.88	4.91
NMP 90060	f	43	37	32.7	13.1	6.0	3.3	11.98	11.67	7.94	3.09	6.18	4.37	3.77	5.29	4.47	8.87	2.68	4.75
NMP 90071	m	45	40	34.1	13.1	6.6	4.4	12.23	11.82	—	3.04	6.24	4.42	3.83	5.27	4.49	8.78	2.81	4.76
NMP 90072	f	45	40	33.4	14.3	6.0	4.6	12.22	11.68	—	2.92	6.06	4.42	4.02	5.39	4.68	8.76	2.81	4.95



Tab. 1. (continued)  
Tab. 1. (pokračování)

No.	sex	LC	LCd	LA	LA	LA	LTr	G	LcR	LcC	LaZ	LaI	LaN	AN	CC	M <sup>3</sup> M <sup>3</sup>	CM <sup>3</sup>	LMd	ACo	CM <sub>3</sub>
<i>Pipistrellus rueppellii</i>																				
NMP 90057	f	48	38	31.4	13.8	5.7	4.2	12.48	11.94	8.06	3.26	6.59	4.71	3.78	4.95	4.42	9.12	2.38	4.67	4.67
NMP 90080	f	51	42	35.2	14.7	5.6	6.1	12.87	12.48	8.53	3.67	6.52	4.92	4.07	5.65	4.75	9.27	2.61	5.10	5.10
NMP 90081	f	51	40	34.6	14.4	5.4	5.9	—	—	8.29	3.72	6.56	—	3.93	5.42	4.68	9.38	2.56	4.87	4.87
<i>Nyctalus leisleri</i>																				
NMP 90026	f	65	46	41.7	17.8	6.5	13.1	14.80	14.96	10.38	4.61	8.02	5.44	5.74	7.08	5.68	11.47	3.41	6.09	6.09
NMP 90034	m	68	44	41.7	16.8	5.6	10.7	15.20	15.26	10.07	4.49	8.22	5.43	5.51	6.94	5.77	11.05	3.06	6.22	6.22
NMP 90100	f	63	51	43.5	18.2	6.8	14.0	15.57	15.59	10.18	4.65	8.39	5.37	5.62	7.02	5.82	11.62	3.23	6.19	6.19
NMP 90101	f	68	46	44.3	18.6	6.1	15.2	15.71	15.67	10.88	4.98	8.27	5.53	5.87	7.28	5.98	11.76	3.52	6.38	6.38
NMP 90102	m	70	44	43.9	18.0	6.4	12.3	15.55	15.87	10.37	4.47	8.44	5.64	5.95	7.05	5.81	11.29	3.48	6.26	6.26
<i>Otonycteris hemprichii</i>																				
NMP 90061	f	77	61	63.2	42.6	17.0	21.0	22.65	21.48	14.18	4.05	10.08	7.07	5.68	9.51	8.29	16.24	6.97	9.02	9.02
NMP 90062	f	79	57	62.4	44.2	16.8	21.5	22.96	21.81	14.72	4.12	10.96	7.51	6.02	10.07	8.41	16.62	7.64	9.32	9.32
NMP 90063	f	83	58	66.6	45.4	16.8	26.3	23.12	22.07	14.58	4.15	11.01	7.68	6.10	9.58	8.31	16.60	7.44	9.19	9.19
NMP 90064	m	77	52	61.0	42.5	17.1	21.4	22.75	21.39	14.37	4.21	10.40	7.63	6.08	9.42	8.29	16.25	6.88	9.08	9.08
<i>Barbastella barbastellus</i>																				
NMP 90025	m	54	49	38.5	18.2	8.7	7.2	14.07	13.33	7.45	3.54	7.04	5.07	3.75	5.27	4.59	9.10	2.54	4.88	4.88
<i>Tadarida teniotis</i>																				
NMP 90078	m	88	58	63.7	37.1	6.6	27.0	24.11	23.54	13.45	4.67	11.68	7.03	5.54	9.14	9.09	17.08	4.23	9.75	9.75
<i>Tadarida aegyptiaca</i>																				
NMP 90065	m	81	57	55.1	27.2	6.3	19.5	20.74	20.18	13.14	4.58	11.08	6.64	5.62	8.78	7.98	14.63	3.96	8.60	8.60

Moroccan record of this species (two males and one female) reported by Aulagnier & Destre (1985) was also made in a rather arid part of the country, at Boudnib, SE Morocco. Only one additional record was made in northern part of Morocco, where the distribution of *M. mystacinus* is most presumable. A colony of *M. mystacinus* was found near Chefchaouen in the Rif Mts. (Ibáñez 1988). von Helversen et al. (2001) studied one individual from Tetouan provided by C. Ibáñez. However, this record is only a different mention of the former one (J. Juste, in litt.).

Our recent observations have increased the number of records of *M. mystacinus* to five – in Morocco and also in whole Africa. The finding made in the Moyen Atlas Mts. in central Morocco connects the known patches of occurrence of *M. mystacinus* (Fig. 2), both geographically and ecologically (Fig. 3). However, the record from the Haut Atlas Mts. represents an extremity of the distribution of *M. mystacinus* in its African range. This record is about 400 km distant from the closest Moyen Atlantic record. Moreover, this record marks the southernmost distribution range of *M. mystacinus* s. l. in the whole Western Palaearctic. Our new records thus suggest a broader distribution of *M. mystacinus* in mountain habitats throughout the country.

Benda & Tsytsulina (2000) tentatively included Moroccan population of *M. mystacinus* into the Iberian subspecies, *M. m. occidentalis* Benda, 2000. *M. m. occidentalis* differs from the nominotypical subspecies from Central Europe, *M. m. mystacinus* (Kuhl, 1817), by a larger size of body and skull and more massive canines. As bats of the *M. mystacinus* group live almost exclusively north of 40° N in Iberia (Fernandez & Ibañez 1989, Benzal et al. 1991, Ibañez et al. 1992, Agirre-Mendi 2002, Agirre-Mendi et al. 2004), Ibañez (1988) pointed out the isolation of Moroccan populations compared to their continuous European range.

The Moroccan specimen collected at Bekrite (NMP 90031) fits well into the variation range of *M. m. occidentalis* by its skull size (Tab. 1), which is significantly larger than in *M. m. mystacinus*. However, the size of canines lies rather on the lower margin of dimension variation given for *M. m. occidentalis* by Benda & Tsytsulina (2000). (Significant dental measurements of the newly collected specimen are as follows: height of cingulum cusp on P<sup>4</sup> – 0.094 mm; mesio-distal length of upper canine – 0.86 mm; palatolabial width of upper canine – 0.66 mm.) Although the final taxonomic evaluation of the Moroccan population would be feasible only after comparison of a sufficient number of museum specimens, the present data suggest that it fits within the Iberian form, despite the apparent gap in distribution of *M. mystacinus* in the southern parts of the Iberian peninsula.

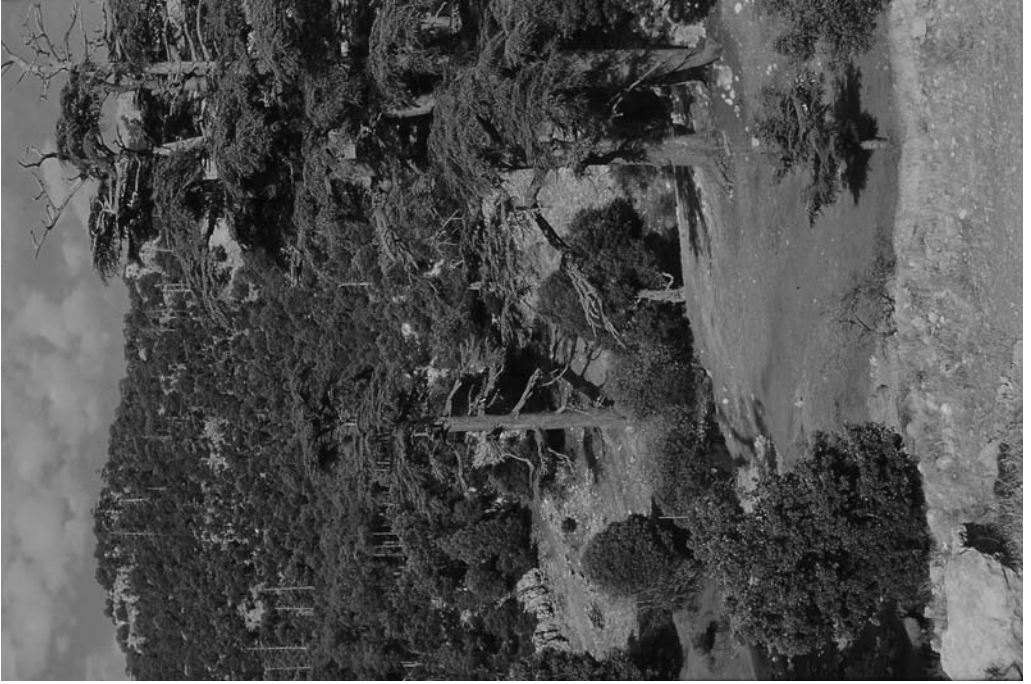
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Fig. 3. Oum er Rbia, 5 km SW of Bekrite, Moyen Atlas Mts., central Morocco, ca. 1780 m a. s. l. Habitat of the Whiskered bat (*Myotis mystacinus*), Isabelline serotine (*Eptesicus isabellinus*), Common pipistrelle (*Pipistrellus pipistrellus*), and Leisler's bat (*Nyctalus leisleri*).  
Obr. 3. Řeka Rbia, asi 5 km jihozápadně od Bekrite, Střední Atlas, střední Maroko, cca 1780 m n. m. Biotop netopýrce vousatého (*Myotis mystacinus*), netopýra tripolitánského (*Eptesicus isabellinus*), netopýra hvízdavého (*Pipistrellus pipistrellus*) a netopýra stromového (*Nyctalus leisleri*).

