

Microbats of the Western Oases of Egypt, Libyan Desert

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Abstract. A complete review of microbat records available from five Western Oases of the Egyptian part of the Libyan Desert (Siwa, Bahariya, Farafra, Dakhla, Kharga) is presented, covering both literature data and particularly new records obtained during the field research carried out in 2010–2012. In total, six species of microbats from three families were recorded in the oases, but only *Asellia tridens* was found in all five oases. *Taphozous nudiventris* (known from two oases), *Pipistrellus kuhlii* (four oases) and *Vansonia rueppellii* (two oases) are reported from the Western Desert of Egypt for the first time (although *P. kuhlii* and *V. rueppellii* were known before from the Libyan part of the Desert). *T. nudiventris* is for the first time mentioned for the whole Libyan Desert, while *Otonycteris hemprichii* and *Plecotus christii* were known previously from both parts of the Desert. Rather surprisingly, *Rhinopoma cystops* has not yet been documented in the Egyptian part of the Libyan Desert. An unusual pattern of the seasonal spatial dynamics observed in *Asellia tridens* is discussed. Some additional records of bats from other parts of Egypt are attached.

Distribution, Chiroptera, oases, Sahara, North Africa, Palaearctic Region

Introduction

The Western Oases are a group of large fertile basins scattered over the Egyptian part of the Libyan Desert. They are comprised of five large systems of oases, viz. Siwa, Bahariya, Farafra, Dakhla, and Kharga, surrounded by sand or hammada deserts of the eastern Sahara. These oases are situated on a tectonic line of the north-eastern rim of the Great Sand Sea (Fig. 1). They are isolated by parched deserts from each other as well as from the Nile Valley (for at least 150 km) and from the Mediterranean Sea (for 200 km). Each oasis covers relatively extensive areas with a patchwork of villages, small fields and palm groves, together with hectares of barren land. The basins reach tens of kilometres in diameter, the smallest oasis of Bahariya spreads over 40 km, while the largest Kharga oasis stretches across almost 120 km.

Although the Oases of the Libyan Desert have been in the focus of explorers from time immemorial, they always stayed in the shadow of the Nile Valley, which is parallel to the chain of the oases and easily passable. The fauna of the Western Oases is rather poorly known; considering the enormous area of the Libyan Desert, only limited numbers of records of mammals, including bats, are available from this area, particularly in comparison with the faunas of the Nile Valley and Delta or the Red Sea Mountains (see Osborn & Helmy 1980, Qumsiyeh 1985).

The first bat record from the Egyptian Western Oases was published by Anderson (1902), who collected three specimens of *Otonycteris hemprichii* from the Siwa Oasis. Almost a half a century

later, Hayman (1949) reported findings of *Plecotus auritus* (= *P. christii*) and *Asellia tridens* from Siwa; a record of the latter species was published in the same year also from the oasis of Kharga (Wassif 1949). Until now, occurrence of four bat species has been documented from the Western Oases. However, only *Asellia tridens* is known from all five oases (Hayman 1949, Wassif 1959a, b), but repeatedly it was documented only from Siwa and Kharga (Gaisler et al. 1972, Goodman 1990, Benda et al. 2006). In addition to the above mentioned records, Gaisler et al. (1972) reported a finding of *Otonycteris hemprichii* from Kharga and Churcher (1991) a record of *Rousettus aegyptiacus* from Dakhla.

Thus, the most diverse bat fauna is reported from the Oasis of Siwa, where three species are known to occur (*A. tridens*, *P. christii*, *O. hemprichii*); two bat species are known from Dakhla and Kharga – *R. aegyptiacus* and *A. tridens* in the former, *A. tridens* and *O. hemprichii* in the latter one. In the remaining two oases, Bahariya and Farafra, only the old findings of *A. tridens* are available.

During an extensive ecological study of *Rousettus aegyptiacus* in the Western Oases carried out in 2010–2012, we also gathered a number of records of other bats species which essentially refined the knowledge of the bat fauna in the Libyan Desert. Thus, in the Egyptian Western Oases, seven species of bats are currently known to occur. The records of *R. aegyptiacus* were published elsewhere as a part of the review of its whole Palaearctic range (Benda et al. 2011a), the list of records of other bat species is provided in this paper along with details on the particular records and comparative notes.

Material and Methods

The lists of records (arranged in alphabetical and/or chronological orders) include, for each item, the following information: name of the locality (each record is primarily listed by a name of the nearest settlement or notable physical feature), and/or description of the record site, date, number of recorded bats with indication of their sex, age and physiological condition (for details see Abbreviations below). Acoustic recordings were made using a portable ultrasound detector D-240x (Pettersson Elektronik, Inc.) set on the time-expansion mode connected to the Sony MZ-RH10 recorder.

Egyptian (Arabic) geographical names are mentioned according to Osborn & Helmy (1980) and Qumsiyeh (1985), respectively, or were adapted to their mode used. Under the Cairo region we understand the populated agglomerations of the Cairo and Giza Governorates and their broader environs.

Abbreviations

ad = adult; – BMNH = Natural History Museum, London, United Kingdom; – coll. = collected; – det. = detected by a bat detector; – FMNH = Field Museum of Natural History, Chicago, United States of America; – IVB = Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, Brno, Czech Republic; – juv = juvenile; – L = lactating; – net. = netted; – NMP = National Museum (Natural History), Prague, Czech Republic; – obs. = observed; – sad = subadult; – USNM = National Museum of Natural History, Washington D.C., United States of America; – ZFMK – Zoological Institute and Museum Alexander Koenig, Bonn, Germany.

