THE BAT FAUNA OF JABAL AL AKHDAR, NORTHEAST LIBYA

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Abstract

Fifty nine specimens of bats representing eight species in three families are reported from the region of Jabal Al Akhdar in northeastern Libya. *Nyctalus lasiopterus* is reported for the first time from Africa, while *Pipistrellus pipistrellus*, *Miniopterus schreibersii* and *Tadarida teniotis* are new additions to the fauna of Libya. *Rhinolophus clivosus*, *R. mehelyi*, *Pipistrellus kuhlii*, and *Plecotus austriacus* are additional distributional records from Libya. Taxonomic comments are given. Although distinctive, the bat fauna of Jabal Al Akhdar is considered of Mediterranean origin and includes taxa seemingly closely associated with those from southcentral Europe rather than the Eastern Mediterranean and Maghreb regions.

Introduction

There are few reports on the bat fauna of Libya (De Beaux, 1932, 1938; Festa, 1921; Hufnagel, 1972; Klaptoicz, 1909; Setzer, 1957; Toschi, 1954; Zavattari, 1934). Almost no collecting of bats has been done in the Jabal Al Akhdar (=the green mountain) in northeastern Libya (previously referred to as “Cyrenaica” or the Cyrenaica Plateau). The Jabal Al Akhdar region is characterized by a Mediterranean Maquis type vegetation (Zohary, 1973) and is unique in this part of northern Africa.

Through the courtesy of the Kuf National Park administration in

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Libya, an inventory of small mammals, especially bats, was made in the park from 8 March through 9 April 1981. During that interval, 58 specimens of bats, representing eight species in three families, were collected. Many of these specimens represent taxonomically and zoogeographically important records for this region of Africa and are reported in this paper.

**MATERIALS AND METHODS**

The collecting localities mentioned in the accounts of species and their coordinates are listed below (numbers correspond to Fig. 1):

1) Al Abraq, 5 km SW—32°45'N, 21°58'E.
2) Baida, 4 km S—32°44'N, 21°43'E.
3) Haniya, 8 km SSE—32°46'N, 21°27'E.
4) Kufanta—32°46'N, 21°34'E.
5) Qasr Maqdam, Ruins 6 km SE—32°38'N, 21°36'E.
6) Wadi Al Kuf, unnamed cave—32°41'N, 21°33'E.
7) Wadi Al Kuf, mistnetting site—32°42'N, 21°35'E.

Unless otherwise indicated in the specimens examined, all specimens were prepared as conventional museum specimen skins and skulls and were collected by the senior
Fig. 2.—Mistnetting site at edge of water pool in Wadi Al Kuf. Habitat of *Pipistrellus kuhlii*, *P. pipistrellus*, *Nyctalus lasiopterus*, *Plecotus austriacus*, and *Tadarida teniotis.*

author in 1981. In some instances, the field numbers, indicated by the prefix MQ, are given for specimens not yet catalogued. Specimens will be divided with most deposited in Carnegie Museum of Natural History, Pittsburgh, and some will be deposited in the Kuf National Park Museum, Beida, Libya. One specimen of *Pipistrellus pipistrellus* from 5 km SW of Al Abraq was examined in the National Museum of Natural History, Washington (USNM). External measurements were taken from the field tags and fore-arm and cranial measurements were taken with dial calipers. All measurements are given in millimeters. Selected external and cranial measurements of the eight species are given in Tables 1 and 2.

In the species accounts, families and genera are listed as they appear in Corbet (1978) but the species are listed alphabetically.

**Jabal Al Akhdar**

The Jabal Al Akhdar is a mountainous region of northeastern Libya, mainly south of the city of Beida. The Wadi Al Kuf, with its tributaries Wadi Beit Saleh and Wadi Sudan, provides the main watershed of the Jabal Al Akhdar (Figs. 1, 2). The watershed consists of wadis cut through the limestone rock, forming many high and narrow valleys. Some valleys are 200 m in depth. Numerous karstic caves and cracks of different sizes occur in the region. Altitude ranges from sea level to 878 m.
Table 1.—External measurements of samples of eight species of bats from Jabal Al Akhdar and some comparative material. Means and ranges of measurements enclosed in parentheses are given for some samples.

