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Bats (Mammalia: Chiroptera) of the Eastern Mediterranean and Middle East. Part 10. Bat fauna of Iran

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Abstract. A complete list of bat records available from Iran was compiled from literature and from new records, based on field studies and examination of museum specimens. The record review is complemented by distribution maps, summaries of distributional status of the particular species, files of field data, findings on feeding ecology, and observations of morphology and variation. Basic descriptive echolocation parameters for at least 24 species (426 calls from 68 call sequences analysed) are given and discussed. From the territory of Iran, at least 902 records of 50 bat species belonging to eight families are known; viz. *Rousettus aegyptiacus* (Geoffroy, 1810) (33 record sites), *Rhinopoma microphyllum* (Brünnich, 1782) (38), *R. muscatellum* Thomas, 1903 (42), *R. hardwickii* Gray, 1831 (12), *Rhinolophus ferrumequinum* (Schreber, 1774) (61), *R. hipposideros* (Borkhausen, 1797) (36), *R. euryale* Blasius, 1853 (17), *R. mehelyi* Matschie, 1901 (14), *R. blasii* Peters, 1866 (28), *Hipposideros fulvus* Gray, 1838 (1), *Asellia tridens* (Geoffroy, 1813) (37), *Triaenops persicus* Dobson, 1871 (5), *Taphozous perforatus* Geoffroy, 1818 (7), *T. nudiventris* Cretzschmar, 1830 (11), *Myotis blythii* (Tomes, 1857) (98), *M. bechsteinii* (Kuhl, 1817) (4), *M. nattereri* (Kuhl, 1817) (2), *M. schaubi* Kormos, 1935 (10), *M. emarginatus* (Geoffroy, 1806) (20), *M. mystacinus* morpho-group (23), *M. capaccinii* (Bonaparte, 1837) (11), *Vespertilio murinus* Linnaeus, 1758 (7), *Eptesicus serotinus* (Schreber, 1774) (25), *E. pachyomus* (Tomes, 1857) (2), *E. nilssonii* (Keyserling et Blasius, 1839) (2), *E. bobrinskoi* Kuzâkin, 1935 (1), *E. anatolicus* Felten, 1971 (10), *E. bottae* (Peters, 1869) (2), *E. ognevi* Bobrinskoj, 1918 (5), *Rhyneptesicus nasutus* (Dobson, 1877) (9), *Hypsugo savii* (Bonaparte, 1837) (19), *H. arabicus* (Harrison, 1979) (1), *Pipistrellus pipistrellus* (Schreber, 1774) (63), *P. pygmaeus* (Leach, 1825) (2), *P. kuhlii* (Kuhl, 1817) (107), *Nyctalus noctula* (Schreber, 1774) (6), *N. lasiopterus* (Schreber, 1780) (1), *N. leisleri* (Kuhl, 1817) (9), *Otonycteris hemprichii* Peters, 1859 (15), *O. leucophaea* (Severcov, 1873) (3), *Barbastella barbastellus* (Schreber, 1774) (4), *B. darjelingensis* (Hodgson, 1855) (6), *Plecotus auritus* (Linnaeus, 1758) (1), *P. macrobullaris* Kuzâkin, 1965 (12), *P. strelkovi* Spitzenberger, 2006 (1–2), *Miniopterus pallidus* Thomas, 1907 (50), *Tadarida teniotis* (Rafinesque, 1814) (26), and *Nyctinomus aegyptiacus* Geoffroy, 1818 (3). *Hipposideros fulvus* and *Myotis nattereri* are here reported from the country for the first time, while *Rhinolophus bocharicus* Kaŝenko et Akimov, 1917 has been deleted from the faunal list of Iran. Reviews of taxonomic opinions concerning the Iranian populations of particular species, supplemented in some cases by original analyses, are added. Three species were detected within the *Myotis mystacinus* morpho-group in Iran: *M. mystacinus* (Kuhl, 1817), *M. davidii* (Peters, 1869) and here described *M. hyrcanicus* sp. n. Within the species rank of *Nyctinomus aegyptiacus*, a separate species occurring in south-western Asia has been documented, *N. thomasi* (Wroughton, 1919). Arthropod ectoparasites were newly collected from 14 species of bats; altogether 36 species of ectoparasites belonging to twelve families were recorded from Iran. The following species are here reported from the country for the first time: *Ischnopsyllus dolosus* Dampf, 1912 (collected from *Myotis blythii*), *Ischnopsyllus petropolitanus* (Wagner, 1898) (from *Plecotus macrobullaris*), *Stricticimex namru* Usinger, 1960 (from a mixed colony), *Basilia nana* Theodor et Moscona, 1954 (from *Myotis bechsteinii* and *M. nattereri*), *Nycteribia latreillii* Leach, 1817) (from *Myotis blythii* and *M. capaccinii*), *Steatonyssus periblepharus* Kolenati, 1858 (from *Pipistrellus kuhlii*), *Spinturnix myoti* (Kolenati, 1856) (from *Myotis blythii*), *Spinturnix psi* (Kolenati, 1856) (from *Myotis capaccinii* and *Miniopterus pallidus*), and *Meristaspis lateralis* Kolenati, 1857 (from *Rousettus aegyptiacus* and *Pipistrellus kuhlii*).

Key words. Distribution, ecology, echolocation, ectoparasites, Iran, Middle East, Palaearctic.