Species List

Asellia tridens (Geoffroy, 1813)

New records

Siwa: El Zeytun, ruins of a Roman tomb, 8 March 2012: obs. remnants of a colony; – tomb on the northern outskirts of the Siwa Oasis, 7 March 2012: obs. remnants of a colony, coll. 1 mummy.

Bahariya: Bawiti, palm orchard, 16 October 2011: det. & obs. tens of foraging inds.; – Bawiti, old tomb, 16 October 2011: obs. 2 roosting inds.; – Bawiti, a volcanic mountain at the NW edge of the Bahariya Oasis,

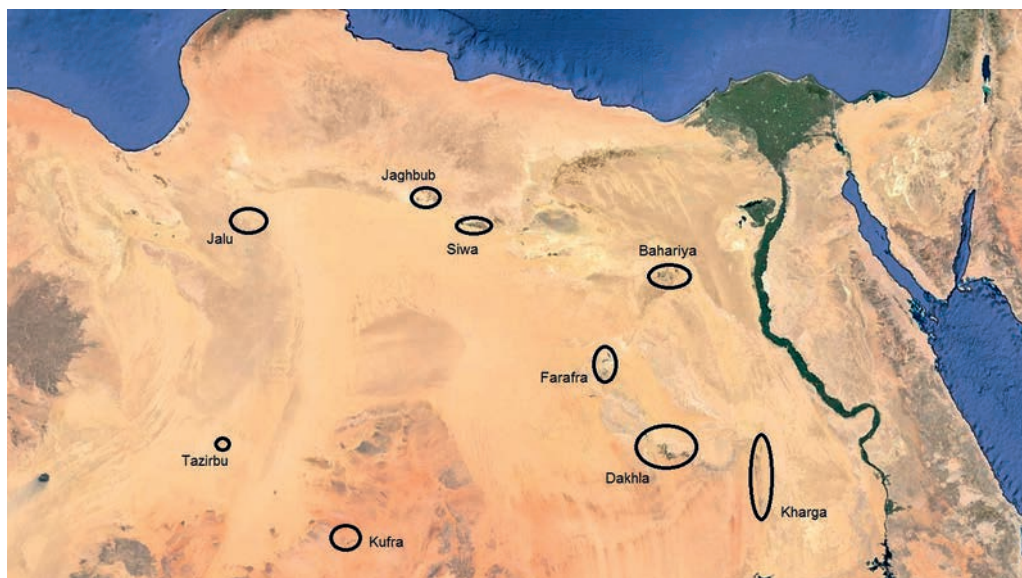


Fig. 1. A satellite photograph of the eastern Sahara showing the Great Sand Sea of the Libyan Desert, surrounded by large oases.

17 October 2011: det. & obs. tens of foraging inds.; – Mandishah, small tomb, 20 November 2010: obs. 1 roosting ind., remnants of a colony.

Farafra: small cave ca. 45 km NE of the Farafra oasis, 20 November 2010: obs. a colony of ca. 30 inds., exam. 1 ♂ ad, 2 ♀♀ ad.

Dakhla: Budkhula, abandoned house, 21 August 2011: obs. a colony of ca. 1300 inds. (in two rooms), 4 July 2012: obs. a colony of ca. 300 inds., exam. 4 ♀♀ adL, 1 ♀ juv; – Deir El Hagar, Mauhoub, vertical tomb, 27 November 2010: obs. a colony of ca. 120 inds., 30 March 2011: obs. a colony of ca. 70 inds. (21 August 2011, 1 March 2012 and 3 July 2012 – negative records); – El Qasr, medina, abandoned house, 22 August 2011: obs a colony of ca. 3000 inds., 13 October 2011: obs. a colony of ca. 3500 inds. (in two separate rooms), exam. 10 ♀♀ ad, 2 ♂♂ juv, 8 ♀♀ juv, 3 July 2012: obs. a colony of ca. 2000 inds.; – El Qasr, palm orchard, 31 March 2011: net. 1 ♀ sad (NMP 94983); – Er Rashda, abandoned building, 23 November 2010: obs. a colony of ca. 70 inds., exam. 6 ♀♀ ad, 27 March 2011: obs. 2 inds., 6 April 2011: obs. 1 ind., 20 August 2011: obs. a colony of ca. 1000 inds., exam. 5 ♂♂ ad, 4 ♂♂ sad, 10 ♂♂ juv, 13 ♀♀ ad, 5 ♀♀ sad, 11 ♀♀ juv, 10 October 2011: obs. a colony of ca. 1500 inds., exam. 2 ♂♂ ad, 1 ♂ juv, 8 ♀♀ adL, 5 ♀♀ juv (coll. 1 ♂, 1 ♀; NMP 94978, 94979), 13 October 2011: net. 1 ♀ juv, 28 February 2012: roost empty, found a carcass, 4 July 2012: obs. a colony of ca. 3000 inds. (in two rooms); – Qalamoun, abandoned house in a palm orchard, 20 August 2011: obs. a colony of ca. 20 inds., 10 October 2011: obs. a colony of 58 inds., exam. 1 ♂ ad, 7 ♀♀ adL, 3 ♂♂ juv, 9 ♀♀ juv.