| Locality, sample, and sex | Total length | Length of tail | Length of hindfoot | Length of ear | Length of forearm |
|---------------------------|--------------|----------------|-------------------|--------------|------------------|
|                          |              |                |                   |              |                  |
|                           | Rhinolophus clivosus |                |                   |              |                  |
| 6 km SE Oasr Maqdam (♂)   | 76           | 29             | 10.5              | 19           | 50               |
| Roman aquaduct, Kufanta (♂) | 78, 76       | 26, 30         | 10, 10            | 18, 21       | 47, 49           |
|                           | Rhinolophus mehelyi |                |                   |              |                  |
| Wadi Al Kuf (6 ♂ ♂)       | 72.5         | (70-77) 24.2   | (8.5-11) 9.8      | (19-21.5) 20.0 | (46-48) 47.3     |
|                           | Wadi Al Kuf (4 ♀ ♂) |                |                   |              |                  |
|                           | 72.8         | (70-75) 26.3   | (8-11) 9.8        | (19-21) 20.4 | (46-49) 47.3     |
|                           | Pipistrellus kuhlii |                |                   |              |                  |
| Wadi Al Kuf (2 ♂ ♂)       | 81, 85       | 38, 41         | 7, 7              | 13, 12.5    | 34, 34           |
|                           | Pipistrellus pipistrellus |      |                   |              |                  |
| Wadi Al Kuf (10 ♂ ♂)      | 71.6         | (67-78) 31.2   | (4-8) 6.1         | (8-11) 10.2 | (30-32) 31.2     |
|                           | Wadi Al Kuf (6 ♀ ♂) |                |                   |              |                  |
|                           | 74.5         | (71-82) 32.0   | (6-7) 6.5         | (10-11) 10.4 | (29.7-32.5) 31.5 |
|                           | Nyctalus lasiopterus |            |                   |              |                  |
| Wadi Al Kuf (2 ♂ ♂)       | 143, 150     | 53, 53         | 14.5, 13          | 21, 22      | 62.5, 61         |
| Wadi Al Kuf (4 ♀ ♂)       | 144.5        | (138-152) 56.3 | (12.5-16) 14.4    | (19-23) 20.8 | (59-64) 61.3     |
|                            | Plecotus austriacus |                |                   |              |                  |
| Wadi Al Kuf (♀)           | 98           | 42             | 9                 | 36           | 40               |
| 6 km SE Qasr Maqdam (♂)   | 95           | 45             | 8.5               | 34.5         | 38               |
Table 1.—Continued.

| Locality, sample, and sex | Total length | Length of tail | Length of hindfoot | Length of ear | Length of forearm |
|---------------------------|--------------|----------------|--------------------|--------------|------------------|
| Egypt: Dandara Temple (2 ♀ ♀) | 95, 93 | 48, 46 | 8, 8.5 | 38, 35 | 38.5, 39 |
| Egypt: Dandara Temple (1 ♂) | 96 | 45 | 8 | 37 | 37 |
| Wadi Al Kuf (3 ♀ ♀) | 107.7 (106–111) | 49.3 (48–50) | 8.8 (8.5–9) | 8.3 (8–8.5) | 43.5 (43–44) |
| Wadi Al Kuf (8 ♂ ♂) | 126.3 (119–132) | 41.4 (37–48) | 11.4 (10–12.5) | 29.5 (25–31) | 58.9 (56–61) |
| Wadi Al Kuf (4 ♀ ♀) | 130.8 (120–136) | 46.8 (46–48) | 11.9 (11.2–12.3) | 29.3 (26–31) | 61.0 (59–63) |

*Miniopterus schreibersii*

*Tadarida teniotis*
Table 2.—Selected cranial measurements of specimens listed in Table 1. Means and ranges of measurements as in Table 1.