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Fig. 4. Gorges du Dadès, 5 km NW of Aït-Ali, southern slope of the Haut Atlas Mts., central Morocco, ca. 1690 m a. s. l. Habitat of the Isabelline serotine (*Eptesicus isabellinus*), Savi's pipistrelle (*Hypsugo savii*), and Common pipistrelle (*Pipistrellus pipistrellus*). In similar habitat of the neighbouring parallel Gorges du Todra furthermore the Desert pipistrelle (*Pipistrellus kuhlii deserti*) and European free-tailed bat (*Tadarida teniotis*) were collected.

Obr. 4. Kaňon Dadès, místo asi 5 km severozápadně od Aït-Ali, na jižním svahu Vysokého Atlasu, střední Maroko, cca 1690 m n. m. Biotop netopýra tripolitánského (*Eptesicus isabellinus*), netopýra Saviova (*Hypsugo savii*) a netopýra hvízdavého (*Pipistrellus pipistrellus*). V podobném prostředí vedlejšího souběžného kaňonu Todra byly navíc dokumentovány netopýr pouštní (*Pipistrellus kuhlii deserti*) a morous evropský (*Tadarida teniotis*).





### *Eptesicus isabellinus* (Temminck, 1840)

RECORDS. Tisbalbat, near the reserve of the Oued Dadès (ca. 35 km E of Ouarzazate, 30° 58' N, 6° 40' W), 16 February 1988, skull (*pro parte*) and two mandibles (DB 42) found in a pellet of *Bubo ascalaphus*, leg. D. Barreau & A. Rocher. – Oued Nfiss, between Mzouzite and Idni (30° 55' N, 8° 22' W), 3 October 1989, an adult male netted over the river and released, leg. M. Ruedi. – River bridge ca. 10 km W of Tabouda (ca. 50 km S of Chefchaouen, 34° 45' N, 5° 14' W, ca. 195 m a. s. l.), 26 August 2003, two subadult males and an adult female (NMP 90027 [A], 90028, 90029 [S+A]) netted, leg. P. Benda. – Oum er Rbia, 5 km SW of Bekrite (ca. 40 km S of Azrou, 33° 2' N, 5° 14' W, ca. 1780 m a. s. l.), 28 August 2003, an adult male (NMP 90032 [S+A]) netted, leg. P. Benda. – Oued Tessaoud, 1 km N of Talkount (ca. 70 km E of Marrakech, 31° 41' N, 7° 17' W, ca. 770 m a. s. l.), 30 August 2003, an adult female (NMP 90056 [S+A]) netted, leg. P. Benda. – Gorges du Dadès, 5 km NW of Aït-Ali (ca. 20 km N of Boumalne Dadès, 31° 31' N, 5° 56' W, ca. 1690 m a. s. l.), 2 September 2003, an adult male (NMP 90068 [S+A]) netted, leg. P. Benda. – Oued Za, Cascades Bou Mazouz (ca. 10 km NW of Taourirt, 34° 29' N, 2° 59' W, ca. 290 m a. s. l.), 6 September 2003, an adult female (NMP 90079 [S+A]) netted, leg. P. Benda. – Gorges du Zegzel, ca. 5 km S of Berkane (34° 53' N, 2° 21' W, ca. 226 m a. s. l.), 8 September 2003, one adult and one juvenile males and four adult females (NMP 90087, 90091 [A], 90086, 90088–90090 [S+A]) netted, leg. P. Benda. – Oued el Ammar, 1 km N of Sebts-es-Âit-Serhrouchen (ca. 40 km E of Fès, 34° 2' N, 4° 33' W, ca. 320 m a. s. l.), 9 September 2003, an adult male and an adult female (NMP 90093 [A], 90094 [S+A]) netted, leg. P. Benda.

Although Harrison (1963) suggested conspecific status of the Isabelline serotine, *Eptesicus isabellinus*, with the Common serotine, *Eptesicus serotinus* (Schreber, 1774), we prefer to consider the populations of smaller North African serotines as a separate species, following some older authors (Heim de Balsac 1936, 1948, Panouse 1951, Brosset 1955, 1960, Deleuil & Labbe 1955, etc.). Hence, *E. isabellinus*, is widely distributed in the Maghreb and north-western Tripolitania and it was also found on the Canary Islands (Aellen & Strinati 1969, Hanák & Elgadi 1984, Kowalski & Rzebik-Kowalska 1991, Trujillo 1991).

In Morocco, *E. isabellinus* was reported for the first time by Heim de Balsac (1948) from the lower parts of the Oued Drâa. This record represents currently the most extreme occurrence of this bat in south-western Morocco (Aulagnier & Thévenot 1986a). *E. isabellinus* has been further recorded in the Beni Snassen area (Brosset 1955), in Rabat and in the Oued Nefifik near Casablanca (Dorst & Panouse 1957), and in Figuig (Hill 1964). These primary records outlined the whole currently known distribution range of this species in Morocco, see Aulagnier & Thévenot (1986a). The rather numerous new records of *E. isabellinus* reported here confirm the range of its previously described distribution area.

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Fig. 5. Oued Makhazen ca. 10 km W of Souk-Khémis-des-Beni-Arouss, western Rif Mts., northern Morocco, ca. 150 m a. s. l. Habitat of the Kuhl's bat (*Pipistrellus kuhlii*), Leisler's bat (*Nyctalus leisleri*), and Western barbastelle (*Barbastella barbastellus*).

Obr. 5. Řeka Makhazen, zhruba 10 km západně od Souk-Khémis-des-Beni-Arouss, západ pohoří Rif, severní Maroko, cca 150 m n. m. Biotop netopýra vroubeného (*Pipistrellus kuhlii*), netopýra stromového (*Nyctalus leisleri*) a ďasíka černého (*Barbastella barbastellus*).

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Fig. 6. Oued Drâa Valley, 5 km NW of Anagam, north-western Sahara, southern Morocco, ca. 670 m a. s. l. Habitat of the Desert pipistrelle (*Pipistrellus (kuhlii) deserti*), Rüppell's bat (*Pipistrellus rueppellii*), Hemprich's long-eared bat (*Otonycteris hemprichii*), and Egyptian free-tailed bat (*Tadarida aegyptiaca*).

Obr. 6. Údolí Drâa, 5 km severozápadně od Anagamu, severozápadní Sahara, jižní Maroko, cca 670 m n. m. Biotop netopýra pouštního (*Pipistrellus (kuhlii) deserti*), netopýra Rüppellova (*Pipistrellus rueppellii*), ušana pustinného (*Otonycteris hemprichii*) a morouse jižního (*Tadarida aegyptiaca*).

### ***Hypsugo savii* (Bonaparte, 1837)**

RECORDS. Gorges du Dadès, 5 km NW of Aït-Ali (ca. 20 km N of Boumalne Dadès, 31° 31' N, 5° 56' W, ca. 1690 m a. s. l.), 2 September 2003, an individual netted, leg. P. Benda. – Gorges du Todra, 5 km SW of Tamtattouchte (ca. 30 km N by road of Tinerhir, 31° 39' N, 5° 34' W, ca. 1710 m a. s. l.), 3 September 2003, an adult male (NMP 90070 [S+A]) netted, leg. P. Benda.

The Savi's pipistrelle, *Hypsugo savii*, is notified to be widespread in the Maghreb region, incl. the Canary Islands (Hayman & Hill 1971). At least six sites of its occurrence have been mentioned from the Mediterranean parts of Algeria (Hill 1964, Gaisler 1983, Gaisler & Kowalski 1986) and one record has been reported from northern Tunisia (Vaughan et al. 1977).

In Morocco, *H. savii* was recorded for the first time by Strinati (1953). Nevertheless, the exact origin of his specimens remains uncertain (perhaps the Tanger region). The first definite locality of *H. savii* in Morocco was mentioned by Brosset (1960, 1963) who reported a specimen from the Moyen Atlas Mts. (Boub Ilan = Bou-Iblane, Brosset 1963). Hill (1964) described a third record of *H. savii* in Morocco from Figuig (three females); he also mentioned a collection of two females from the Atlas Mts. (but he did not confirm their Moroccan origin). Most of the other Moroccan records of *H. savii* have also come from the Atlas Mts. Besides one additional record from the Rif Mts., Aulagnier & Thévenot (1986a) reported the observation of *H. savii* made by K. Kowalski in the south-western part of the Haut Atlas Mts. Fonderflick et al. (1998) netted four males of *H. savii* in the Gorges du Todra (central parts of the Haut Atlas Mts.). Finally, Z. Řehák (in Beneš & Hanák 2003) collected two males of this species near Asni (SW Haut Atlas Mts.) and Médard et al. (1997) reported a capture over the Oued Ziz in Errachidia. The currently recorded individuals from two deep rocky canyons in the central parts of the Haut Atlas Mts. confirm the rather common occurrence of *H. savii* in this mountain chain, and also its preference for rocky habitats (Fig. 4).

### ***Pipistrellus pipistrellus* (Schreber, 1774)**

RECORDS. Oukaïmeden (CAF chalet, 31° 12' N, 7° 52' W, ca. 2650 m a. s. l.), 30 June 1988, one dead specimen (DB 46), leg. D. Barreau. – Oum er Rbia, 5 km SW of Bekrite (ca. 40 km S of Azrou, 33° 2' N, 5° 14' W, ca. 1780 m a. s. l.), 28 August 2003, an adult female (NMP 90033 [S+A]) netted, leg. P. Benda. – Gorges du Dadès, 5 km NW of Aït-Ali (ca. 20 km N of Boumalne Dadès, 31° 31' N, 5° 56' W, ca. 1690 m a. s. l.), 2 September 2003, an adult male (NMP 90069 [S+A]) netted, leg. P. Benda. – Gorges du Todra, 5 km SW of Tamtattouchte (ca. 30 km N by road of Tinerhir, 31° 39' N, 5° 34' W, ca. 1710 m a. s. l.), 3 September 2003, two subadult males, three adult females (NMP 90073 [A], 90074–90077 [S+A]) netted, leg. P. Benda.

Pipistrelle bats of the *Pipistrellus pipistrellus* group are distributed only marginally in Africa, solely in the Maghreb and in the Mediterranean part of Cyrenaica, in Libya (Benda et al. 2004b). In the Maghreb, five record sites are known from Algeria (Kowalski & Rzebik-Kowalska 1991) and Vaughan et al. (1977) have reported the only verified records from one site in Tunisia (Jebel Ressay Mts. near Tunis).