CONTENTS

INTRODUCTION

The territory of Iran (1.648,200 km^2, see Fig. 1) represents the easternmost part of the Middle East, lying eastwards of the proper Mediterranean Basin and belonging to the Mediterranean region only in its broader sense (Blondel et al. 2010); it is situated at the transition of two principal biogeographical regions, the Palaearctic and Oriental, and within the Palaearctic, it covers gradual transitions of three main biomes, the temperate forests, Mediterranean woodlands, and the Saharo-Sindic steppes and deserts (Djamali et al. 2011). Similarly as the true Mediterranean countries of the Middle East (Turkey, Levant), Iran also lies on the crossroads of cultural and environmental influences between the West and the Orient, between the Afro-tropical, Palaearctic, and Oriental regions, and/or between the fertile Mediterranean and Caucasus on one side and arid Arabia and West Turkestan on the other side. Iran also lies in a cultural cradle important for most human inhabitants of the western Palaearctic, connecting Mesopotamia and West Turkestan from the south-west to the north-east and the Caucasus and Indian regions from the north-west to the south-east. On the other hand, due to the extreme environmental diversity, the territory of Iran has been attractive for naturalists similarly as for archaeologists and/or art historians, unlike the situation in Turkey and/or the Levant (see Benda et al. 2006, 2010).

Mammal fauna of Iran, including bats, has been thoroughly studied since long time ago, both by Iranian and foreign zoologists, see Missone (1959), Lay (1967) and Karami et al. (2008) for reviews. Perhaps the most dynamic period in the research of bats in Iran was at the break of the 1960s and 1970s. While Lay (1967) and Etemad (1969) reported 28 species of bats from the country (although their records belong to 31 contemporarily recognised species, see Karami et al. 2008), DeBlase (1980) reported already 38 species of bats (under a more or less identical taxonomic arrangement). So, the faunal list of Iranian bats was enlarged by 36% during approximately ten years (Table 1). Karami et al. (2008) reported 45 species of bats in the fauna of Iran, however, most of the newly listed species of bats are in fact a result of the changes in taxonomy (*Myotis aurascens*, *M. nipalensis*, *Eptesicus anatolicus*, *Pipistrellus pygmaeus*, *Barbastella barbastellus*), while only two species were really discovered to occur in Iran (*Hypsugo arabicus*, *Plecotus auritus*).

Moreover, the extraordinary effort given to the research of Iranian bats is well documented by the number of taxa described from the territory of this country; at least eighteen names originate from Iran; viz. *Vespertilio* (*Vesperus*) *mirza* de-Filippi, 1863, *Triaenops persicus* Dobson, 1871, *Vesperus shiraziensis* Dobson, 1871, *Vespertilio desertorum* Dobson, 1875, *Phyllorhina tridens* var. *murraiana* Anderson, 1881, *Rhinolophus midas* Andersen, 1905, *Myotis myotis omari* Thomas, 1905, *Vespertilio matschiei pellucens* Thomas, 1905, *Pipistrellus aladdin* Thomas, 1905, *Miniopterus pallidus* Thomas, 1907, *Otonycteris cinereus* Satunin, 1910, *Rhinopoma muscatellum seianum* Thomas, 1913, *Rhinopoma pusillum* Thomas, 1920, *Myotis lanaceus* Thomas, 1920, *Rhinolophus ferrum-equinum irani* Cheesman, 1921, *Myotis myotis risorius* Cheesman, 1921, *Rhinopoma microphyllum harrisoni* Schlitter et DeBlase, 1974, and *Eptesicus bottae taftanimontis* de Roguin, 1988. At least ten of these names still remain valid, see the reviews below. This is in sharp contrast with the situation in the western part of the Middle East; for comparison, from five countries of this region (Turkey, Syria, Jordan, Lebanon, Israel), only seven bat taxa were described in total – *Rhinolophus* (*Euryalus*) *judaicus* Andersen et Matschie, 1904, *Taphozous kachhensis babylonicus* Thomas, 1915, *Pipistrellus bodenheimeri* Harrison, 1960, *Myotis myotis macrocephalicus* Harrison et Lewis, 1961, *Nyctalus noctula lebanoticus* Harrison, 1962, *Myotis nattereri hoveli* Harrison, 1964, and *Eptesicus anatolicus* Felten, 1971 (Benda & Horáček 1998, Mendelssohn & Yom-Tov 1999, Benda et al. 2006, 2010, Horáček et al. 2008). Besides others,