| Locality, sample, and sex | Greatest length of the skull | Zygomatic breadth | Length of maxillary toothrow | Length of mandible | Length of mandibular toothrow |
|--------------------------|-------------------------------|-------------------|-------------------------------|--------------------|-------------------------------|
| 6 km SE Qasr Maqdam (♂) | 20.6                          | 11.1              | 7.6                           | 13.4               | 8.6                           |
| Roman aqueduct, Kufanta (♂, ♀) | 20.3, 20.4             | 10.9, 11.0        | 7.5, 7.5                      | 13.2, 13.2         | 8.2, 8.1                      |
| **Rhinolophus clivosus** |                               |                   |                               |                    |                               |
| Wadi Al Kuf (6 ♂ ♂) | 19.5                          | 10.2              | 6.8                           | 12.0               | 7.5                           |
| (19.3–19.8)             |                               | (9.9–10.6)        | (6.7–6.9)                     | (11.9–12.1)        | (7.4–7.7)                     |
| Wadi Al Kuf (4 ♀ ♀) | 19.5                          | 10.4              | 6.7                           | 12.0               | 7.5                           |
| (19.4–19.5)             |                               | (10.2–10.5)       | (6.6–6.8)                     | (11.9–12.1)        | (7.3–7.7)                     |
| **Rhinolophus mehelyi** |                               |                   |                               |                    |                               |
| Wadi Al Kuf (2 ♂ ♂) | 13.4, 13.8                    | 8.4, 9.0          | 4.7, 4.9                      | 9.4, 9.3           | 5.3, 5.5                      |
| **Pipistrellus kuhlii** |                               |                   |                               |                    |                               |
| Wadi Al Kuf (10 ♂ ♂) | 12.5                          | 7.6               | 4.3                           | 8.2                | 4.7                           |
| (12.2–12.7)             |                               | (7.4–7.9)         | (4.2–4.4)                     | (8.0–8.4)          | (4.5–4.8)                     |
| Wadi Al Kuf (6 ♀ ♀) | 12.4                          | 7.7               | 4.3                           | 8.1                | 4.7                           |
| (11.5–12.7)             |                               | (7.0–8.0)         | (4.0–4.4)                     | (7.4–8.5)          | (4.4–5.0)                     |
| **Pipistrellus pipistrellus** |                               |                   |                               |                    |                               |
| Wadi Al Kuf (2 ♂ ♂) | 22.7, 22.1                    | 15.7, 15.4        | 9.0, 8.6                      | 16.8, 16.3         | 9.7, 9.4                      |
| Wadi Al Kuf (4 ♀ ♀) | 22.4                          | 15.5              | 8.8                           | 16.5               | 9.5                           |
| (22.2–22.7)             |                               | (15.1–16.0)       | (8.7–8.9)                     | (16.3–16.7)        | (9.4–9.7)                     |
| **Nyctalus lasiopterus** |                               |                   |                               |                    |                               |
| Wadi Al Kuf (♀) | 17.7                          | 9.0               | 5.7                           | 11.0               | 6.5                           |
| 6 km SE Qasr Maqdam (♂) | 17.6                          | 9.1               | 5.2                           | 10.6               | 6.2                           |
| Egypt: Dandara Temple (2 ♀ ♀) | 16.8, 16.8            | 8.5, 8.6          | 5.3, 5.4                      | 9.9, 10.1          | 5.5, 5.9                      |
| Egypt: Dandara Temple (1 ♂) | 17.0                          | 8.6               | 5.5                           | 10.1               | 6.1                           |
| **Plecotus austriacus** |                               |                   |                               |                    |                               |
Table 2.—Continued.

| Locality, sample, and sex | Greatest length of the skull | Zygomatic breadth | Length of maxillary toothrow | Length of mandible | Length of mandibular toothrow |
|--------------------------|-----------------------------|------------------|-----------------------------|-------------------|-------------------------------|
| Wadi Al Kuf (2 ♀ ♀)      | 14.7, 14.8                  | 8.1, 8.2         | 5.6, 5.7                    | 10.0, 10.4        | 6.4, 6.5                      |
|                          |                             |                  |                            |                   |                               |
| Wadi Al Kuf (8 ♂ ♂)      | 23.9                        | 14.0             | 8.7                         | 16.3              | 9.8                           |
|                          | (23.3–24.8)                 | (13.5–15.1)      | (8.5–9.0)                   | (15.8–17.0)       | (9.6–10.2)                    |
| Wadi Al Kuf (4 ♀ ♀)      | 23.5                        | 13.4             | 8.6                         | 16.3              | 9.7                           |
|                          | (23.2–23.8)                 | (13.1–13.7)      | (8.5–8.6)                   | (15.9–16.7)       | (9.5–9.8)                     |
The climate of the area is mild Mediterranean. The rainfall ranges between 300 and 600 mm per year, with most of the precipitation occurring during the winter months of November through February. Temperatures range from highs of 35°C in July and August to below freezing during January. Fog occurs extensively during winter months.

The vegetation of the Jabal Al Akhdar is a Maquis type. Groves of *Cupressus sempervirans* occur in protected areas but the main tree species are *Juniperus phoenicea*, *Pistacia lentiscus*, *Arbutus pavarrii*, *Cistus salviaefolius*, *Ceratonia siliqua*, *Zizyphus lotus*, *Sparteum funceum*, *Olea europea*, *Myrtus communis* and *Quercus coccifera*.

**ACCOUNT OF SPECIES**

**Family Rhinolophidae**

**Rhinolophus clivosus** Cretzschmar, 1828

*Specimens examined (5).—Roman aqueduct, Kufanta (2 ♂♂, 1 ♀ in alcohol); Ruins, 6 km SE Qasr Maqdam (1 ♂, 1 ♀ in alcohol).*

*Remarks.—Rhinolophus clivosus* was previously recorded from Fezzan by Toschi (1954) as *R. c. schwarzi* Heim de Balsac, originally described from the Algerian Sahara. Hayman and Hill (1971:23) list Algerian Sahara and Libya as the range of *R. c. schwarzi*. The specimens from Jabal Al Akhdar are larger than those examined from the Algerian Sahara (*R. c. schwarzi*) and Egypt (*R. c. brachygnathus*).