In Morocco, the common pipistrelle was initially recorded in the Rif Mts. near Chefchaouen and in the Targlitz Valley (Morales Agacino 1933, 1943). A colony of *P. pipistrellus* was further reported by Brosset (1960, 1963) from near Taforalta in Beni Snassen. Aulagnier & Thévenot (1986a) summarised at least six records in the northern parts of Morocco, including one in the northern margin of the Moyen Atlas Mts. which in that time represented the southernmost Maghrebian record. Surprisingly, two more records of *P. pipistrellus* were reported from the Gorges du Todra in the central parts of the Haut Atlas Mts., ca. 250 km further to the south. Fonderflick et al. (1998) netted one female there, Řehák (in Beneš & Hanák 2003) collected one

male and one female at this site. Romero Zarco (1990) also mentioned an unpublished record from Ourika in the Haut Atlas Mts (Estacion Biologica Doñana, No. 13780; J. Juste, in litt.). Our first record confirmed the occurrence of the species in the western, and highest, part of the chain. Two of the present records were also made in the central parts of the Haut Atlas Mts. and confirmed the permanent existence of an extreme southern population. Another new record of *P. pipistrellus* from the Moyen Atlas Mts. (Bekrite) interconnects the northern and southern patches of its occurrence in Morocco (Figs. 3, 4).

All newly collected bats presented here (except the first one) were included in the taxonomic analyses of African “common” pipistrelle populations, which combined genetic and morphologic approaches (Hulva et al. 2004, Benda et al. 2004b). These studies resolved taxonomic position of these populations within the species complex of *P. pipistrellus* and *P. pygmaeus*. While the Cyrenaican bats have been described as a separate species (Benda et al. 2004b), the Maghrebian populations belong to the *pipistrellus* lineage within the species *P. pipistrellus*. As these populations show some slight meristic and genetic differences compared to the Eurasian ones, their definitive taxonomic status remains open to discussion (Benda et al. 2004b).

### ***Pipistrellus kuhlii* (Kuhl, 1817)**

RECORDS. Oued Makhazen ca. 10 km W of Souk-Khémis-des-Beni-Arouss (ca. 40 km NW of Chefchaouen, 35° 18' N, 5° 42' W, ca. 150 m a. s. l.), 25 August 2003, an adult male (NMP 90024 [S+A]) netted, leg. P. Benda. – River bridge ca. 10 km W of Tabouda (ca. 50 km S of Chefchaouen, 34° 45' N, 5° 14' W, ca. 195 m a. s. l.), 26 August 2003, an adult male (NMP 90030 [S+A]) netted, leg. P. Benda. – A small oasis ca. 5 km NW of Âit-Saoun (ca. 30 km SE of Ouarzazate, 30° 44' N, 6° 39' W, ca. 1475 m a. s. l.), 1 September 2003, two adult females (NMP 90066, 90067 [S+A]) netted, leg. P. Benda. – Oued Isly, Sidi Moussa, 10 km N of Guenfouda (ca. 20 km SSE of Oujda, 34° 33' N, 2° 4' W, ca. 715 m a. s. l.), 7 September 2003, an adult male and three adult females (NMP 90082–90085 [S+A]) netted, leg. P. Benda. – Oued el Ammar, 1 km N of Sebt-es-Âit-Serhrouchen (ca. 40 km E of Fès, 34° 2' N, 4° 33' W, ca. 320 m a. s. l.), 9 September 2003, two adult males and three adult females (NMP 90096, 90097 [A], 90095, 90098, 90099 [S+A]) netted, leg. P. Benda.

The Kuhl's pipistrelle, *Pipistrellus kuhlii*, is a bat species with a mostly Mediterranean type of distribution (cf. Kock 2001). In North Africa, it occurs in the ca. 300 km wide belt along the coast of the Atlantic Ocean and of the Mediterranean Sea. Its range extends from south-western Morocco over the whole Maghreb, northern Libya and Egypt (Hanák & Elgadi 1984, Qumsiyeh 1985, Aulagnier & Thévenot 1986a, Kowalski & RzebiK-Kowalska 1991). In this region, *P. kuhlii* is one of the most widespread species owing to its broad ecological tolerance (cf. Harrison & Bates 1991). It occurs both in the Mediterranean arboreal and in semi-desert habitats of the supra-Saharan parts of Africa. In Morocco, *P. kuhlii* is the second most common bat (Aulagnier & Thévenot 1986a). Our records of this bat confirmed the relatively broad ecological requirements as they have been found in many parts of the country except in true deserts and forested higher mountains.

### ***Pipistrellus (kuhlii) deserti* Thomas, 1902**

RECORDS. Small pool in the Oued Drâa, 5 km NW of Anagam (ca. 30 km SE of Zagora, 30° 11' N, 5° 35' W, ca. 670 m a. s. l.), 31 August 2003, an adult male, a subadult male, and a subadult female (NMP 90058–90060 [S+A]) netted, leg. P. Benda. – Gorges du Todra, 5 km SW of Tamtattouchte (ca. 30 km N by road of Tinerhir, 31° 39' N, 5° 34' W, ca. 1710 m a. s. l.), 3 September 2003, an adult male and a subadult male (NMP 90071, 90072 [S+A]) netted, leg. P. Benda.

COMPARATIVE MATERIAL. *P. deserti*: Algeria (6 specimens): 1 m, 1 f (ISEZ 9589, 9590 [S]), Djanet, 1 March 1981, leg. K. Kowalski & B. RzebiK-Kowalska; – 2 m (BMNH 79.987., 79.988. [S+A]), Hoggar Plateau, 1887 m,

27 February 1979, leg. D. James; – 2 f (ISEZ 9445, MUB A-490 [S+B]), Taghit, 18 July 1983, leg. J. Gaisler, K. Kowalski & B. Rzebiak-Kowalska. – Egypt (16): 1 m, 15 f (IVB 1–16 [S+B]), Luxor, hotel garden, 26–29 April 1969, 1 May 1969, leg. J. Gaisler. – Libya (17): 1 m (NMP 48321 [S+A]), Al-Fjayj, 6 October 1999, leg. P. Benda; – 1 m, 12 f (NMP 48302–48305, 48309–48316, 48318 [S+A]), Gabroon, 2 October 1999, leg. P. Benda; – 1 m (NMP 48320 [S+A]), Germa, 6 October 1999, leg. P. Benda; – 1 m (BMNH 2.11.4.1. [S+B]), holotype of *Pipistrellus deserti* Thomas, 1902), Mursuk (= Murzuq), 3 May 1901, leg. J. I. S. Whitaker; 1 m (NMP 48319 [S+A]), Murzuq, 6 October 1999, leg. P. Benda. – *P. kuhlii*: Algeria (32, all ISEZ specimens leg. K. Kowalski & B. Rzebiak-Kowalska): 1 m (ISEZ 9424 [S+B]), Arba Tahtani, 31 October 1981; – 1 m, 1 f (ISEZ 9421, 9446 [S+B]), Benni Abbès, 16 May 1981, 19 July 1983; – 1 f (ISEZ 9453 [S+B]), Bouira, 14 August 1983; – 2 m, 1 f (ISEZ 9447, 9448, 9450 [S+B]), Brezina, 23–24 July 1983; – 1 m (ZFMK 54.2 [S+B]), Djelfa, 18 July 1950; – 2 f (ISEZ 9438, 9439 [S+B]), Es Senia near Oran, 23 April 1983; – 5 m (ISEZ 9434, 9436, 9437, 9443, 9455 [S+B]), Les Andalouses, 8 October and 5 November 1982, 21 January, 24 June and 9 October 1983; – 1 m, 4 f (ISEZ 9422, 9433, 9440, 9441, 9444 [S+B]), Misserghin, 14 June 1981, 22 June 1982, 13 June and 14 July 1982; – 1 m (ISEZ 9432 [S+B]), Oran, 21 June 1982; – 1 m, 2 f (ISEZ 9430, 9431, 9435 [S+B]), Oued Tlalat, 8 June 1982, 18 October 1982; – 2 f (ISEZ 9428, 9429 [S+B]), Sebdou, 30 April 1982; – 2 m, 1 f (ISEZ 9425–9427 [S+B]), Setif, 16 December 1981; – 1 f (ISEZ 9451 [S+B]), Yakouren, 11 August 1983; – 2 ind. (MNHN 1962-1770a, 1770b [S]), Algeria (undef.). – Croatia (8): 2 f (SMF 23402, 23403 [S+B]), Primošten, 30 km S of Šibenik, 27 September 1964, leg. H. Coffler & K. Walch; – 5 m, 1 f (SMF 23399–23401, 23404, 23405 23407 [S+B]), Zadar, 26, 29 and 30 September 1964, leg. H. Coffler & K. Walch. – Egypt (5): 2 m (IVB 2, 3 [S+B]), Abu Rawash, 19 April 1969, leg. J. Gaisler; – 1 ind. (SMF 22014 [S+A]), betw. Cairo and Ismailia, 5 September 1962, leg. R. Rau; – 1 m (IVB 4 [S+B]), Burgh el Arab, 14 May 1969, leg. J. Gaisler; – 1 m (SMF 26114 [S+A]), Bahig, Western Desert, 16 August 1965, leg. Linsenmair & Kiepenhauer. – France (6): 1 m (MHNG 1882.050 [S+A]), Ain, Seyssel, 26 August 2003, leg. N. Chardonness; – 1 m (MNHN 1997-313 [S]), Camargue, leg. H. Heim de Balsac; – 1 m, 1 f (MNHN 1980-453, 1980-454 [S]), Digne, 8 September 1908, leg. C. Mottaz; – 1 ind. (MHNG 1255.32 [S+A]), Chambord, Pavillon de Monfrault, June 1943, leg. F. Chanudet; – 1 m (MNHN 1985-1977 [S]), Thaars, July 1951, leg. D. Senes. – Greece (32): 1 f (NMP 49022 [S+A]), Artiki, 25 August 2001, leg. P. Benda; – 1 m, 1 f (NMP 48703, 48704 [S+B]), Asproklisi, 1 July 1989, leg. V. Hanák & V. Vohralík; – 1 f (SMF 28220 [S+B]), Kourna Lake n. Mouri, Crete, 15 April 1958, leg. H. Kahmann; – 4 f (ZFMK 62.59–62.62 [S+B]), Mesologgi, 3 April 1962, leg. O. von Helversen; – 2 f (NMP 48705, 48706 [S+B]), Mesopotamo, 2 July 1989, leg. V. Hanák & V. Vohralík; – 1 m (NMP 48555 [S+B]), Ormylia, 14 September 1988, leg. V. Hanák & V. Vohralík; – 1 m, 1 f (NMP 48561, 48562 [S+B]), Paralia Skotinas, 19 September 1988, leg. V. Hanák & V. Vohralík; – 1 m (ZFMK 59.429 [S+B]), Perivolo bei Patras, 21 May 1959, leg. Buchholz & Forst; – 3 f (NMP 49013–49015 [S+A]), Simopoulo, 23 August 2001, leg. P. Benda; – 1 m, 6 f (SMF 45213–45219 [S+B]), Skiathos, N Sporades, 16, 18 and 21 October 1973, leg. D. Kock & G. Storch; – 1 m, 4 f (NMP 48733–48737 [S+A]), Spárti, 16 September 1996, leg. P. Benda & M. Uhrin; – 2 m, 1 f (SMF 26791, 26793–26795 [S+B]), Tegea, 16 August 1960, leg. H. Kahmann. – Italy (17): 1 m (SMF 16989 [S+B]), Favignana (Trapani), Aegedic Isl., 17 May 1955, leg. K. Klemmer & H. Krampitz; – 4 m, 1 f (MHNG 1716.87 [S]), SMF 50430–50433 [S+A]), Florence, 2 May 1911 and 6 May 1976, leg. K. Walch; – 3 m, 6 f (SMF 16992–17000, 17014 [S+A]), Linguaglossa, Sicily, 9 and 11 July 1955, leg. K. Klemmer & H. Krampitz; – 1 m (SMF 35536 [S+A]), Sicily, Palermo. – Libya (15, all NMP specimens collected in May 2002 leg. M. Andreas, P. Benda, V. Hanák, A. Reiter & M. Uhrin): 1 m (NMP 49843 [S+A]), Al Jawsh, 7 May 2002; – 1 f (NMP 48332 [S+A]), 20 km N of Al Qusbat, 11 October 1999, leg. P. Benda; – 1 m (NMP 49893 [S+A]), Wadi Al Kuf, 5 km SW Al Bayda, 19 May 2002; – 1 f (NMP 48326 [S+A]), Al Aquriyah (Tokra), 9 October 1999, leg. P. Benda; – 2 m, 2 f (NMP 49933, 49934, 49936, 49937 [S+A]), Al Rajmah, 23 May 2002; – 2 m, 4 f (NMP 49953–49955, 49958–49960 [S+A]), Ar Sharshara, 27 May 2002; – 1 f (NMP 49939 [S+A]), Jalu, 24 May 2002; – 3 m, 3 f (NMP 49968–49970, 49972–49974 [S+A]), Nanatalah, 28 May 2002; – 1 m (NMP 48322 [S+A]), Sabkhat Karkurah, 8 October 1999, leg. P. Benda; – 3 m (NMP 49981–49983 [S+A]), Sabratalah, 28 May 2002; – 1 m, 1 f (NMP 49921, 49923 [S+A]), Sidi Mohammad Al Mablehut, 22 May 2002; – 3 m, 6 f (NMP 49845–49851, 49853, 49859 [S+A]), Sinawan, 8 May 2002; – 2 f (NMP 49930, 49931 [S+A]), Tolmeita, 22 May 2002; – 1 m (MHNG 987.14 [S]), Tripoli, 1918, leg. Taubert; – 2 m (NMP 49917, 49918 [S+A]), estuary of the Wadi Al Kuf, 20 May 2002. – Morocco (15, incl. the presented above ones): 3 m, 1 f (SMF 47747–47780 [S+B]), Dekeira near Inezgane, Oued Sous, 31 January 1975, leg. M. Dachsel; – 1 f (ZFMK