Kharga: Khargah Oase, 18 October 1980: 1 ♂ ad (ZFMK 81.253; leg. H.-E. Beck).

Published records

Siwa: Siwa, 1935: 16 ♂♂, 1 ♀ (Hayman 1949), Siwa, 17 inds., BMNH (Qumsiyeh 1985); – Siwa oasis, Shali, 12 April 2002: 1 ♀ ad, 3 ♀♀ sad, NMP (Benda et al. 2006, 2008, 2011b).

Bahariya: Bir Abu Darag, Mandisha, January–February 1958: 5 ♂♂ (Wassif 1959a, b); Bahariya Oasis, February 1958: 6 ♂♂, 1 ♀ (Wassif et al. 1984).



Farafra: Ain el Raml, Qasr Farafra, 29–31 January 1958: 8 ♂♂, 3 ♀♀ (Wassif 1959a, b); Farafra Oasis, January 1958: 5 ♂♂, 3 ♀♀ (Wassif et al. 1984).

Dakhla: Mut, main graveyard and roofed lanes between houses, January–February 1959 (Wassif 1959b).

Kharga: Oasis of Kharga, one of the tombs of the ancient Christian city of Necropolis, January 1942: 12 ♂♂, 15 ♀♀ (Wassif 1949); Kharga Oasis, January 1942: 2 ♂♂, 1 ♀, 6 inds. (Wassif et al. 1984); – Kharga city, burial chambers of the ancient Necropolis, January–February 1959 (Wassif 1959b); – Oasis of Kharga, 12 inds. (Setzer 1952); – Kharga Oasis, Nekropolis of El Bagawat (City of Deads), tomb, 6 May 1969: 1 ♂ sad, 1 ♀ ad, 2 ♀♀ sad, IVB (Gaisler et al. 1972, Benda et al. 2008); – Kharga Oasis, Temple of Ibis, 6 May 1969: 1 ♂ ad, 1 ♂ sad, 8 ♀♀ ad, IVB (Gaisler et al. 1972, Benda et al. 2008); – El Kharga oasis, 12 inds., USNM (Qumsiyeh 1985); – Kharga Oasis, 2.5 km north of Kharga City, a crevice in a lone rock outcrop, 5 February 1989: 10 inds. from *Bubo ascalaphus* pellets (Goodman 1990); – Kharga Oasis, a chamber of the Hibis Temple (Goodman 1990).

***Taphozous nudiventris* Cretzschmar, 1830**

New records

Bahariya: Bawiti, 16 October 2011: det. tens of foraging inds. (above street lamps); – Bawiti, a volcanic mountain at the NW edge of the Bahariya Oasis, crevices in rocks, 17 October 2011: obs. tens of roosting inds., coll. 1 ♀ ad, 2 ♂♂ juv. (NMP 94971–94973).

Dakhla: Bir El Wastani, ruins of a large house, 27 March 2011: obs. a small colony in wall fissure (at least 2 inds.); – Budkhula, abandoned house, 27 March 2011: obs. 1 roosting ind.; – Deir El Hagar, a crevice in a ruined village house, 30 March 2011: obs. 1 roosting ind., 21 August 2011: obs. a colony; – Deir El Hagar, crevices in Roman ruins, 26 November 2010: obs. several inds., 30 March 2011: obs. a group of at least 3 inds.; – El Qasr, above pools in the southern part of the village, 2 December 2010: det. calls of 1 foraging ind.; – El Qasr, medina, 24 November 2010: det. calls of 1 foraging ind.; – El Mozawaka, crevices in tombs ca. 7 km W of El Qasr, 26 November 2010: obs. 1+3 roosting inds., 27 March 2011: obs. 1 ind.; – Er Rashda, an abandoned house, 28 March 2011: obs. a small colony (6 inds.), 3 April 2011: obs. a colony of 12+ inds., 24 August 2011: obs. a colony of ca. 20 inds., 11 October 2011: obs. a colony of several tens of inds. (cf. Lučan & Šálek 2013), 13 October 2011: net. 2 ♂♂ ad, 8 ♀♀ ad, 6 ♂♂ juv. (coll. 2 ♂♂, 2 ♀♀; NMP 94974–94977), 3 July 2012: obs. a colony of ca. 50 inds.; – Hindaw, fissures in a house wall, 20 August 2011: obs. a colony ca. 30 inds., exam. 1 ♂ ad; – Ismant, medina, crevice in an abandoned house, 28 November 2010: obs. a group of ca. 5 inds., 11 October 2011: obs. 1 ind.; – Mut, above a lake, 15 October 2011: det. calls of 1 foraging ind.

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

New records

Siwa: Siwa, Shali, ruins at the citadelle hill, 7 March 2012: net. 1 ♂ ad, 1 ♀ sad; – Siwa, Shali, ruins in the medina, 5 March 2012: obs. & det. calls of a colony emergence (>30 inds.); – Siwa oasis, at a small pond, 6 March 2012: obs. & det. calls of ca. 20 foraging inds.