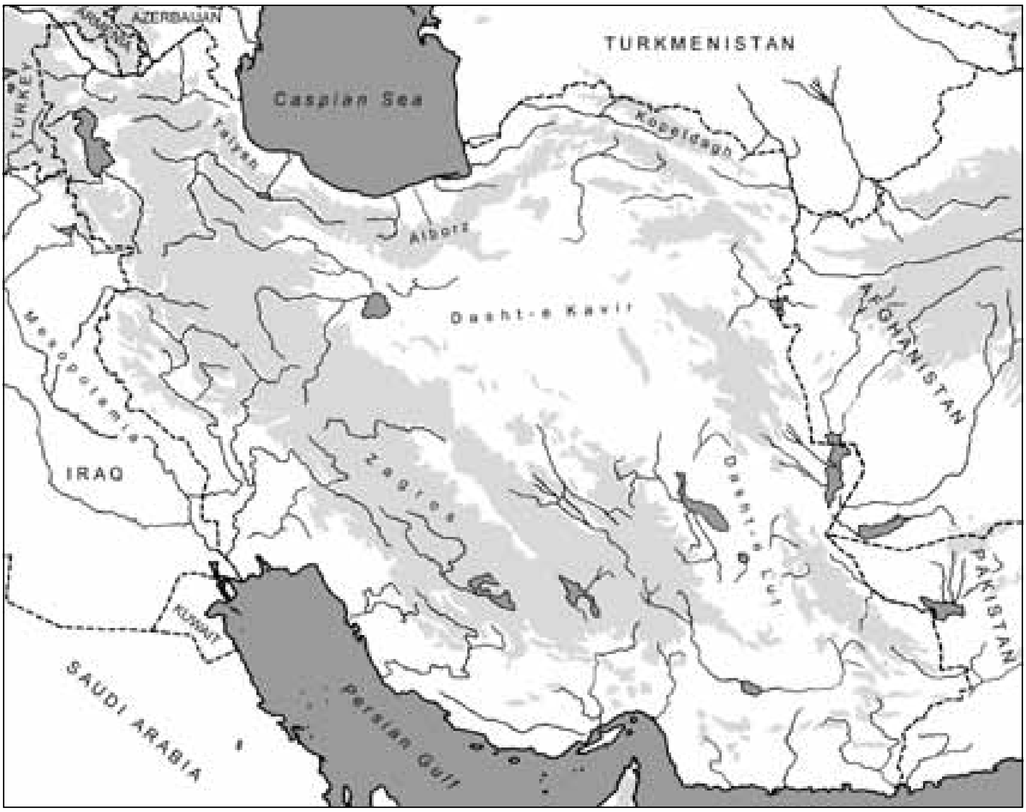

Fig. 1. General map of Iran showing main geographical features (shaded – area above 1500 m a. s. l.).

Table 1. Composition of the bat fauna of Iran and the number of records of particular species according to subsequent reviews (numbers of records are expressed as the number of record sites, similarly as in species maps). Numbers in brackets refer to the records given under a different taxonomic arrangement than that used in the present review

species	Etemad 1969	DeBlase 1980	this review
Rousettus aegyptiacus	5	6	33
Rhinopoma microphyllum	3	15	38
Rhinopoma muscatellum	[7]	17	42
Rhinopoma hardwickii	3	7	12
Rhinolophus ferrumequinum	12	25	61
Rhinolophus bocharicus	–	1	–
Rhinolophus hipposideros	6	13	36
Rhinolophus euryale	6	10	17
Rhinolophus mehelyi	–	4	14
Rhinolophus blasii	5	17	28
Hipposideros fulvus	–	–	1
Asellia tridens	9	16	37
Triaenops persicus	2	4	5
Taphozous perforatus	–	2	7
Taphozous nudiventris	3	6	11
Myotis blythii	14	32	98
Myotis bechsteinii	–	1	4
Myotis nattereri	–	–	2
Myotis schaubi	[1]	[3]	10
Myotis emarginatus	8	10	20
Myotis mystacinus morpho-group	7	14	23
Myotis capaccinii	2	5	11
Vespertilio murinus	1	3	7
Eptesicus serotinus	10	13	25
Eptesicus pachyomus	–	–	2
Eptesicus nilssonii	1	1	2
Eptesicus bobrinskoi	1	1	1
Eptesicus anatolicus	[3]	[4]	10
Eptesicus bottae	–	–	2
Eptesicus ognevi	–	[3]	5
Rhyneptesicus nasutus	1	5	9
Hypsugo savii	–	4	19
Hypsugo arabicus	–	–	1
Pipistrellus pipistrellus	9	29	63
Pipistrellus pygmaeus	–	–	2
Pipistrellus kuhlii	31	56	107
Nyctalus noctula	3	4	6
Nyctalus lasiopterus	–	1	1
Nyctalus leisleri	[1]	4	9
Otonycteris hemprichii	1	1	15
Otonycteris leucophaea	–	[1]	3
Barbastella barbastellus	–	[1]	4
Barbastella darjelingensis	[3]	[3]	6
Plecotus auritus	–	–	1
Plecotus macrobullaris	[3]	[4]	12
Plecotus strelkovi	[1]	[1–2]	1–2
Miniopterus pallidus	[8]	[23]	50
Tadarida teniotis	–	4	26
Nyctinomus aegyptiacus	–	1	3
total number of records (at minimum)	170	375	902
total number of species	28	38	50
average number of records per species	6.1	9.9	18.0

such an enormous taxonomical focus on the bats of Iran emphasises valuability of the Iranian populations for any further taxonomic evaluation of other populations of the respective taxa.

DeBlase (1980) gave a very detailed review of history of the bat research in Iran and summarised descriptions of all records published until the late 1970s. He reviewed data from more than forty literature sources and precisely described the records of bats resulting from two Street expeditions to Iran (held by the Field Museum of Natural History, Chicago, in 1962 and 1968) and from examinations of numerous specimens in several European and US museums. Altogether, he reported 375 records of 38 bat species from Iran (Table 1), complemented by very modern comments on their biology and taxonomy.

Here, we present a review of bat fauna of Iran in the light of new findings in bat taxonomy obtained in the last years (cf. Simmons 2005 and subsequent changes) and records of bats resulting from six field trips (1997–2011) and some other, rather random records, as well as all data available from the published sources. Since the faunal report by DeBlase (1980) represents the most comprehensive summary of the data on Iranian bats available so far, we arranged the present review of the fauna in a similar order and added all new findings concerning the distribution, ecology, taxonomy, echolocation, and ectoparasites of the respective species. We tried to find all news on the bats of Iran that appeared during the last thirty years and complemented DeBlase's (1980) view on biology of the flying mammals in this large and diverse country.