97.177 [S+B]), Tizin-Test Pass, 11 September 1969, leg. G. Rheinwald. – Spain (14): 3 m, 3 f, 1 ind. (ZFMK 34.119–34.125 [S+B]), Langunilla, Bejar Salamanca, 1–4 June 1934, leg. H. Grünig; – 1 m, 6 f (SMF 18690–18705 [S+A]), Nava de San Pedro, Sierra de Cazorla, 14 May 1959, leg. K. Klemmer. – Switzerland (13): 3 m, 3 f (MHNG 898.38 [S]), 1826.026, 1826.027, 1828.068, 1869.032, 1882.052 [S+A]), Genève, 22 September 1951, 1 and 7 September 2001, 24 May 2002, 1 March 2003, 15 July 2003, leg. de Giorgi and others; – 1 f (MHNG 1828.067 [S+A]), Chêne-Bourg (Genève), 19 December 2001; – 1 m (MHNG 1813.034 [S+A]), Plan-les-Ouates (Genève), 7 September 2000, leg. A. Keller; – 1 f (MHNG 1807.028 [S+A]), Veyrier (Genève), 21 August 2000, leg. M. Ruedi; – 1 m (MHNG 1868.076 [S+A]), Châteauneuf (Valais), 29 June 2001, leg. R. Arlettaz; – 3 m (MHNG 1806.038 [S+A], 1868.073 [S], 1868.075 [S+A]), Sion (Valais), 10 August 1990, 7 April and 3 August 1999, leg. R. Arlettaz. – Syria (31): 2 m, 2 f (NMP 48844–48847 [S+A]), Al Tawani, Anti-Libanon Mts., 21 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 m (SMF 60364 [S+A]), Qala'at Al Moudik (= Apamea), 25 March 1980, leg. R. Kinzelbach; – 3 m, 3 f (NMP 48903–48908 [S+A]), Baniyas, 31 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 m (MNHN 1983-1500 [S+B]), NE-Damas, leg. H. Gadeau de Kerville; – 1 m (NMP 49988 [S+A]), Qala'at al Hosn, 10 May 2001, leg. R. Lučan; – 3 m (NMP 48767–48769 [S+A]), Qala'at Ja'abar, 12 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 2 f (NMP 48889, 48890 [S+A]), Qantara, 30 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 m (NMP 48891 [S+A]), Qasr ibn Wardan, 31 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 2 m, 1 f (NMP 48929–48931 [S+A]), Qatura, 2 June 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 m, 1 f (NMP 48947, 49987 [S+A]), Ras al Bassit, 29 April 2001, 3 June 2001, leg. M. Andreas, P. Benda, R. Lučan, A. Reiter & D. Weinfurtová; – 2 m, 2 f (NMP 48884–48887 [S+A]), Safita, 29 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 3 f (NMP 48862–48864 [S+A]), Talsh'hab, 25 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová. – Tunisia (17): 2 m, 2 f (ZFMK 59.269–59.271 [S+B]), SMF 19551 [S+B]), Carthago, 14 March 1959, 6 March 1961, leg. H. Roer & K. Walch; – 1 m, 2 f (SMF 83440–83442 [S+B]), Douz, Nefzaoua, 29 and 30 April 1994, leg. D. Kock & C. Winter; – 1 f (ZFMK 97.169 [S+B]), El Haouaria, 19 March 1957, leg. J. Niethammer; – 1 m, 1 ind. (MHNG 921.16, ZFMK 97.174 [S]), Gabès, 1922, leg. Sicard, 1956, leg. M. Costan; – 1 m (MHNG 1684.56 [S]), 100 km S Gabès, 1984, leg. P. Gaucher & A. Brosset; – 1 m, 1 f (SMF 41617, 41618 [S+A]), Galita Archipelago, Ile de la Galite, 29 August 1971, leg. K. Schuberth, I. Vesmanis & F. Charousset; – 3 m (SMF 41619–41621 [S+A]), Kebili, 18 March 1971, leg. K. Schuberth, I. Vesmanis & P. Nagel; – 1 ind. (MNHN 1995-1702 [S+B]), Tunisia (undef.). – Turkey (14): 1 f (SMF 36754 [S+A]), Alanya, Incekum, 24 May 1966, leg. H. Felten et al.; – 5 m, 5 f (SMF 42352–42358, 42361–42363 [S+A]), Alişam, 17 and 25–27 September 1971, leg. D. Kock, F. Malec & G. Storch; – 1 ind. (ZFMK 85.87 [S+B]), Birecik, 28 March 1973, leg. U. Hirsch; – 1 m, 1 f (ZFMK 68.244, 68.245 [S+B]), Ceylanpinar, 18 May 1968, leg. H. Mittendorf.

The Desert pipistrelle, *Pipistrellus deserti*, is predominantly a Saharan species (Hayman & Hill 1971, Horáček et al. 2000), although some records have been described also from sub-Saharan Africa (Koopman et al. 1978, Decher et al. 1997). This species has been reported mainly from two regions of the most arid parts of the central Sahara. The first area of occurrence includes south-eastern Algeria and south-western Libya (Thomas 1902, Heim de Balsac 1934, Qumsiyeh 1985, Hill & Harrison 1987, Kowalski & Rzebik-Kowalska 1991, own unpubl. data), the second group of record sites lies along the Nile in Upper Egypt and northern Sudan (Kock 1969, Gaisler et al. 1972, Qumsiyeh 1985).

However, *P. deserti* was also recorded in the north-western part of the Sahara, in Algeria close to the Moroccan territory, viz., Beni Abbès (Qumsiyeh 1985) and Taghit (Gaisler & Kowalski 1986). Our findings of *P. deserti* in Morocco come from the north-western extent of desert habitats of the Sahara (Oued Drâa, Fig. 6) as well as from southern slopes of the Haut Atlas Mts. (Gorges du Todra, which continues to the Oued Drâa). These localities lie close to the above mentioned Algerian record sites of this bat.