Bahariya: Bawiti, palm orchard, 18 January 2010: det. calls of 2–3 foraging inds., 19 November 2010: net. 22 inds., 30 December 2010: det. calls of ca. 5 foraging inds., net. 1 ♂ ad, 1 ♀ sad (NMP 94958, 94959; cf. Benda et al. 2014), 4 March 2012: exam. 3 ♀♀ sad roosting behind bark of a palm; – Bawiti, above an irrigation channel in a palm orchard, 19 January 2010: net. 1 ♂ ad (NMP 92571; cf. Benda et al. 2014, in

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Figs. 2–5. Bahariya Oasis (photos by R. K. Lučan). 2 – General view of the Bahariya Oasis from the north-east. 3 – Basalt rocks on the top of a hill at the NE edge of the Oasis containing numerous fissure roosts of a colony of *Taphozous nudiventris*. 4 – *Vansonia rueppellii* netted at a lake in the Oasis on 17 October 2011. 5 – Palm garden in the northern part of the Oasis, a foraging habitat of *Pipistrellus kuhlii* and *Roussettus aegyptiacus*.



press), det. calls of min. 2 other foraging inds.; – Bawiti, village, 16 October 2011: det. calls of tens of foraging inds., net. 4 ♂♂ ad, 1 ♀ ad; – Bawiti, small mosque at a lake, 4 March 2012: obs. 3+1 inds. roosting in roof fissures, exam. 1 ♂ ad, 2 ♀♀ sad.

Dakhla: Balat, medina, crevice in wall of a house, 25 November 2010: obs. 1 ind., 22 August 2011: obs. a small colony; – Bashindi, crevices of the Tomb of Pasha Hindi, 23 January 2010: obs. 3 inds. (coll. 1 ♂, 1 ♀; NMP 92580, 92581; cf. Benda et al. 2014, in press); – Bir El Wastani, ruins, 9 October 2011: obs. a colony of ca. 10 inds., exam. 2 ♀♀ adL, 3 ♀♀ juv; – Budkhla, streets of the village, 3 December 2010: det. calls of ca. 5 foraging inds.; – Budkhla, abandoned house, 21 August 2011: obs. a colony of 14 inds. in a beam fissure; – El Gharghour, at a small pond, 27 November 2010: det. calls of several foraging inds.; – El Qasr, medina, 21 January 2010: net. 2 ♂♂ ad (NMP 92572, 92573; cf. Benda et al. 2014, in press), 24 November 2010: det. calls of several tens of foraging inds., 25 November 2010: net. 2 ♂♂ ad, 2 ♂♂ sad, 1 ♀ sad, 5 January 2011: obs. & det. calls of ca. 20 foraging inds.; – El Qasr, medina, abandoned house, 26 November 2010: obs. a group of at least 3 inds. in beam fissure, 27 November 2010: obs. 1 ind. in a beam fissure, 2 December 2010: obs. 1 ind. in a wall fissure, 27 March 2011: obs. a colony of 9 inds. in a beam fissure, 22 August 2011: obs. a colony of ca. 15 inds. in a beam fissure, 28 February 2012: obs. a group of 4 inds., 2 March 2012: obs. a colony of ca. 20 inds.; – El Qasr, medina, Nasr El Din mosque, 29 March – 8 April 2011 (one check per day): obs. a colony of 3–46 inds., 2 March 2012: obs. 1 roosting ind.; – El Qasr, above a pool at medina, 21 January 2010: net. 2 ♂♂ ad (NMP 92574, 92575; cf. Benda et al. 2014, in press), 22 January 2010: net. 1 ♂ ad (NMP 92579; cf. Benda et al. 2014, in press), det. calls of numerous foraging inds., 25 March 2011: net. 1 ♂ ad, obs. & det. calls of ca. 5 foraging inds.; – El Qasr, pools in the southern part of the oasis, 2 December 2010: det. calls of tens of foraging inds.; – El Qasr, palm orchard, 21 November 2010: net. 1 ♂ ad, 23 November 2010: net. 2 ♂♂ ad, 4 July 2012: det. calls of 1 foraging ind.; – El Qasr, stands of eucalyptus trees, 2 December 2010: det. calls of tens of foraging inds., 28 March 2011: det. calls of of ca. 5 foraging inds.; – Ezab El Qasr, 28 March 2011: coll. 1 ♂ ad (NMP 94980; cf. Benda et al. 2014); – Gedida, village, 26 November 2010: det. calls of several inds.; – Gedida, tomb, 28 February 2012: obs. a group of min. 3 roosting inds.; – Hindaw, village, 5 January 2011: 1 ind.; – Ismant, medina, crevice in an abandoned house, 28 November 2010: obs. 3 inds., 5 January 2011: exam. 6 ♂♂ ad (coll. 4 ♂♂; NMP 94960–94963; cf. Benda et al. 2014); – Mushieh, above a small pool, 27 November 2010: det. calls of ca. 5 foraging inds.; – Mut, medina, 22 January 2010: det. calls of 2 foraging inds., 13 December 2010: obs. & det. calls of several foraging inds.; – Mut, above a lake, 15 October 2011: det. calls of tens of foraging inds.

Kharga: El Kharga Oasis, palm orchard at the S edge of the town, 23 January 2010: det. calls of 1 foraging ind.

***Vansonia rueppellii* (Fischer, 1829)**

New records

Bahariya: Bawiti, above a lake, 17 October 2011: net. 11 ♂♂ ad, 21 ♀♀ ad, 1 ♂ juv, 6 ♀♀ juv (coll. 3 ♂♂, 3 ♀♀; NMP 94965–94970; cf. Benda et al. 2014), det. calls of several tens of foraging inds.