Bat ectoparasites of Iran

Bat ectoparasites represent a special chapter in the biology of bats in Iran, which has not been summarised yet. Here we review the available information from the country as a basis for further discussion in the List of species.

Considering the size of the country and the richness of bat fauna, the literature concerning arthropod ectoparasites of the Iranian bats is rather scarce. Among insect parasites, records of species of the families of bat fleas, Ischnopsyllidae, and bat flies, Nycteribiidae and Streblidae, are available. The bat fleas were studied by Klein et al. (1963), Farhang-Azad (1969b, 1970b), and Peus (1976). They mentioned three species of fleas, *Ischnopsyllus elongatus*, *I. octactenus*, and *Chiropteropsylla brockmani*, found on four bat species (*Asellia tridens*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Nyctalus noctula*). More findings are available in bat flies; Theodor (1967) reported two species, *Nycteribia vexata* and *Penicillidia dufourii*, both from *Myotis myotis* [= *M. blythii*] from the Alborz Mts. Maa (1968) mentioned *Brachytarsina alluaudi* [= *B. diversa*] collected from *Rhinopoma microphyllum*, and *Nycteribia pedicularia* from a mixed collection of hosts composed of *Hipposideros* [= *Asellia* or *Triaenops*] and *Myotis* sp. Kock (1983) first summarised the fauna of bat flies of Iran and also reported new findings of *Brachytarsina flavipennis*, *Nycteribia schmidlii*, *N. vexata*, *Stylidia biarticulata* [= *Phthiridium biarticulatum*], *Penicillidia dufourii*, and *P. conspicua* from various species of host bats collected in northern Iran. Hůrka (1984a) first mentioned records of *Eucampsipoda hyrtlii* [= *E. aegyptia*] from *Rousettus aegyptiacus* and *Raymondia huberi* from *Asellia tridens*, both coming from the Hormozgan province.

Concerning bat ticks and mites, species from the families Ixodidae, Spinturnicidae, Myobiidae, Trombiculidae, and Chirodiscidae are known from Iran. Pomerancev (1950) reported occurrence of the long-legged bat tick *Ixodes vespertilionis* from northern Iran, however, no details were given. The first record of this tick with the data on host species (*Myotis blythii*) and locality was published by Vatandoost et al. (2010). Filippova et al. (1976) mentioned a record of the short-legged bat tick *Argas vespertilionis* from *Pipistrellus pipistrellus* as well as four tick species, primarily preferring other mammal groups than bats as hosts, viz. *Ixodes redikorzevi* and *Dermacentor marginatus* (from *Pipistrellus pipistrellus*), *Haemaphysalis erinacei* (from *Nyctalus noctula* and *Otonycteris hemprichii* [= *O. leucophaea*]), and *H. sulcata* (from *Eptesicus ognevi* and *O. hemprichii* [= *O.*

leucophaea]). Uchikawa (1985) described the myobiid mite *Calcaromyobia dusbabeki* from Iran, collected from *Miniopterus schreibersii* [= *M. pallidus*] at an unspecified site. Vercammen-Grandjean et al. (1970) and Kudrâšova (1975) reported five mite species of the family Trombiculidae from different parts of Iran; four of them as new species, viz. *Neoschoengastia elegans* (collected from *Asellia tridens*), *Chiroptella mozdorani* (from *Rhinolophus ferrumequinum*), *C. vavilovi* (from *Rhinopoma hardwickii* s.l.), and *Schoutedenichia chilmirica* (from *Pipistrellus pipistrellus*); and also *Chiroptella aelleni*, collected from *Eptesicus ognevi* in Iran, which was known previously from Afghanistan (Vercammen-Grandjean 1963). However, Kudrâšova (1992) revised taxonomy of the respective group and the mites originally identified as *Chiroptella mozdorani* she re-identified as *Willmannium aelleni*, while those originally referred to *Chiroptella aelleni* she described as a new species, *Willmannium cavum*. Fain (1982) mentioned the chirodiscid mite *Alabidocarpus calcaratus* from *Myotis blythii*.

Records of bat parasites were reported in two recent host-parasite relationship studies on *Myotis blythii* by Sharifi et al. (2008b) and Vatandoost et al. (2010). The former group of authors mentioned only names of genera, *Penicillidia* sp., *Ixodes* sp., and *Spinturnix* sp., without species identification, while the latter group somewhat enigmatically reported several Neotropical species of bat flies* along with specimens identified as *Ixodes vespertilionis* (see above) and Spinturnicidae sp.

MATERIAL AND METHODS

Records

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) [in brackets, number of locality is given as indicated in the map; number in *italics* is not marked in the respective map], 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), and a reference to museum specimen/s.

Taxonomy of bats follows the arrangement by Simmons (2005) with some exceptions; taxonomy of the genus *Eptesicus* follows Juste et al. (in press), that of the tribe Plecotini follows Spitzenberger et al. (2006), Benda et al. (2008), and Benda & Gvoždík (2010), that of the genus *Miniopterus* follows Furman et al. (2010b) and Šrámek et al. (in press), and that of the family Molossidae follows Lamb et al. (2011).

Morphological analysis

For morphological comparisons, we used museum specimens which were examined as described in previous studies (see e.g. Benda et al. 2006). Specimens were measured in a standard way with the use of mechanical or optical callipers. Horizontal dental dimensions were taken on cingulum margins. Bacula were extracted in 4% solution of NaOH and coloured with alizarin red. The examined museum material is mentioned in the respective species chapters, the list of comparative material is given in Appendix II. For the evaluated external and cranial measurements see Abbreviations. Statistical analyses were performed using the Statistica 6.0 software. Other methodological details or aspects are described in the respective chapters giving the statistics.