The identification of the respective individuals as of *P. deserti* is undoubted, being based on a very simple determination criterion – the skull size (Tab. 2). Thomas (1902) described *P. deserti*

Tab. 2. Forearm and skull measurements of Kuhl's pipistrelles (*Pipistrellus kuhlii*) from the Mediterranean and Desert pipistrelles (*Pipistrellus (k.) deserti*) from the Saharan countries (Egypt, Libya, Algeria). For the data on Moroccan specimens of *P. (k.) deserti* see Tab. 1, for measurement abbreviations see Appendix  
 Tab. 2. Rozměry předloktí a lebky netopýrů vroubených (*Pipistrellus kuhlii*) ze Středomoří a netopýrů pouštních (*Pipistrellus (k.) deserti*) ze saharských zemí (Egypt, Libye, Alžírsko). Pro údaje marockých jedinců netopýra pouštního viz tab. 1, zkratky rozměrů jsou vysvětleny v appendixu

	<i>P. kuhlii</i> (North Africa)				<i>P. kuhlii</i> (Europe, Middle East)				<i>P. (k.) deserti</i> (Sahara)			
	n	M	min	max	n	M	min	max	n	M	min	max
LA <sub>t</sub>	103	33.71	31.00	36.40	137	34.17	27.80	36.50	35	31.33	29.40	33.30
LC <sub>r</sub>	110	13.10	12.52	13.84	147	13.24	12.52	13.92	38	11.87	11.47	12.24
LC <sub>b</sub>	109	12.70	12.13	13.43	147	12.81	11.87	13.55	38	11.42	11.03	11.77
La <sub>Z</sub>	85	8.59	8.07	9.27	115	8.58	7.49	9.24	26	7.83	7.49	8.32
La <sub>l</sub>	110	3.27	2.97	3.55	151	3.25	2.98	3.57	39	3.03	2.74	3.33
La <sub>N</sub>	110	6.47	6.12	6.92	151	6.57	6.20	6.95	38	6.10	5.73	6.34
AN <sub>c</sub>	108	4.70	4.32	5.24	148	4.73	4.13	5.08	38	4.35	4.05	4.64
CC	108	4.22	3.76	4.65	148	4.25	3.72	4.61	38	3.69	3.53	3.86
M <sup>3</sup> M <sup>3</sup>	111	5.66	4.95	6.18	148	5.63	4.95	5.99	38	5.05	4.75	5.38
CM <sup>3</sup>	111	4.88	4.51	5.27	151	4.97	4.42	5.23	39	4.33	3.94	4.56
LM <sub>d</sub>	109	9.53	8.88	10.18	148	9.63	8.61	10.27	36	8.52	8.12	9.05
AC <sub>o</sub>	109	3.05	2.67	3.39	148	3.02	2.53	3.37	37	2.69	2.38	3.01
CM <sub>3</sub>	110	5.24	4.91	5.63	150	5.35	4.68	5.72	39	4.63	4.37	4.83

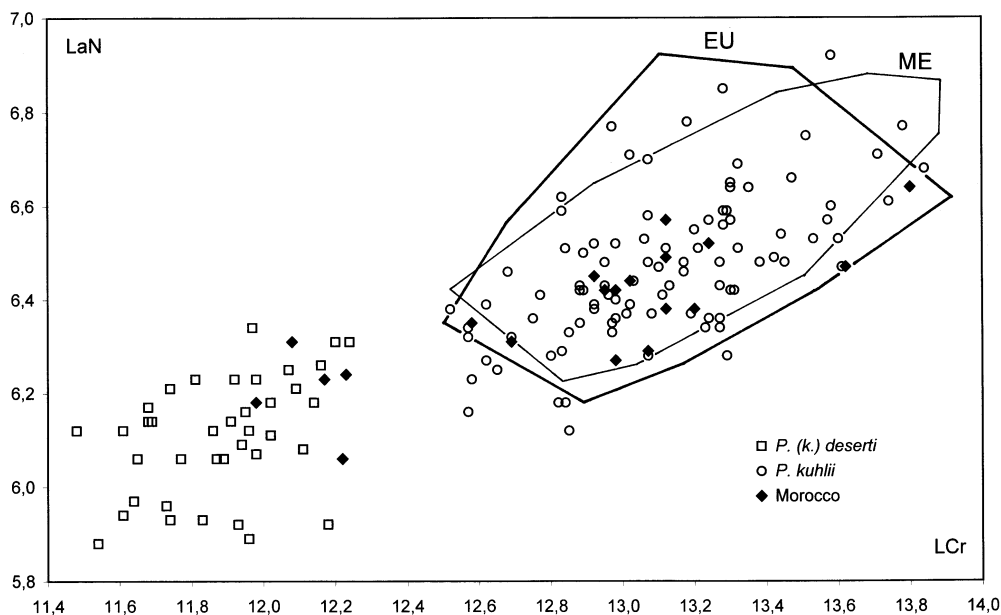


Fig. 7. Bivariate plot of skull dimensions of the Desert pipistrelle (*Pipistrellus (k.) deserti*) and Kuhl's pipistrelle (*P. kuhlii*): greatest length of skull (LCr) against braincase width (LaN). Symbols stand for African specimens, polygons stand for the comparative non-African samples of *P. kuhlii*: EU – Europe, ME – Middle East.

Obr. 7. Srovnání lebečních rozměrů netopýra pouštního (*Pipistrellus (k.) deserti*) a netopýra vroubeného (*P. kuhlii*): největší délka lebeční (LCr) proti šířce mozkovny (LaN). Symboly ukazují africké jedince, polygony srovnávací neafrické populace *P. kuhlii*: EU – Evropa, ME – Blízký východ.

as “a small [...] ally of *P. kuhlii*” and other than size characters well useful for differentiation of these two forms were never observed (Gaisler et al. 1972, Qumsiyeh 1985, Kowalski & Rzebik-Kowalska 1991). All the examined comparative specimens of *P. deserti* from the Sahara (Egypt, Algeria and Libya, incl. the holotype specimen) are very small, the upper margin of variation range of their greatest length of skull (LCr) does not reach above 12.3 mm, while all comparative samples of *P. kuhlii* from North Africa, Europe and the Middle East are much larger, the lower margin of variation range of their LCr does not reach below 12.5 mm (Fig. 7). The examined Moroccan specimens of *P. kuhlii*-like bats fall into both clusters, thus *P. deserti* was confirmed among Moroccan bats.

Although most authors have considered *P. deserti* as a separate species (e.g., Heim de Balsac 1934, 1936, Allen 1939, Ellerman & Morisson-Scott 1951, Kock 1969, 1999, Hayman & Hill 1971, Gaisler et al. 1972, Koopman 1975, 1993, 1994, Anciaux de Faveaux 1976, Hanák & Elgadi 1984, Qumsiyeh 1985, Gaisler & Kowalski 1986, Hill & Harrison 1987, Le Berre 1990, Kowalski & Rzebik-Kowalska 1991, Horáček et al. 2000, etc.), others (Corbet 1978, Aulagnier & Thévenot 1986a, Pavlinov et al. 1995, perhaps Rode 1947) doubted the full species status and regarded it as conspecific with *P. kuhlii*. However, *P. deserti* and *P. kuhlii* are two separate morphotypes which differ clearly in size (Gaisler et al. 1972, Kowalski & Rzebik-Kowalska 1991, see above). As these forms do not occur in sympatry (but see Kowalski & Rzebik-Kowalska 1991), they may perhaps represent two ecogeographic forms of one species. However, this question requires profound revision of the whole *P. kuhlii* complex both on morphologic and genetic bases (see Kock 2001). Therefore, here we keep this problem open and name this form tentatively *P. (kuhlii) deserti*.

### ***Pipistrellus rueppellii* (Fischer, 1829)**

RECORDS. Oued Ziz, ca. 1 km S of Aoufouss (31° 41' N, 4° 11' W), 11 October 1989, an adult male netted and released, leg. M. Ruedi. – Small pool in the Oued Drâa, 5 km NW of Anagam (ca. 30 km SE of Zagora, 30° 11' N, 5° 35' W, ca. 670 m a. s. l.), 31 August 2003, an adult female (NMP 90057 [S+A]) netted, leg. P. Benda. – Oued Za, Cascades Bou Mazouz (ca. 10 km NW of Taourirt, 34° 29' N, 2° 59' W, ca. 290 m a. s. l.), 6 September 2003, an adult male and a subadult male (NMP 90080, 90081 [S+A]) netted, leg. P. Benda.

The Rüppell's bat, *Pipistrellus rueppellii*, is a species of mainly Afrotropical type of distribution. It does not occur in the Sahara *per se*, but it reaches the supra-Saharan regions in its margins, including the western Maghreb, the Nile Valley and the Middle East (Hayman & Hill 1971, Benda et al. 2004a). In north-western Africa, *P. rueppellii* was found once in Mauritania (Qumsiyeh & Schlitter 1981), and twice in Morocco and in Algeria (Arletta & Aulagnier 1988).

The known records of *P. rueppellii* in the Maghrebian countries cover a restricted area of semi-deserts to the south of the Atlas Mts. In Algeria, two records have been made in the Hamada du Guir, at Beni Abbès and Abadla (Hayman & Hill 1971, Gaisler & Kowalski 1986). In Morocco, this bat was found in Fom Zguid and in Aoufouss, Tafilalt (Aulagnier & Thévenot 1986a, Arletta & Aulagnier 1988).

The present findings represent three more records of *P. rueppellii* in Morocco (Fig. 2). Two of these findings (Tafilalt, Oued Drâa) come from the same region of Morocco like the previous ones (Fig. 6). But more surprisingly, the last record was made in north-western Morocco (Cascades Bou Mazouz), in the region of mostly Mediterranean vegetation and of coastal climate. This surprising occurrence of *P. rueppellii*, which is generally considered a semi-desert species, is unique among other similarly distributed bats (e.g., *Rhinopoma* sp., *Taphozous nudiventris*, *Asellia tridens*, *Otonycteris hemprichii*, *Tadarida aegyptiaca*; see Aulagnier & Thévenot 1986a,

Denys et al. 1995, Aulagnier & Denys 2000, present data). However, this area of the lower part of the Moulouya Valley seems to be rather an extreme extent of semi-desert habitats which are mixed with Mediterranean habitats. This view is supported by data on several desert and/or semi-desert species of rodents and of a small carnivore (according to Aulagnier & Thévenot 1986a): *Pachyuromys duprasi* Lataste, 1880, *Psammomys obesus* Cretzschmar, 1828, *Meriones libycus* Lichtenstein, 1823, *Ctenodactylus gundi* (Rothmann, 1776) and *Poeciliictis libyca* (Hemprich et Ehrenberg, 1833). Like *P. rueppellii*, these mammal species are distributed in semi-deserts to the south-east of the Atlas Mts. but their range stretches up to the Mediterranean coast through the arid High Plateaus of eastern Morocco.