Dakhla: El Qasr, above a pool at medina, 22 January 2010: net. 1 ♂ ad (NMP 92578; cf. Benda et al. 2014), 25 March 2011: det. calls of & obs. foraging ca. 10 inds., 30 March 2011: det. calls of & obs. foraging ca. 10 inds.; – El Qasr, at pools in the southern part of the village, 2 December 2010: det. calls of & obs. 3 foraging inds.; – El Qasr, at sewage water pools, 2 April 2011: net. 1 ♂ ad, 3 ♀♀ ad (coll. 3 ♀♀; NMP 94984–94986); – El Qasr, above a water pool near the eucalyptus stand, 28 February 2012: det. calls of ca. 5 foraging inds.; – Mut, above a lake, 15 October 2011: det. tens of foraging inds.

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Figs. 6–9. Dakhla Oasis (photos by R. K. Lučan). 6 – El Qasr, a permanent pond at the historical centre is a crucial watering and foraging site of *Rousettus aegyptiacus*, *Pipistrellus kuhlii* and *Vansonia rueppellii*. 7 – El Qasr, a mosaic of occupied and abandoned houses and gardens provides a suitable habitat for a rich bat community. 8 – Er Rashda, a roosting colony of *Taphozous nudiventris*. 9 – Er Rashda, a part of a huge maternity colony of *Aselia tridens* roosting in an abandoned house.

Table 1. Composition of bat faunas in the Oases of the Libyan Desert in Egypt (EG) and Libya (LY); cf. Benda et al. (2011a, 2014). The species recorded only in the Egyptian part of the Desert are typed in bold

species	Siwa	Bahariya	Farafra	Dakhla	Kharga	Jaghbub	Jalu	Kufra & Tazirbu	no. oases inhab.
country	EG	EG	EG	EG	EG	LY	LY	LY	
<i>Rousettus aegyptiacus</i>	–	+	–	+	+	–	–	–	3
<i>Rhinopoma cystops</i>	–	–	–	–	–	+	–	–	1
<i>Asellia tridens</i>	+	+	+	+	+	–	–	–	5
<i>Taphozous nudiventris</i>	–	+	–	+	–	–	–	–	2
<i>Pipistrellus kuhlii</i>	+	+	–	+	+	–	+	–	5
<i>Vansonia rueppellii</i>	–	+	–	+	–	+	–	–	3
<i>Otonycteris hemprichii</i>	+	–	–	–	+	+	–	–	3
<i>Plecotus christii</i>	+	+	–	+	–	+	–	–	3
no. species	4	6	1	6	4	4	1	0	8

***Otonycteris hemprichii* Peters, 1859**

Published records

Siwa: Oasis of Siwah, 3 ♀♀ (Anderson 1902); – Siwa, 3 inds., BMNH (Qumsiyeh 1985); – Siwa Oasis, 2 ♀♀, BMNH (Benda & Gvoždík 2010).

Kharga: Kharga oasis, “City of Deads”, 6 May 1969: 2 ♂♂, IVB (Gaisler et al. 1972, Benda & Gvoždík 2010).

***Plecotus christii* Gray, 1838**

New records

Bahariya: Bawiti, abandoned building, 19 November 2010: obs. 1 roosting ind. and remnants of a colony.

Dakhla: El Qasr, medina, 21 January 2010: net. 2 ♂♂ ad (NMP 92576, 92577; cf. Benda et al. 2010); – El Qasr, medina, Nasr El Din mosque, 2 March 2012: obs. 1 ind.; – El Qasr, at a sewage water pool, 2 April 2011: net. 1 ♀ ad; – El Qasr, palm orchard, 31 March 2011: net. 1 ♂ ad (NMP 94981), 3 April 2011: net. 2 ♀♀ adL; – Hindaw, a tomb 3 km NW of the village, 6 December 2010: coll. 1 ♂ ad (NMP 93849; cf. Benda et al. 2010).

Published records

Siwa: Siwa, 1935: 1 ♀ (Hayman 1949); – Siwa Oasis (Hoogstraal 1962); – Siwa Oasis, March 1953: 1 ♀ (Wassif et al. 1984); – Siwa, 1 ind., BMNH, 4 inds., FMNH, 6 inds., USNM (Qumsiyeh 1985).

Comments

In his comprehensive review of bats of Egypt, Qumsiyeh (1985) reported records of three species from the Western Oases, *Asellia tridens*, *Otonycteris hemprichii* and *Plecotus austriacus* (= *P. christii*). Later on, Churcher (1991) added a finding of *Rousettus aegyptiacus* from the Oasis of Dakhla. Along with the review by Benda et al. (2011a), the present report mentions evidence of the occurrence of altogether seven species in the region of the Western Oases of Egypt (Table 1). Three of them (*Taphozous nudiventris*, *Pipistrellus kuhlii*, *Vansonia rueppellii*) are new faunal elements for this vast region of Egypt. However, the latter two species were already known from the Cyrenaican part of the Libyan Desert, from the Oases of Jalu and Al Jaghbub (De Beaux 1932, Benda et al. 2004). Thus, only *T. nudiventris* represents a completely new faunal element of the Libyan Desert as well.