Genetic analysis

For the genetic part of the study we used an analysis of mitochondrial DNA. Genetic material was obtained from pectoral muscles or wing punches preserved in alcohol. Complete (*Rhinopoma*, *Myotis*) or partial (*Pipistrellus*) sequences of the mitochondrial gene for cytochrome *b* were obtained according to the protocol described by Benda & Vallo (2009); in some *Rhinopoma* samples, sequencing was carried out with newly designed internal primers L15224 (5'-CTAGTAGA-ATGAGTCTGAGGAGG-3') and H15332 (5'-TGTTGGGTTGTTAGATCCTG-3'). For comparisons, sequences from previous studies stored in GenBank were used (Ruedi & Mayer 2001, Benda et al. 2003, 2004b, Hulva et al. 2004, 2007b, Kawai et al. 2003, 2006, Tsytsulina et al. 2012). Uncorrected (*p*) genetic distances and phylogenetic reconstructions were obtained using the PAUP 4.0b10 software under maximum parsimony (MP) and Bayesian methods. Additional NJ tree based on the *p* distances was calculated for representation purpose of *Pipistrellus* phylogeny. MP was carried out using heuristic search of 100 sequence addition replicates and TBR swapping algorithm. Nodal support was assessed by 1000× non-paramteric bootstrapping. Bayesian analysis was carried out in two independent runs of one million (*Rhinopoma*)

* the records of Neotropical dipteran ectoparasites reported by Vatandoost et al. (2010) from Iran seem to be completely erroneous. Since we consider these records certainly misidentified, they are not mentioned in the review of bat parasites of Iran given below.

or five millions (*Myotis*, *Pipistrellus*) generations, respectively, under GTR+Γ+I substitution model, with first 25% discarded as burn-in.

Sound recordings and analysis
Acoustic recordings were made using a portable ultrasound detector D-240x (Pettersson Elektronik AB, Uppsala, Sweden) set on time-expansion mode connected to Edirol R-09HR recorder (Roland Corp., Japan). The analysed bat calls were recorded in free flight under natural conditions, usually near the sites where the bats were also mist-netted which allowed us to be confident in bat species determination. Several echolocation call sequences were recorded when handling the bat in a resting position (*Rhinolophus blasii*, *Asellia tridens*), hand-releasing the bat at capture sites (*Rhinopoma microphyllum*, *R. muscatellum*, *R. hardwickii*, *Taphozous perforatus*, *Nyctalus leisleri*) and hand-releasing the bat inside a closed room in a building (*Otonycteris hemprichii*).

The recordings were analysed with the BatSound Pro 4.00 software (Pettersson Elektronik AB, Uppsala, Sweden). Time-expanded sequences (expansion factor 10) were digitised at the sampling rate 48 kHz with 16-bit precision and saved as *wav files. A 1024 pt. FFT with Hanning window was used for the analyses; oscillograms, power spectra and spectrograms were evaluated. For each echolocation call, the following parameters were measured: pulse duration (PDUR), start frequency (SF), end frequency (EF, both SF and EF at –30 dB below the peak power spectral intensity), frequency of maximum energy (FMAXE) and inter-pulse interval (IPI, the time between two consecutive calls). In most cases, we used only high quality recordings for analyses. Only the search phase calls were measured.

In total, we analysed 68 call sequences (426 calls) of at least 24 bat species. Most figures of spectrograms of echolocation sequences in the text serve as an illustration of real field conditions, and, hence, they show a real time of particular recording on the time axes.

Diet composition analysis
We collected sets of faecal pellets during our field studies for further examination. Content of digestive tracts was analysed from museum specimens. Pellets were disassembled in a Petri dish filled with water under a binocular microscope. Particular pieces of prey were identified to the order or family level and the percentage volume of prey categories was estimated for each pellet. The total volume of each diet item in a sample was counted as a mean value per sample. Digestive tracts were dissected in a Petri dish filled with water and the percentage volume of particular prey categories was estimated for each tract. The number of analysed pellets or digestive tracts regarding particular species is mentioned in the corresponding chapter and in the legends of the respective figures.

Ectoparasites
Ectoparasites were collected directly from the captured bats and preserved in alcohol. Individuals of the families Cimicidae, Nycteribiidae and Streblidae were simply examined under microscope, selected specimens of bat flies (Nycteribiidae and Streblidae) were dissected and examined under microscope in detail. Fleas (Ischnopsyllidae) were examined under microscope after the following preparation procedure: (1) flushed in distilled water; (2) left for 24–48 hours in 15% KOH solution; (3) flushed in distilled water; (4) left for 10–15 minutes in concentrated acetic acid; (5) flushed in propanol; (6) mounted in the 'Liquid de Swan' to permanent microscopic slides. Mites (Spinturnicidae and Macronyssidae) were mounted in the 'Liquid de Swan' to permanent microscopic slides after exposition to 15% KOH solution. Selected specimens of the Argasidae and Ixodidae families were mounted as permanent preparations. The parasites were determined with the help of identification keys (Hoogstraal 1955, Theodor 1967, 1975, Arthur 1956, Hopkins & Rothschild 1956, Aellen 1959b, Rudnick 1960, Vermeil 1960, Till & Evans 1964, Filippova 1966, Usinger 1966, Radovsky 1967, Hůrka 1969, 1970, Yamaguti 1971, Micherdziński 1980, Aktaş 1987, Peribáñez-López et al. 1989, Estrada-Peña 1990). In the insect parasites (Cimicidae, Nycteribiidae, Streblidae, Ischnopsyllidae), we identified sex and stage of the life cycle (ma – adult male, fa – adult female); in ticks (Argasidae, Ixodidae) sex and stage (larva, nymph, and adult – see insects); and in mites (Spinturnicidae, Macronyssidae) sex and stage (protonymph, deutonymph, and adult – see insects). The lists of ectoparasite records (arranged in taxonomical, alphabetical and/or chronological orders) include, for each item, the following information: name of the family, species name, number and stage/sex of the specimens recorded, number and sex of hosts, name of the locality, and date of collection; according to these data the record is detectable in the Records paragraph, where other circumstances of the record are available. Taxonomy and nomenclature of ectoparasites follow Maa (1965a), Theodor (1968) and Guglielmone et al. (2010).