### *Nyctalus leisleri* (Kuhl, 1817)

RECORDS. Oued Makhazen ca. 10 km W of Souk-Khémis-des-Beni-Arouss (ca. 40 km NW of Chefchaouen, 35° 18' N, 5° 42' W, ca. 150 m a. s. l.), 25 August 2003, a subadult female (NMP 90026 [S+A]) netted, leg. P. Benda. – Oum er Rbia, 5 km SW of Bekrite (ca. 40 km S of Azrou, 33° 2' N, 5° 14' W, ca. 1780 m a. s. l.), 28 August 2003, a subadult male (NMP 90034 [S+A]) netted, leg. P. Benda. – Oued el Ammar, 1 km N of Sebt-es-Âit-Serhrouchèn (ca. 40 km E of Fès, 34° 2' N, 4° 33' W, ca. 320 m a. s. l.), 9 September 2003, an adult male and two adult females (NMP 90100–90102 [S+A]) netted, leg. P. Benda.

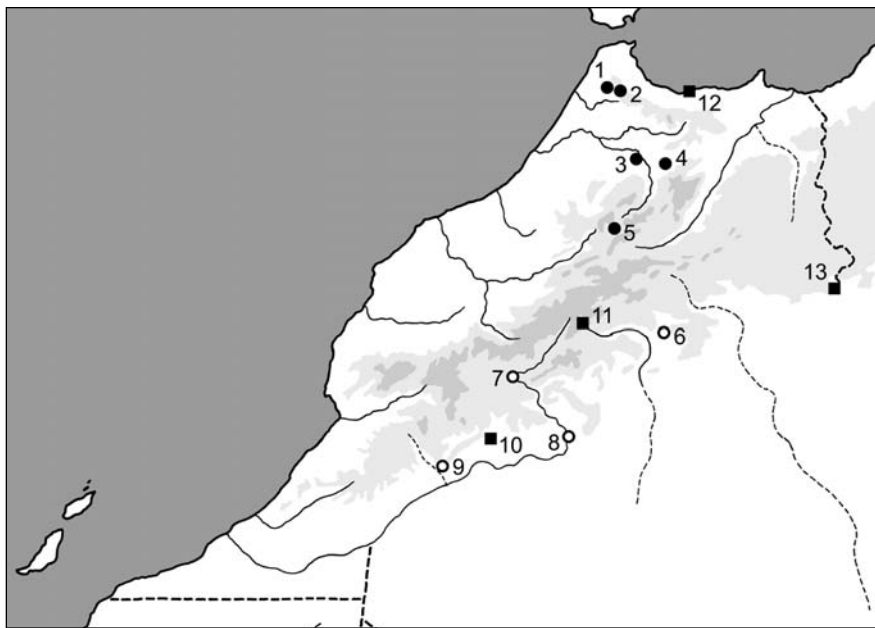


Fig. 8. Records of the Leisler's bat (*Nyctalus leisleri*) (closed circles), Hemprich's long-eared bat (*Otonycteris hemprichii*) (open circles) and European free-tailed bat (*Tadarida teniotis*) (squares) in Morocco.  
 Obr. 8. Nálezny netopýra stromového (*Nyctalus leisleri*) (plné kroužky), ušana pustinného (*Otonycteris hemprichii*) (prázdné kroužky) a morouse evropského (*Tadarida teniotis*) (čtverce) v Maroku.  
 Sites / lokality: 1 – Souk-Khémis-des-Beni-Arouss, 2 – Jbel Buhasen, 3 – Fès, 4 – Sebt-es-Âit-Serhrouchèn, 5 – Bekrite, 6 – Tafilalt, 7 – Ouarzazate, 8 – Anagam, 9 – Tazart, 10 – Foum Zguig, 11 – Gorges du Todra, 12 – coastal cliff of the Rif Mts., 13 – Figuig.

The Leisler's bat, *Nyctalus leisleri* was recorded in Africa for the first time by Hanák & Gaisler (1983); they found it in north-eastern Algeria (E of Tizi Ouzou) and in northern Cyrenaica, Libya (SE of Al Bayda). These two localities remain the only known sites of occurrence of this species in these countries. *N. leisleri* was reported in Morocco only by Ibañez (1988). He found a colony of this bat in a eucalyptus tree near Fès but also netted 29 individuals above a stream near Jbel Buhasen (Rif Mts.). At the same time, Trujillo et al. (1988) discovered *N. leisleri* on the Canary Islands. Newly recorded individuals of *N. leisleri* from northern Morocco have significantly increased the known findings of the species in that country (Fig. 8). The record from the Moyen Atlas Mts. (Bekrite) represents the southernmost locality of *N. leisleri* in the Maghreb and also the most continental site of its occurrence in Africa (Figs. 3, 5). At present, five localities are known from Morocco, i.e. the highest number for all African countries.

Thus, *N. leisleri* seems to be the most common *Nyctalus* species in Africa. There are at least seven known record sites of this species (see above), while *N. lasiopterus* (Schreber, 1780) has been recorded five times in North Africa (Palmeirim 1982, Qumsiyeh & Schlitter 1982, Spitzenberger 1982, Ibañez 1988) and only one unconfirmed record of *N. noctula* (Schreber, 1774) has been reported from Algeria (Kowalski & RzebiK-Kowalska 1991). This relative abundance of *Nyctalus* species is in accordance with the data known from some parts of southern Europe – Iberia (Benzal et al. 1991, Ibañez et al. 1992) or Greece (Hanák et al. 2001) and give credit to the hypothesis that the usual predominance of *N. noctula* in temperate Europe is replaced by a pair of species (*N. leisleri* and *N. lasiopterus*) in the western and central parts of the true Mediterranean, including North Africa (see Hanák et al. 2001). However, this pattern does not hold in the Middle East where only *N. noctula* is distributed to the south of Anatolia (Spitzenberger 1979, Mendelsohn & Yom-Tov 1999, Benda et al. in press) whereas *N. leisleri* and *N. lasiopterus* live only in the northern and western parts of Turkey (Benda & Horáček 1998).

### ***Otonycteris hemprichii* Peters, 1859**

RECORDS. Tazart, 10 km S of Tata (29° 41' N, 7° 57' W), 1988, skull and two mandibles (DB 39) found in a pellet of *Bubo ascalaphus*, leg. D. Barreau. – Small pool in the Oued Drâa, 5 km NW of Anagam (ca. 30 km SE of Zagora, 30° 11' N, 5° 35' W, ca. 670 m a. s. l.), 31 August 2003, one adult male, one adult female, two subadult females (NMP 90061–90064 [S+A]) netted, leg. P. Benda.

The Hemprich's long-eared bat, *Otonycteris hemprichii*, is a Saharo-Sindian faunal element (Ghairabeh & Qumsiyeh 1995). In Africa, its distribution is restricted to the Sahara (Horáček 1991). This bat was reported from all countries of the northern Sahara (Hayman & Hill 1971, Fairon 1980, Horáček 1991). According to the present records of *O. hemprichii*, the border of its distribution range in the Maghreb lies in the Saharan Atlas Mts. and the Anti-Atlas Mts. (Aulagnier & Thévenot 1986a, Kowalski & RzebiK-Kowalska 1991).

Four records of *O. hemprichii* have been published from Tunisia (Deleuil 1957, Fain 1959, Beaucournu et al. 1983, Nader & Kock 1983) and at least six sites of its occurrence are known from Algeria (Gaisler & Kowalski 1986, Kowalski & RzebiK-Kowalska 1991). The records come from both the central and northern Algerian Sahara.

Until now, *O. hemprichii* has been documented only twice from Morocco, both records were represented by bone remnants found in pellets of *Bubo ascalaphus* (Aulagnier 1989). For the first time, it was reported by Aulagnier & Mein (1985) from near Ouarzazate (Fig. 8). The second record was mentioned by Aulagnier & Thévenot (1986a) from the northern parts of the Tafilalt region. Our first record extends westward the distribution area of the species. The live individuals of *O. hemprichii* caught in the Oued Drâa near Anagam represent the first

confirmation of the actual distribution of this species in Morocco. This finding indicates the true habitat of this species in Morocco (Fig. 6) as the previous ones can be potentially shifted due to movements of the owl.

***Barbastella barbastellus* (Schreber, 1774)**

RECORD. Oued Makhazen ca. 10 km W of Souk-Khémis-des-Beni-Arouss (ca. 40 km NW of Chefchaouen, 35° 18' N, 5° 42' W, ca. 150 m a. s. l.), 25 August 2003, an adult male (NMP 90025 [S+A]) netted, leg. P. Benda.

The Western barbastelle, *Barbastella barbastellus*, is a rather boreal species, which is distributed in Africa only in Morocco and on the Canary Islands (Hayman & Hill 1971, Ibañez & Fernández 1985, Rydell & Bogdanowicz 1997), the occurrence in Senegal mentioned by Rochebrune (1883) is considered apparently doubtful (Grubb & Ansell 1996).

For the first time, *B. barbastellus* was reported from Morocco by Panouse (1955). He mentioned a record from Jbel Tarhmarite, Col du Zad, Moyen Atlas Mts. (Fig. 1). The second finding of this bat was mentioned by Ibañez (1988) who netted it above a stream in Jbel Tissouka near Chefchaouen. Fonderflick et al. (1998) reported the third record of *B. barbastellus* in Morocco from the Gorges du Todra, in the central parts of the Haut Atlas Mts. This finding confirmed that the fauna of the Haut Atlas Mts. belongs to the Mediterranean Arboreal region, like the present record of *M. mystacinus* (see above). Two additional records of *B. barbastellus* in Morocco mentioned by Trujillo et al. (2002) and Juste et al. (2003) originated from Azrou (Moyen Atlas Mts.) and Tetouan (Rif Mts.).