The female was not pregnant and the adult males showed no enlarged testes.

**Rhinolophus mehelyi** Matschi, 1901

*Specimens examined.—Unnamed cave in Wadi Al Kuf (6 ♂♂, 4 ♀♀).*

*Remarks.—Rhinolophus mehelyi* was listed from “Cyrenaica” by Corbet (1978) based on specimens in the British Museum. The taper of the lancet in our specimens is abrupt and the connecting process of the sella is short and slightly blunt. These characters and the relatively large cranial measurements (Table 2) clearly refer the Jabal Al Akhdar specimens to *Rhinolophus mehelyi* rather than *R. euryale*. However, specimens of the former species originating from eastern Libya and Egypt are small in many cranial and external measurements when compared to those of the Eastern Mediterranean region and northwestern Africa (Algeria, Morocco, Tunisia). This difference may help explain why various authors have identified some Egyptian material as *R. euryale* (see DeBlase, 1972, for a review of this species group in Egypt and Southwest Asia).

The range of measurements of testes of five of the adult males collected was 2.0 to 2.1 in length and 1.0 to 1.6 in width.
Family Vespertilionidae

Pipistrellus kuhlii (Natterer, 1817)

Specimens examined (2).—Wadi Al Kuf, mistnetting site (2 ♂ ♂).

Remarks.—While Pipistrellus kuhlii is common in most of the southwestern Palearctic, including Libya and southwestern Asia (De Beaux, 1932, 1938; Harrison, 1964), it seems to be less common in forested areas where it is outnumbered by the smaller species Pipistrellus pipistrellus. This was the case in Jabal Al Akhdar where only two specimens of P. kuhlii were caught compared to 18 of P. pipistrellus. The Jabal Al Akhdar specimens are referred to the nominate subspecies. They are indistinguishable in size from specimens of P. kuhlii kuhlii from northwestern Africa and southern Europe; measurements of specimens from Crete given by Pohle (1953) agree with those of the Jabal Al Akhdar specimens.

An adult male collected on 9 April had testes measuring 3.5 by 2.0.

Pipistrellus pipistrellus (Schreber, 1774)

Specimens examined (19).—Wadi Al Kuf (8 ♂ ♂, 3 ♀ ♀; 2 ♂ ♂, 2 ♀ ♀ in alcohol); 4 km S Beida (2 ♂ ♂); 8 km SSE Haniya (1 ♂); 5 km SW Al Abraq (1 ♂, USNM).

Remarks.—These are the first specimens of Pipistrellus pipistrellus reported from Libya. The species is known to occur in the Maghreb, the Eastern Mediterranean region, and in southern Europe (Atallah, 1977; Corbet, 1978; and Harrison, 1964). There seems to be little geographic variation in this species in this part of its continuous range. The populations around the Mediterranean are tentatively all considered to belong to the nominate subspecies.

The range of measurements of testes of seven adult males collected was 1.5 to 3.5 in length and 1.2 to 2.5 in width.

Nyctalus lasiopterus (Schreber, 1780)

Specimens examined (6).—Wadi Al Kuf (2 ♂ ♂, 4 ♀ ♀).

Remarks.—These are the first records of Nyctalus lasiopterus from Africa, although Nyctalus noctula had been reported from Rabat, Morocco (Laurent, 1937), Algiers, Algeria (Dobson, 1878:213; specimen examined in B.M.), and as far south as Lebanon (Lewis and Harrison, 1962) and Oman (Harrison and Jennings, 1980) in southwestern Asia. Another record of Nyctalus noctula exists from Mozambique (Peters, 1852). This record was doubted, but in view of the widespread records of the genus in Africa and southwestern Asia and the long migrations known for N. noctula in Europe (Roer, 1960), individuals of this genus should be expected elsewhere in northern and eastern Africa.
Fig. 3.—Lateral view of head of a male specimen of Nyctalus lasiopterus from Wadi Al Kuf to illustrate ear pinna and tragus shape. Drawn from Kodachrome slide of live specimen.

The cranial measurements of the Libyan specimens are slightly smaller than those of European specimens of N. lasiopterus. The external measurements of the Libyan specimens are smaller than are those of European specimens and correspond more closely with those of N. aviator (=N. lasiopterus aviator) of the Far East. The shape of the ear (Fig. 3) also indicates that the Libyan specimens are referable to N. lasiopterus, being thicker and wider at the base than those of N. noctula.