ABBREVIATIONS

Collection acronyms
AUB = American University Beirut, Lebanon; – BMNH = Natural History Museum, London, United Kingdom; – CMŠ = Martin Ševčík private collection, Nitra, Slovakia; – CUP = Department of Zoology, Charles University, Prague, Czech Republic; – ESMK = East Slovakian Museum, Košice, Slovakia; – FMNH = Field Museum of Natural History, Chicago, USA; – HMNH = Hungarian Museum of Natural History, Budapest, Hungary; – HMSC = Hans M. Steiner private collection, Vienna, Austria; – HZM = Harrison Zoological Museum, Sevenoaks, England; – DET = Department of En-

vironment, Tehran, Iran; – IMC = Indian Museum Calcutta, India; – IPHR = Iran Public Health Research, University of Tehran, Tehran, Iran; – IPT = Institute d'Pasteur, Tehran, Iran; – ISEA = Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland; – IVB = Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, Brno, Czech Republic; – JOC = Ján Obuch private collection, Blatnica, Slovakia; – KAUM = Karaj Agricultural University Museum, Karaj, Iran; – MHNG = Natural History Museum, Geneva, Switzerland; – MMTT = National Museum of Natural History, Tehran, Iran; – MNHN = National Museum of Natural History, Paris, France; – MSNG = Civil Natural History Museum Giacomo Doria, Genoa, Italy; – MUB = Department of Zoology, Masaryk University, Brno, Czech Republic; – MZST = Museum and Institute of Zoological Systematics, University of Torino, Turin, Italy; – MZUF = Natural History Museum, Florence, Zoology Section "La Specola", Italy; – NHMB = Naturhistorisches Museum Bern, Switzerland; – NMNHS = National Museum of Natural History, Sofia, Bulgaria; – NMP = National Museum (Natural History), Prague, Czech Republic; – NMW = Natural History Museum, Vienna, Austria; – OHC = Otto von Helversen collection, Erlangen, Germany; – ROM = Royal Ontario Museum, Toronto, Canada; – RSCN = collection of the Royal Society for the Conservation of Nature, 'Amman, Jordan; – RUBC = Razi University Bat Collection, Razi University, Kermanshah, Iran; – SMF = Senckenberg Museum and Research Institute, Frankfurt am Mein, Germany; – SNMB = Slovak National Museum, Bratislava, Slovakia; – SMNS = State Museum of Natural History, Stuttgart, Germany; – SMMZ = South Moravian Museum in Znojmo, Czech Republic; – UIM = University of Illinois Museum, Urbana, USA; – UMM = University of Michigan Museum, Ann Arbor, USA; – USNM = National Museum of Natural History, Washington D.C., USA; – ZDNU = Department of Zoology, Niğde University, Niğde, Turkey; – ZFMK = Zoological Institute and Museum Alexander Koenig, Bonn, Germany; – ZIN = Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia; – ZMB = Zoological Museum, Humboldt University, Berlin, Germany; ZMMU = Zoological Museum, Moscow State University, Moscow, Russia.

Measurements

External dimensions. LC = head and body length; – LCd = tail length; – LAt = forearm length; – LPl = thumb length (without claw); – LA = auricle length; – LTr = tragus length; – LaFE = horseshoe width; – G = body weight; IV.D1 = length of proximal phalanx of the fourth wing finger; IV.D2 = length of medial phalanx of the fourth wing finger.

Cranial dimensions. LCr = greatest length of skull (incl. the praemaxilla in *Rhinolophus*); – LOc = occipito-canine length; – LCb = condylobasal length; – LCc = condylocanine length; – LaZ = zygomatic width; – LaI = width of interorbital constriction; – LaPO = width of postorbital constriction; – LaInf = infraorbital witdth; – LaN = neurocranium width; – LaM = mastoidal width; – ANc = neurocranium height; – LBT = largest horizontal length of tympanic bulla; – CC = rostral width between canines (incl.); – P^2P^2 = width of the rostral constriction at the first upper premolars (in *Myotis bechsteinii*); – P^4P^4 = rostral width between the large upper premolars (incl.); – M^2M^2 = rostral width between the second upper molars (incl.); – M^3M^3 = rostral width between the third upper molars (incl.); – IM^3 = length of upper tooth-row between I^1 and M^3 (incl.); – CM^2 = length of upper tooth-row between C and M^2 (incl.); – CM^3 = length of upper tooth--row between C and M^3 (incl.); – M^1M^3 = length of upper tooth-row between M^1 and M^3 (incl.); – CP^4 = length of upper tooth-row between C and P^4 (incl.); – P^2P^3 = length of upper tooth-row between P^2 and P^3 (incl.); – LMd = condylar length of mandible; – ACo = height of coronoid process; – IM_3 = length of lower tooth-row between I_1 and M_3 (incl.); – CM_3 = length of lower tooth-row between C and M_3 (incl.); – M_1M_3 = length of lower tooth-row between CM_3 (incl.); – CP_4 = length of lower tooth-row between C and P_4 (incl.); – P_2P_3 = length of lower tooth-row between P_2 and P_3 (incl.).