All bat species known to occur in the Western Oases are also inhabitants of the Nile Valley of Egypt, including the Cairo region and Nile Delta (Qumsiyeh 1985). Records of four of them are rather numerous in the Valley, viz. *Rousettus aegyptiacus*, *Asellia tridens*, *Pipistrellus kuhlii*, and *Plecotus christii*, and these species belong to the most common and widespread Egyptian mammals. For two of these bats, *R. aegyptiacus* and *P. christii*, the Libyan Desert represents the westernmost area of occurrence in the Palaearctic (and for the latter species in its whole range as well). The remaining three species, *Taphozous nudivetris*, *Otonycteris hemprichii* and *Vansonia rueppellii*, were found at several sites in the Cairo region and at only one or very few sites in the Nile Valley (for the first record of *O. hemprichii* in the Nile Valley south of El Fayum see Appendix 2). For these bats, the oases in the Libyan Desert represent a substantial part of their North African range, in the remaining areas of the Sahara they belong to very rare bats (see the review by Benda et al. 2014).

One bat species was documented to occur in the Libyan Desert in Cyrenaica but remains to be found in its Egyptian section, *Rhinopoma cystops* Thomas, 1903. This species belongs to the bats best adapted to desert conditions and was found in the Oasis of Al Jaghbub in Libya (Benda et al. 2004) as well as in the whole length of the Nile Valley of Egypt, including the Oases of El Fayum and Wadi El Natrun (Qumsiyeh 1985). Its finding in one of the Western Oases is perhaps only a question of time.

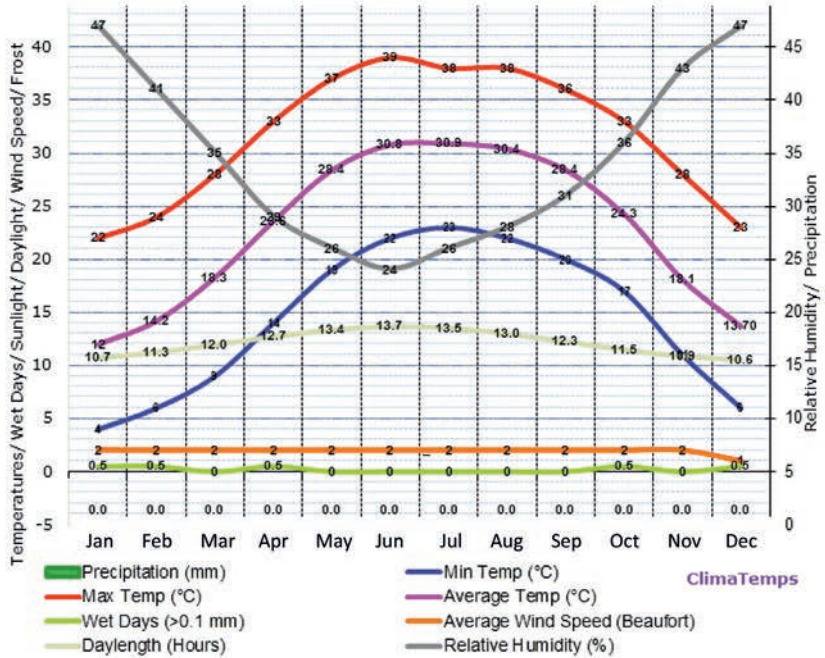
On the other hand, it is difficult to identify other bat species with possible occurrence in the Libyan Desert. Among the bats known from the Nile Valley of Egypt, only two or three species could be considered as possible desert inhabitants which could be found in several oases in the eastern part of the Desert (e.g. Dakhla and/or Kharga), particularly *Rhinopoma microphyllum* (Brün-



Fig. 10. Siwa Oasis (photo by I. Horáček); the partly ruined old town of Shali provides numerous roosting and foraging opportunities for *Pipistrellus kuhlii*.

A

**annual course of climatic currents
Dakhla Oasis, Libyan Desert**



B

annual cycle of *Asellia tridens* in the Libyan Desert, Egypt



Fig. 2. Schematic review of the annual cycle of *Asellia tridens* life as reconstructed from the observations in the Western Oases, Libyan Desert, Egypt (B) and the annual course of climatic currents in the Dakhla Oasis (A; after Climatemps.com).

nich, 1782), *Taphozous perforatus* Geoffroy, 1818 and perhaps also *Nycteris thebaica* Geoffroy, 1818. On the other hand, three remaining species, *Hypsugo ariel* (Thomas, 1904), *Nycticeinops schlieffenii* (Peters, 1859) and *Nyctinomus aegyptiacus* Geoffroy, 1818, represent rare bats in the north-eastern part of Africa and are probably not distributed in the lowland parts of the Sahara.