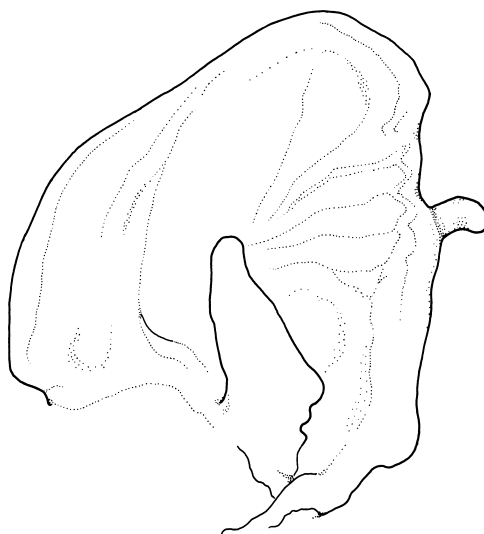


Fig. 9. Left ear of the Western barbastelle (*Barbastella barbastellus*; NMP 90025) from near Souk-Khémis-des-Beni-Arouss; note the shape of ear outer margin lobe.  
Obr. 9. Levý ušní boltec ďasika černého (*Barbastella barbastellus*; NMP 90025) odchyceného nedaleko Souk-Khémis-des-Beni-Arouss; netradiční je tvar lalůčku na vnějším okraji ušního bolce.

The newly recorded specimen from the westernmost margin of the Rif Mts. (Fig. 5) represents the sixth record of *B. barbastellus* in Morocco and also on the African continent. In this specimen, the ear lobe which is considered an important character in barbastelles, is of the true *B. barbastellus* type (type 2 *sensu* Hackethal et al. 1988; Fig. 9), however, it is not of the typical shape (it is rather long and comparatively narrow).

#### ***Plecotus teneriffae* Barret-Hamilton, 1907**

RECORDS. Marrakech palm-grove (31° 40' N, 8° 5' W), 10 November 1987, one dead specimen (DB 30) found in a rhattara, leg. D. Barreau & A. Rocher. – Tisbalbat, near the reserve of the Oued Dadès (ca. 35 km E of Ouarzazate, 30° 58' N, 6° 40' W), 19 January 1988, two mandibles and several bones (DB 41) found in a pellet of *Bubo ascalaphus*, leg. D. Barreau. – Kef Azigza, near Tazougerte (ca. 20 km N of Boudenib, 32° 5' N, 3° 47' W), 13 October 1989, an adult male and three adult females were netted and released, leg. M. Ruedi.

The Mediterranean long-eared bat, *Plecotus teneriffae* s. l., is distributed mainly in the Mediterranean of North Africa, the Canary Islands, the Balkans and of the southern Asia Minor (Juste et al. 2004, Benda et al. 2004c). In the Maghreb, it is the only occurring species of the genus *Plecotus*, belonging to separate subspecies *P. t. gaisleri* Benda, Kiefer, Hanák et Veith, 2004. In this region, this bat ranks among rather common species (Aellen & Strinati 1969, Aulagnier & Thévenot 1986a, Kowalski & Rzebik-Kowalska 1991).

*P. teneriffae* is widely distributed in the whole Mediterranean biotic zone of Morocco (Aulagnier & Thévenot 1986a), but has been variably attributed to *P. auritus* or to *P. austriacus* (see Benda et al. 2004c for details). In the Kef Azigza, where one of the present records come from, this bat was previously recorded (Aulagnier & Destre 1985). We observed several harems of these long-eared bats hanging on the walls of the cave, indicating that they reproduce in this area. All three presented records of *P. teneriffae* come from near the southern border of the distribution range of the species in the Maghreb.

#### ***Miniopterus schreibersii* (Kuhl, 1817)**

RECORDS. Kef Azigza, near Tazougerte (ca. 20 km N of Boudenib, 32° 5' N, 3° 47' W), 13 October 1989, 80 males and 56 females netted and released, leg. M. Ruedi. – Oued Tessaoud, 1 km N Talkount (ca. 70 km E of Marrakech, 31° 41' N, 7° 17' W, ca. 770 m a. s. l.), 30 August 2003, a colony of ca. 200 ind. observed in an irrigation canal, three adult and three subadult males and three adult and one subadult females (NMP 90047, 90048, 90053 [A], 90046, 90049–90052, 90054, 90055 [S+A]) collected, leg. P. Benda. – Oued el Ammar, 1 km N of Sebt-es-Âit-Serhrouhèn (ca. 40 km E of Fès, 34° 2' N, 4° 33' W, ca. 320 m a. s. l.), 9 September 2003, a subadult female (NMP 90103 [S+A]) netted, leg. P. Benda.

In Africa, the Schreibers' bat, *Miniopterus schreibersii* (*sensu* Maeda 1982 and Appleton et al. 2004) is distributed in the Maghreb, Tripolitania and Cyrenaica (Hayman & Hill 1971, Qumsiyeh & Schlitter 1982, Hanák & Elgadi 1984). This species is one of the most common bats in all Maghrebian countries (Aellen & Strinati 1969, Aulagnier & Thévenot 1986a, Kowalski & Rzebik-Kowalska 1991). *M. schreibersii* occurs throughout the Mediterranean biotic zone of Morocco, down to the southern slope of the Haut Atlas Mts. (Aulagnier & Thévenot 1986a); the present records lie in its known distribution range.

#### ***Tadarida teniotis* (Rafinesque, 1814)**

RECORD. Gorges du Todra, 5 km SW of Tamtattouchte (ca. 30 km N by road of Tinerhir, 31° 39' N, 5° 34' W, ca. 1710 m a. s. l.), 3 September 2003, a subadult male (NMP 90078 [S+A]) netted, leg. P. Benda.

In Africa, the European free-tailed bat, *Tadarida teniotis*, occurs only in the northernmost parts of the continent (Aellen 1966, Kock & Nader 1984) and on the Canary Islands (Hutterer 1989). This bat is known from several records in the Cairo region of Lower Egypt (Qumsiyeh 1985) and in one site in the Mediterranean Cyrenaica, Libya (Qumsiyeh & Schlitter 1982). *T. teniotis* has been found twice in Tunisia (Beaucournu et al. 1983, Kock & Nader 1984) and at least four records of this species come from Algeria\* (Gervais 1854, Kock & Nader 1984, Gaisler & Kowalski 1986).

In Morocco, *T. teniotis* has been recorded only three times, but in different parts of the country (Fig. 8). Hill (1964) reported three males and one female of this species from Figuig, SE Morocco. Aulagnier & Thévenot (1986a) reported the occurrence of a small colony in a coastal cliff of the Rif Mts. A male specimen of *T. teniotis* from Foug Zguid, Anti-Atlas Mts., is deposited in the Smithsonian Institution (Aulagnier & Thévenot 1986a, Kock 1987).

The newly recorded individual of *T. teniotis* in Morocco represents the fourth record for the country and the first record in the Haut Atlas Mts. The fact that it is found so rarely is fairly surprising since the high rocky walls of deep canyons in many parts of this mountain massif seem to be optimal habitats for this species (cf. Fig. 4). An ultrasound survey in such environments of Morocco would certainly show that this species is much more widespread than the rare records suggest.

### ***Tadarida aegyptiaca* (Geoffroy, 1818)**

RECORD. Small pool in the Oued Drâa, 5 km NW of Anagam (ca. 30 km SE of Zagora, 30° 11' N, 5° 35' W, ca. 670 m a. s. l.), 31 August 2003, an adult male (NMP 90065 [S+A]) netted, leg. P. Benda.

The Egyptian free-tailed bat, *Tadarida aegyptiaca*, is widely distributed in Africa, however, in the northern part of the continent it is known only from Egypt and Algeria (Hayman & Hill 1971) and recently has been reported also for Morocco (Denys et al. 1995). Although its records are rather scarce in most Saharan countries (Koopman 1975, Qumsiyeh 1985, Le Berre 1990, etc.), *T. aegyptiaca* was reported from five sites in Algeria, both from central and northern Saharan regions\* (Dorst & Petter 1959, Hayman & Hill 1971, Schlitter & Robbins 1973, Qumsiyeh 1985, Kowalski & Rzebik-Kowalska 1991). Unlike the Afrotropical region, where *T. aegyptiaca* is mostly a steppe or a savanna inhabitant, in the Palaearctic region (i.e., North Africa and the Middle East) it seems to be a dweller of desert habitats only.

Until now, *T. aegyptiaca* has been documented from Morocco only by bone material found in pellets of *Bubo ascalaphus*. Denys et al. (1995) published first such record from Tata, the Anti-Atlas Mts. (Fig. 1). Later, a second finding of the species came from the same area, also from an owl pellet (Aulagnier & Denys 2000). The newly recorded live *T. aegyptiaca* netted over the Oued Drâa near Anagam (Fig. 6) represents the first confirmation of the actual occurrence of this species in Morocco and a second reported site of its occurrence in that country.

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\* Dorst & Petter (1959) reported a record of a mummy of a free-tailed bat without exact species identification from Marhouma, 30 km S of Beni Abbès. However, they gave the forearm length of this specimen as 55 mm. This value fits with the forearm length of our individual of *T. aegyptiaca* collected in the Oued Drâa near Anagam in Morocco (Tab. 1) and is very close to the value given for this species by Schlitter & Robbins (1973), 54.0 mm. Although several authors identified the specimen recorded by Dorst & Petter (1959) as of *T. teniotis* (Aellen 1966, Anciaux de Faveaux 1976, Kock & Nader 1984), we consider this record as of *T. aegyptiaca*, in concordance with suggestions by Kowalski & Rzebik-Kowalska (1991). This species identification is also supported by the habitat, i.e. lowland desert region, which is more typical for *T. aegyptiaca*. Moreover, in Beni Abbès this species was subsequently found (Qumsiyeh 1985), while unequivocal Maghrebian records of *T. teniotis* come from higher situated and/or more humid habitats (see above).



## Conclusions

The present list of Moroccan records gives new distribution data on 24 species of bats belonging to seven families. The Desert pipistrelle (*Pipistrellus (kuhlii) deserti*), has been reported in Morocco for the first time. If the species status of this Saharan form is confirmed, the number of bat species in the Moroccan fauna will increase to 30 (Aulagnier 1991, Denys et al. 1995, Aulagnier & Denys 2000).