Dental dimensions (in the *Myotis mystacinus* morpho-group). LCn = mesio-distal length of the upper canine; – LaCn = labio-palatal width of the upper canine; – RCn = canine ratio (LCn/LaCn); – P^3 = mesio-distal length of the second small upper premolar; – P^4 = labio-palatal width of the large upper premolar; – ACin = hight of cusp on the mesio-palatal margin of cingulum on the large upper premolar; – M^1 = labio-palatal width of the first upper molar; – M^2 = labio-palatal width of the second upper molar; – M^3 = labio-palatal width of the third upper molar; – P_3 = mesio-distal length of the second small lower premolar.

Others

a = adult; – A = alcoholic preparation; – B = stuffed skin (balg); – coll. = collected; – det. = detected by a bat detector; – df = degrees of freedom; – exam. = examined; – f = female; – F = F value of ANOVA; – G = pregnant; – j = juvenile; – m = male; – M = mean; – max., min. = dimension range margins; – net. = netted; – obs. = observed; – p = probability; – P = slide preparation; – rec. = a call recording collected; – s = subadult; – S = skull; – SD = standard deviation; – Sk = skeleton; – Sf = skull fragments.

LIST OF SPECIES

Rousettus aegyptiacus (Geoffroy, 1810)

Records. **Original data**: B u s h e h r: Kuh-e Namak [1], 8 km S of Esmâil Mahmudi, 52 km SE of Khormuj, 28 March 2009: obs. a group of ca. 20 inds. (leg. M. Filippi), 14 October 2011: obs. traces of a colony (cf. Benda et al. 2011a). – F â r s:

Bishapur [2], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April 2000: obs. colony of ca. 500 inds. (mixed with a colony of *Myotis blythii*), remnants of 2 inds. (2 right and 2 left mandibles, fragments of a skull) found in *Bubo bubo* pellets, 6 October 2011: obs. a colony of ca. 300 inds., net. 3 ma, 2 fG, 1 fL(+juv), 2 fa, 1 fs in the cave, coll. 1 ma (NMP 93873; cf. Benda et al. 2011a); – Bushigân Deilami [3], 15 km NW of Kâzerun, small cave, 7 October 2011: obs. 3 roosting inds. (cf. Benda et al. 2011a); – Jahrom, Sang Eshkan [4], artificial caves, 21 November 2009: obs. a colony, 8 October 2011: obs. a colony of ca. 50 inds., net. 4 ma, 2 mj, 1 fG, 3 fa, coll. 2 ma (NMP 93890, 93891; cf. Benda et al. 2011a); – Mâniân [5], 33 km WNW of Jahrom, cave, 20 November 2009: obs. a colony, 8 October 2011: obs. traces of a large colony (cf. Benda et al. 2011a); – Tang-e Tekhe [6], 34 km NW of Jahrom, small cave, 8 October 2011: obs. 7 inds. (cf. Benda et al. 2011a); – Tang-e Zorok [7], 40 km NW of Jahrom, small cave, 22 November 2009: obs. a colony of ca. 50 inds., net. 2 inds. (cf. Benda et al. 2011a). – H o r m o z g â n: 3-N salt cave [8], south-eastern part of Namakdân, 12 km ENE of Kani, SW Qeshm Is., Spring 2005: obs. small group of less than 10 inds. (photo; leg. M. Filippi, cf. Benda et al. 2011a); – Âli Âbâd [9], palm grove, NE of Darpahn, 25 August 2012: obs. 1 ind. feeding on a palm tree (leg. T. Ghadirian); – Bongaru [10], 16 km W of Dehbârez, pseudokarst cave, Spring 2011: obs. a colony (leg. G. H. Yusefi & H. Fahimi), 11 October 2011: obs. a colony of ca. 40 inds. (exam. 1 fL+juv) (cf. Benda et al. 2011a); – Chahâr Dahaneh [11], 12 km ENE of Dehbârez, river valley, 17 April 2000: remnant of 1 ind. (left part of rostrum) found in *Strix butleri* pellets (cf. Benda et al. 2011a); – Isin [12], 15 km N of Bandar Abbâs, 29 April 1977: shot 2 ma, 1 fa, 2 fG, 1 ind. juv, 2 May 1977: shot 1 ma, 1 fa, 2 fG (NMP 40467/1–40467/10; leg. B. Pražan, cf. Hůrka 1984a, Benda et al. 2006, 2008, 2011a); – Pâsorkhi gorge [13], 4 km E of Dehbârez, rocky overhangs, 11 October 2011: obs. traces of frequent presence