Among the eight bat species occurring in the Libyan Desert (Table 1), only one was found in all five large Western Oases of Egypt, both by previous authors and by the recent survey, i.e. *Asellia tridens*. However, records of this bat are still missing from the Cyrenaican section of the Libyan Desert (Benda et al. 2014). *Pipistrellus kuhlii* was documented in four oases of the Egyptian part of the Libyan Desert plus in the Jalu Oasis, at the western margin of the Desert in western Cyrenaica (see above). All other species were documented only from one to three oases at maximum. However, the level of survey effort which was made in the particular oases of the Libyan Desert is quite incomparable. Regarding the known faunal composition (Table 1), the bat fauna of two large Oases, Bahariya and Dakhla, is identical and the richest, comprising six species. A similar composition of the bat fauna can be expected also in the southernmost oasis, Kharga, when its geographic conditions are taken into account and mainly, if a similar research effort is taken as in the former oases. In contrast, the scarcity of bat records in Farafra, the smallest of the Western Oases, is to be looked upon as a real phenomenon. It was the only oasis where more than 10 hrs of repeated bat detecting revealed literally no bat call. It is also the only oasis where *Pipistrellus kuhlii* is missing. We stress this fact particularly because this species was found to be by far the most regular species in all Oases (except for Farafra) and it appeared roughly in the same numbers throughout the year. In this respect, it markedly differs from the other microbat species common during summer months, viz. *Asellia tridens* and *Taphozous nudiventris*, whose appearance in the Oases exhibited a remarkable seasonal variation.

This phenomenon has been convincingly illustrated by repeated checks in all known roosts of the respective species in the Dakhla Oasis covering most periods of the year (undertaken from January 2010 to July 2012, cf. Lučan et al. 2014). During summer months until the beginning of October, *A. tridens* was observed to be undoubtedly the most common bat species in all settlements of the Oasis with at least 5000 individuals in repeatedly checked roosts and an impressive mass occurrence at the time of evening emergence from the roosts. Yet, in November and in winter months until the beginning of April, these roosts were empty (except for single individuals seen in March and April) and no individuals were detected even during night time. The records from the other oases show the same picture as well. The only colonies found in that period were rather small (70 or 120 inds.) and occupied vertical caves in the desert far from the major areas of their anthropogenic summer roosts. A similar pattern, though with less impressive numbers, was observed also in *T. nudiventris*. At least for *A. tridens* it clearly suggests that the annual life cycle includes extensive migrations associated with a radical shift in preferences of the roosts and foraging grounds. Unfortunately, we are unable to identify whether a mass long-distance migration (e.g. to the Nile Valley) is included or whether the migration takes rather a form of a dispersal over short distances into the adjacent desert regions with formation of smaller colonies in various rocky roosts. The occasional records in such roosts (see above) and suitable climatic conditions in the respective period (Fig. 2) seem to support the latter alternative more likely.

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Appendix 1 Gazetteer

Siwa: El Zeytun, ruins of a Roman tomb, 29°10'N, 25°47'E; – Siwa oasis, small pond, 29°12'N, 25°33'E; – Siwa, Shali, 29°12'N, 25°31'E; – Siwa, tomb on the northern outskirts of the oasis, 29°14'N, 25°32'E.

Bahariya: Bawiti, palm orchard, 28°21'N, 28°52'E; – Bawiti, old tomb, 28°21'N, 28°52'E; – Bawiti, a volcanic mountain at the NW edge of the Bahariya oasis, 28°23'N, 28°54'E; – Bawiti, above an irrigation channel in a palm orchard, 28°21'N, 28°51'E; – Bawiti, village, 28°21'N, 28°52'E; – Bawiti, lake, 28°24'N, 28°53'E; – Mandishah, small tomb, 28°21'N, 28°55'E.

Farafra: small cave ca. 45 km NE of the Farafra oasis, 27°26'N, 28°11'E.

Dakhla: Balat, medina, 25°34'N, 29°16'E; – Bashindi, Tomb of Pasha Hindi, 25°33'N, 29°18'E; – Bir El Wastani, ruins, 25°41'N, 28°49'E; – Budkhula, village, 25°38'N, 28°55'E; – Deir El Hagar, ruins, 25°40'N, 28°49'E; – El Gharghour, small pond, 25°35'N, 28°52'E; – El Mozawaka, tombs ca. 5 km S of El Qasr, 25°39'N, 28°54'E; – El Qasr, medina, 25°42'N, 28°53'E; – El Qasr, palm orchard, 25°41'N, 28°53'E; – El Qasr, pools in the southern part of the village, 25°41'N, 28°53'E; – El Qasr, sewage water pools, 25°41'N, 28°52'E; – El Qasr, stands of eucalyptus trees, 25°41'N, 28°53'E; – Er Rashda, abandoned house, 25°35'N, 28°56'E; – Ezab El Qasr, 25°41'N, 38°55'E; – Gedida, village, 25°35'N, 28°52'E; – Gedida, tomb, 25°34'N, 28°51'E; – Hindaw, a tomb 3 km NW of the village, 25°34'N, 28°59'E; – Hindaw, village, 25°33'N, 29°00'E; – Ismant, medina, 25°32'N, 29°04'E; – Mut, lake, 25°32'E, 28°57'E; – Mut, medina, 25°30'N, 28°59'E; – Qalamoun, abandoned house in a palm orchard, 25°34'N, 28°53'E.

Kharga: El Kharga Oasis, palm orchard at the S edge of the town, 25°25'N, 30°33'E; – Khargah Oase, 25°26'N, 30°33'E.