For the first time, live individuals of the Hemprich's long-eared bat (*Otonycteris hemprichii*) and Egyptian free-tailed bat (*Tadarida aegyptiaca*) were recorded in Morocco. Until now, these species have been known only from bone remnants found in owl pellets (Aulagnier & Mein 1985, Aulagnier & Thévenot 1986a, Aulagnier & Denys 2000). Thus, the new findings confirmed the actual occurrence of these species in Morocco.

The list also presents records of some species rarely found in Morocco or in North Africa, viz., the Greater mouse-tailed bat (*Rhinopoma microphyllum*), Lesser mouse-tailed bat (*Rhinopoma hardwickii*), Egyptian slit-faced bat (*Nycteris thebaica*), Blasius' horseshoe bat (*Rhinolophus blasii*), Sundevall's leaf-nosed bat (*Hipposideros caffer*), Natterer's bat (*Myotis nattereri*), Whiskered bat (*Myotis mystacinus*), Savi's pipistrelle (*Hypsugo savii*), Common pipistrelle (*Pipistrellus pipistrellus*), Rüppell's bat (*Pipistrellus rueppellii*), Leisler's bat (*Nyctalus leisleri*), Western barbastelle (*Barbastella barbastellus*), and European free-tailed bat (*Tadarida teniotis*). These species are known from Morocco only from a few records.

The most important new data are the findings of three of these species. *Myotis mystacinus* has been found near Asni in the south-western parts of the Haut Atlas Mts. This record extends the known distribution range of this species in Africa by 400 km to the south-west. *Pipistrellus rueppellii* was found in the lower part of the Moulouya Valley in north-eastern Morocco, some 340 km to the north of the closest record in Tafilalt. *Nyctalus leisleri* was found for the first time in the Moyen Atlas Mts. and its known distribution range in Morocco was extended by ca. 100 km to the south.

The present list also gives new records of some bat species commonly found in Morocco and/or in the Maghreb, such as the Greater horseshoe bat (*Rhinolophus ferrumequinum*), Mehely's horseshoe bat (*Rhinolophus mehelyi*), Trident leaf-nosed bat (*Asellia tridens*), Maghrebian mouse-eared bat (*Myotis punicus*), Isabelline serotine (*Eptesicus isabellinus*), Kuhl's pipistrelle (*Pipistrellus kuhlii*), Mediterranean long-eared bat (*Plecotus teneriffae*), and Schreibers' bat (*Miniopterus schreibersii*).

The Moroccan bat fauna now consists of 29–30 species. It is a mixture of Maghrebian, Saharan, Boreal Palaearctic, and Mediterranean faunas and in addition it incorporates two rather unexpected true Afrotropical species (*N. thebaica*, *H. caffer*). From the Maghrebian (*M. punicus*, *E. isabellinus*, *P. t. gaisleri*) and the Mediterranean (Rhinolophidae, *M. nattereri*, *M. emarginatus*, *M. capaccinii*, *H. savii*, *P. pipistrellus*, *P. kuhlii*, *N. leisleri*, *N. lasiopterus*, *M. schreibersii*, *T. teniotis*) faunal elements, the Moroccan bat fauna includes all representatives known to occur in Mediterranean Algeria and Tunisia. The Saharan fauna (Rhinopomatidae, *T. nudiventris*, *A. tridens*, *P. (k.) deserti*, *P. rueppellii*, *O. hemprichii*, *T. aegyptiaca*) still contains two other bat species which might appear also in the Moroccan territory (*Taphozous perforatus*, *Rhinolophus clivosus*) but their closest records were made in relatively distant parts of the central Sahara (Le Berre 1990). The Boreal Palaearctic fauna extends to Morocco at least by two species (*M. mystacinus*, *B. barbastellus*), which do not live elsewhere in continental Africa. Several other bat species living in southern Iberia might also occur in northern Morocco (*Myotis bechsteinii*, *Myotis daubentonii*, *Pipistrellus pygmaeus*, *Nyctalus noctula*), but remain unrecorded. However, the Gibraltar Strait

might also be a barrier for these species as it has been shown for other bats (e. g. *Rhinolophus blasii*, *Myotis myotis*, *M. blythii*, *M. punicus*, *Plecotus austriacus*, *P. teneriffae*; Castella et al. 2000, Juste et al. 2004, etc.).

According to data collected by Fonderflick et al. (1998) and to our new data, some bat species, previously considered to be restricted to the northernmost parts of Morocco (Aulagnier 1991), such as *M. mystacinus*, *P. pipistrellus*, *N. leisleri*, or *B. barbastellus*, might occur throughout the mountains of the Mediterranean parts of Morocco. However the zoogeographical designation of these species remain different from the type of common Mediterranean species (of e.g., Rhinolophidae, *M. punicus*, *E. isabellinus*, *P. kuhlii*, *M. schreibersii*, etc.), that are widely distributed over the “non-Saharan Morocco” (*sensu* Aulagnier 1991) and the whole Barbarian region (*sensu* Heim de Balsac 1936).

## Souhrn

**Nové údaje o rozšíření netopýrů (Chiroptera) v Maroku.** Předložený přehled marockých nálezů podává nové údaje o rozšíření celkem 24 druhů netopýrů náležejících sedmi čeledím. Netopýr pouštní (*Pipistrellus kuhlii deserti*) byl v Maroku nalezen vůbec poprvé a pokud bude v budoucnu potvrzen dosud poněkud zpochybňovaný druhový statut této saharské formy, vzroste počet známých druhů netopýrů ve fauně Maroka na 30 (Aulagnier 1991, Denys et al. 1995, Aulagnier & Denys 2000). Vůbec poprvé byli v Maroku nalezeni živí jedinci dvou druhů, ušana pustinného (*Otonycteris hemprichii*) a morouse jižního (*Tadarida aegyptiaca*). Oba druhy byly z Maroka dosud dokladovány pouze kosterními zbytky ze sovích vývržků (Aulagnier & Mein 1985, Aulagnier & Thévenot 1986a, Aulagnier & Denys 2000, presentovaná data). Nové nálezy tedy s určitostí potvrdily výskyt obou druhů na území Maroka.

Přehled dále uvádí nálezy některých v Maroku či severní Africe spíše vzácněji dokladovaných druhů. Mezi tyto druhy lze zařadit víkonosa velkého (*Rhinopoma microphyllum*), víkonosa menšího (*Rhinopoma hardwickii*), rýhonosa egyptského (*Nycteris thebaica*), vrápence Blasiova (*Rhinolophus blasii*), pavrápence afrického (*Hipposideros caffer*), netopýrce řasnatého (*Myotis nattereri*), netopýrce vousatého (*Myotis mystacinus*), netopýra Saviova (*Hypsugo savii*), netopýra hvízdavého (*Pipistrellus pipistrellus*), netopýra Rüppellova (*Pipistrellus rueppellii*), netopýra stromového (*Nyctalus leisleri*), ďasíka černého (*Barbastella barbastellus*) a morouse evropského (*Tadarida teniotis*). Tyto druhy netopýrů byly známy z Maroka pouze z několika jednotlivých nálezových lokalit (3–8), viz obr. 1, 2, 8.

Nejvýznamnější jsou některé nálezy tří z těchto druhů. Netopýrec vousatý (*M. mystacinus*) byl nalezen nedaleko Asni na jihozápadě Vysokého Atlasu. Tento nález posouvá známý areál rozšíření druhu v Africe a současně v Palearktidě o zhruba 400 km na jihozápad. Netopýr Rüppellův (*P. rueppellii*) byl odchycen v dolní části údolí řeky Muluja v severovýchodním Maroku, tj. zhruba 340 km daleko od známých nálezů v oblasti Tafilaltu. Nález je celkem překvapující, neboť tento druh je vesměs považován za polopouštní prvek v severoafrické části svého areálu (Benda et al. 2004a) a oblast nálezu je spíše středozemního podnebí. Netopýr stromový (*N. leisleri*) byl poprvé nalezen ve Středním Atlasu a hranice známého areálu rozšíření druhu v Maroku se posunula o zhruba 100 km jižně. Jedná se o nejkontinentálnější nález netopýra stromového v Africe.

Předložený přehled také podává nové nálezy několika v Maroku či Maghrebu spíše běžných druhů netopýrů. K nim nepochybně patří vrápenec velký (*Rhinolophus ferrumequinum*), vrápenec Mehelyův (*Rhinolophus mehelyi*), pavrápenec trojzubcový (*Asellia tridens*), netopýrec punský (*Myotis punicus*), netopýr tripolitánský (*Eptesicus isabellinus*), netopýr vroubený (*Pipistrellus kuhlii*), ušan středomořský (*Plecotus teneriffae*) a létavec evropský (*Miniopterus schreibersii*).

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## Appendix

**Body and skull measurements.** LC – head and body length; LCd – tail length; LA<sub>t</sub> – forearm length; LA – auricle length; LTr – tragus length; G – body weight; LCr – greatest length of skull; LCb – condylobasal length of skull; LCc – condylocanine length of skull; LaZ – zygomatic width; Lal – width of interorbital constriction; LaN – braicase width; AN – braicase height; CC – rostral width between canines (incl.); M<sup>3</sup>M<sup>3</sup> – rostral width between third upper molars (incl.); CM<sup>3</sup> – length of upper tooth-row between CM<sup>3</sup> (incl.); LMd – mandible length; ACo – height of coronoid process; CM<sub>3</sub> – length of lower tooth-row between CM<sub>3</sub> (incl.).

**Collections.** BMNH – Natural History Museum, London, United Kingdom; ISEZ – Institute of Systematics and Evolution of Animals PAN, Cracow, Poland; IVB – Institute of Vertebrate Biology AS CR, Brno, Czech Republic; MHNG – Natural History Museum, Geneva, Switzerland; MNHN – National Museum of Natural History, Paris, France; MUB – Department of Zoology and Ecology, Masaryk University, Brno, Czech Republic; NMP – National Museum (Natural History), Prague, Czech Republic; SMF – Senckenberg Institute and Museum, Frankfurt am Main, Germany; ZFMK – Zoological Institute and Museum Alexander Koenig, Bonn, Germany.

**Others.** A – alcohol specimen, B – prepared skin, S – prepared skull; m – male, f – female.

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