The baculum of N. lasiopterus closely resembles that of N. noctula in shape but is significantly larger in size (Lanza, 1959). The os penes of the two male specimens from Libya measured 7.7 and 8.1 mm in length and 1.15 and 1.18 mm in width at the proximal end. The corresponding measurements for N. noctula given by Topal (1958) were 5.51 and 6.22 (mean 5.83) in length and 0.84 to 1.09 (mean 0.94) in width.
An adult male collected on 15 March had testes measuring 2.1 by 1.8.

Six individuals of this species were taken in mist nets in Wadi Al Kuf (Fig. 2). Three females and a single male were netted on 15 March and a single female and male were taken on 28 March and 29 March, respectively.

**Plecotus australiacus** (Fischer, 1829)

*Specimens examined* (2).—Wadi Al Kuf, mistnetted (1 ♂); Ruins, 6 km SE Qasr Maqdam (1 ♂).

*Remarks.*—The two specimens listed above and a third individual collected at Gharian, Libya, agree with specimens of *Plecotus australiacus* from Europe in external and cranial measurements, color of pelage, and shape of bacula. However, they are darker in color and larger in size than the holotype of *P. australiacus christie*, and specimens from Egypt and Giarabub Oasis in Libya referred to this subspecies by Lanza (1960), Harrison (1964), and Hanak (1966). The determination of the subspecific status of the Libyan specimens requires more comparative study.

**Miniopterus schreibersii schreibersii** (Kuhl, 1819)

*Specimens examined* (3).—Unnamed cave, Wadi Al Kuf (3 ♀ ♀).  

*Remarks.*—This is the first record of *Miniopterus schreibersii* from Libya. This widespread species occurs from South Africa across Africa to Morocco and then across Europe as far as Australasia. External and cranial measurements and color of pelage of the three specimens agree with those of specimens from Europe and northeast Africa (the nominate subspecies) rather than with those of the Eastern Mediterranean region referable to *M. s. pallidus*.

**Family Molossidae**

**Tadarida teniotis** (Rafinesque, 1814)

*Specimens examined* (12).—Wadi Al Kuf, mistnetted (8 ♂♂, 4 ♀ ♀).

*Remarks.*—These are the first specimens of *Tadarida teniotis* recorded from Libya. They are referred, on geographic reasons, to *T. teniotis ruepelli* Temminck, the subspecies found in Morocco, Algeria, Egypt, and elsewhere in the Middle East.

One adult male with descended testes had testes measurements of 6.0 by 4.0. The range of measurements of testes of five other males was 2.0 to 3.0 in length and 1.1 to 2.0 in width.
DISCUSSION

The eight species of bats recorded from Jabal Al Akhdar fall into two general groups based on their zoogeographic distribution—Palaearctic species or species with primarily Eurasian distributions but which also occur in North Africa to varying degrees and Cosmopolitan species or species with broad Eurasian and African distributions. The Palaearctic species are Rhinolophus mehelyi, Pipistrellus pipistrellus, Nyctalus lasiopterus, Plecotus austriacus, and Tadarida teniotis. The Cosmopolitan species include Rhinolophus clivosus, Pipistrellus kuhlii, and Miniopterus schreibersii. The specimens of Nyctalus lasiopterus are the first records for the species for the African continent. Plecotus austriacus is known from as far south as Ethiopia in the East and Senegal and Cape Verde Islands in the West (Hayman and Hill, 1971).

In spite of the close proximity of the Jabal Al Akhdar to Egypt, only the specimens of Rhinolophus mehelyi and Tadarida teniotis show a close relationship with Egyptian populations. In the case of Pipistrellus pipistrellus, there seems to be little variation in external and cranial size and color of pelage around the whole of the Mediterranean. The Nyctalus lasiopterus of northeastern Libya seem to be closely related to populations of southcentral Europe. The Rhinolophus clivosus of northeastern Libya are larger than populations from neighboring North African countries. Miniopterus schreibersii and Pipistrellus kuhlii are similar to those from northwestern Africa and southern Europe.

The distributions and morphological attributes of the bats studied, and the characteristic Mediterranean Maquis type vegetation (Zohary, 1973:85), suggest that the bats of Jabal Al Akhdar are related to those of southcentral Europe and some probably reached this part of Libya by spreading across the islands of the central Mediterranean sea or are relicts of the more temperate climate (Hey, 1963) of the late Pleistocene/early Holocene in Cyrenaica.

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