Appendix 2

New records of microbats from the Nile Valley and adjacent areas of Egypt

Rhinopoma cystops Thomas, 1903

Aswan, Tombs of the Nobles, 9 January 2011: obs. a colony of ca. 1000 inds. scattered over several tombs (the largest group contained some 150 inds.), exam. 3 ♂♂ ad, 5 ♀♀ ad (coll. 3 ♂♂, 3 ♀♀; NMP 93839–93844); – El Qahirah, Muqattam, old quarry, 29 January 2010: obs. 1 ind. roosting on the ceiling, 30 January 2010: obs. 2 inds. on the ceiling, 20 October 2011: obs. 15 inds.; – El Uksur (Thebes), tombs at the main road to the Valley of the Kings, 27 January 2010: obs. a colony of ca. 230 inds. (in several groups up to 60 inds. scattered over five tombs; coll. 4 ♂♂ ad, 2 ♂♂ sad, 1 ♂ juv, 2 ♀♀ ad, 1 ♀ juv; NMP 92599–92608), 12 January 2011: obs. a colony of ca. 80 inds. (scattered over five tombs), exam. 3 ♂♂ ad, 6 ♀♀ ad, 1 ♂ juv; – Nag Siteih, at a water channel, 11 January 2011: det. calls of 2 foraging inds.

***Rhinolophus clivosus* Cretzschmar, 1828**

Aswan, tunnel under railway, 24 January 2010: net. 1 ♂ ad (NMP 92584; cf. Benda & Vallo 2012); – El A'aqab, under a road bridge, 25 January 2010: net. 1 ♀ ad (NMP 92596, cf. Benda & Vallo 2012).

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

Aswan, Tombs of the Nobles, 9 January 2011: obs. a colony of ca. 130 inds.; – Aswan, tunnel under railway, 24 January 2010: net. 8 ♂♂, 2 ♀♀ (NMP 92585–92594; cf. Benda et al. 2011b), 10 January 2011: net. 1 ♂ ad, 1 ♂ juv.

***Taphozous perforatus* Geoffroy, 1818**

El A'aqab, under a road bridge, 25 January 2010: net. 1 ♂ ad (NMP 92595), det. calls of several foraging inds.; – El Uksur (Thebes), on the Nile bank, 26 January 2010: det. calls of several foraging inds., 27 January 2010: det. calls of several foraging inds.; – El Uksur (Thebes), tombs at the main road to the Valley of the Kings, 27 January 2010: obs. a colony of ca. 25 inds. (coll. 1 ♂ ad, 1 ♂ sad, 1 ♀ ad, 2 ♀♀ sad; NMP 92609–92613), 12 January 2011: obs. a colony of ca. 150 inds. (in two tombs), exam. 4 ♂♂ ad, 2 ♂♂ juv, 3 ♀♀ ad.

***Taphozous nudiventris* Cretzschmar, 1830**

Nagaa El Sitayh, at a water channel, 11 January 2011: det. calls of 2 foraging inds.

***Nycteris thebaica* Geoffroy, 1818**

Aswan, palm garden at the N edge of the town, 24 January 2010: net. 1 ♂ ad (NMP 92583); – Aswan, tunnel under railway, 10 January 2011: net. 2 ♂♂ ad, 2 ♀♀ ad, 11 ♀♀ adG (coll. 2 ♂♂, 3 ♀♀; NMP 93845–93848, 93964).

***Hypsugo ariel* (Thomas, 1902)**

El A'aqab, under a road bridge, 25 January 2010: net. 2 ♀♀ ad (NMP 92597, 92598; cf. Benda et al. 2011c), det. calls of several foraging inds.

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

Aswan, palm garden at the N edge of the town, 24 January 2010: det. calls of several foraging inds.; – El Qahirah, Muqattam, old quarries, 29 January 2010: obs. a group of ca. 5 inds. roosting in a wall crevice (coll. 2 ♂♂ ad; NMP 92614, 92615; Benda et al. 2014, in press), 30 January 2010: net. 3 ♂♂ ad, 17 November 2010: obs. a group of 4 inds. roosting in a wall crevice, exam. 1 ♂ ad; – El Qahirah, Zamalek Island, 29 January 2010: det. calls of several foraging inds., 22 March 2011: obs. & det. calls of 1 foraging ind.; – El Uksur (Thebes), on the Nile bank, 26 January 2010: det. calls of several foraging inds., 27 January 2010: det. calls of 1 foraging ind.; – Mersa Matruh, city, 8 March 2012: det. calls of 2 foraging inds.; – Nagaa El Sitayh, at a water channel, 11 January 2011: det. calls of 1 foraging ind.; – San El Hagar El Gibiliya, 20 September 2005: 5 ♂♂ ad, 2 ♂♂ sad, 3 ♀♀ ad, 1 ♀ sad (coll. 6 ♂♂, 3 ♀♀; NMP 90534–90542; cf. Benda et al. 2008, 2014, in press).

***Otonycteris hemprichii* Peters, 1859**

El Uksur (Luxor), El Karnak Temple, 28 January 2010: coll. a skull from *Tyto alba* pellets (NMP 92616; cf. Benda & Gvoždík 2010).

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

El Qahirah, Muqattam, old quarries, 29 January 2010: obs. & det. calls of several individuals emerging from crevices in a cliff; – Wadi El Natrun, garden, 20 February 2005: det. calls of 1–2 foraging inds.

***Nyctinomus aegyptiacus* Geoffroy, 1818**

Aswan, palm garden at the N edge of the town, 24 January 2010: det. calls of several foraging inds.; – El Uksur (Luxor), El Karnak Temple, 28 January 2010: coll. a skull from *Tyto alba* pellets (det. J. Obuch).