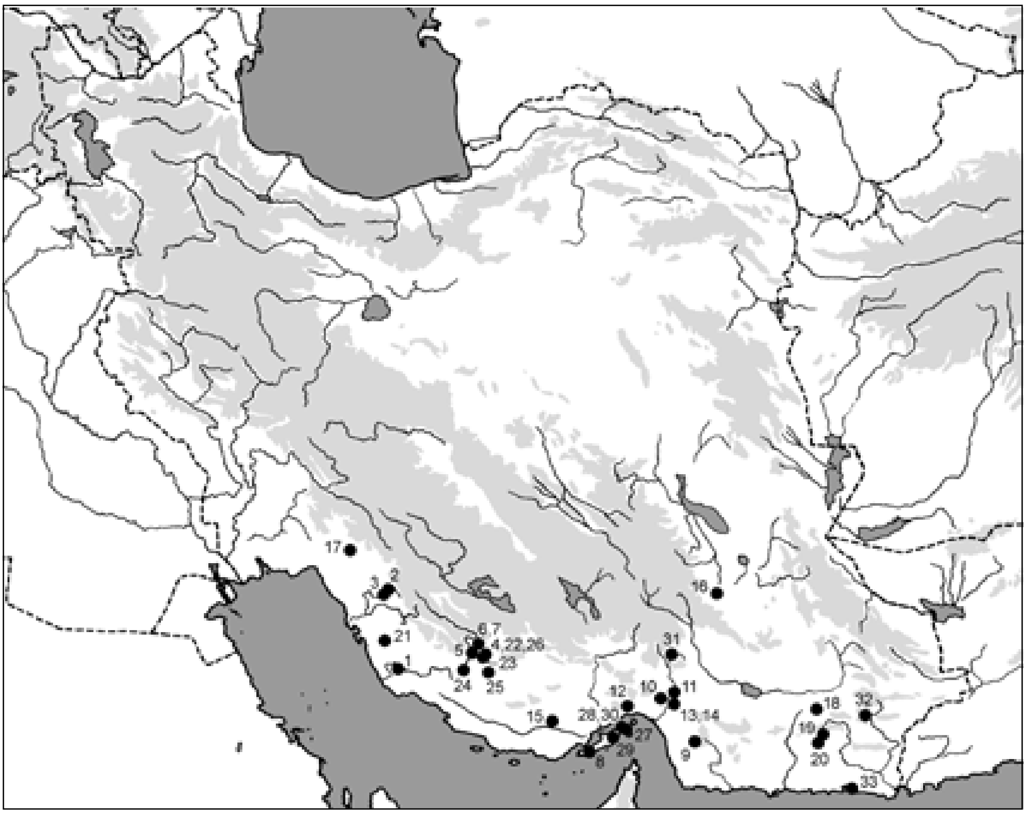

Fig. 2. Records of *Rousettus aegyptiacus* (Geoffroy, 1810) in Iran.

(cf. Benda et al. 2011a); – Podonu [14], 10 km E of Dehbârez, palm oasis, 10 October 2011: net. 1 ma, 2 fa, 1 fj, coll. 1 ma (NMP 93897; cf. Benda et al. 2011a), det. & rec. calls of 1 foraging ind.; – Zangârd [15], 25 km E of Bastak, palm oasis, 9 October 2011: net. 1 ma, 1 mj, 2 fa, 1 fj, coll. 1 ma (NMP 93896; cf. Benda et al. 2011a). – K e r m â n: Arg-e Bam [16], Bam, ruined fortress town, 8 April 2000: found a mummy of a juvenile (NMP 48375; cf. Benda et al. 2011a). – K o h g i l u y e v a B o y e r A h m a d: Espar cave [17], 45 km N Gachsârân, September 2010: obs. a colony of ca. 500–600 inds. (leg. M. Sufi & M. Chalâni). – S i s t â n v a B a l u c h e s t â n: oasis 4 km S of Espakeh [18], 68 km SW of Irânshahr, date palm grove, 10 April 2000: net. 5 ma, 6 fG, coll. 5 ma, 5 fa (NMP 48377–48386; cf. Benda et al. 2006, 2008, 2011a, Hulva et al. 2012); – Darukhan [19], 25 km NNE of Nikshahr, small cave, 4 October 2011: obs. a colony of ca. 300 inds. (leg. M. Chalâni, cf. Benda et al. 2011a); – Nikshahr [20], W edge of the town, crevice, 23 November 2011: obs. a colony of ca. 50 inds. (leg. M. Chalâni, cf. Benda et al. 2011a). – **Published data**: B u s h e h r: Khâyeez Mts. [21], SE Ahram, 2009: obs. 1 ind. (Abdoli et al. 2010). – F â r s: 1.6 km. west of Jahrom [22], cave, 31 December 1962: obs. 15–20 inds., coll. 5 m, 3 f, FMNH (Lay 1967, DeBlase 1980) = 4 km WSW of Jahrom, 31 December 1962 and 1 January 1963: 4 ma, 1 ms, 2 fs, FMNH (Bergmans 1994); – 5.3 km. (3.3 miles) SW Jahrom [23], cave, 12 November 1968: coll. 1 ma, FMNH (DeBlase 1980, Bergmans 1994); – Âbgarm [24], 20 km S Qir (Akmali et al. 2011a); – Ahmad Mahmoudi [25], cave, 1 January 1963: obs. “a smaller colony of five or six bats”, coll. 1 ma, 1 fs, FMNH (Lay 1967, DeBlase 1980, Bergmans 1994); – Bushigân Deilami [3], 17 km NW Kâzerun (Akmali et al. 2011a); – Jahrom [4], Sang Eshkan, man-made cave (Akmali et al. 2011a); – Jahrom, Simakân [26], Sisân garden, 11 September 2004: coll. 1 f (Zohoori et al. 2004), 15 June 2006: coll. 1 ma, 5 fa, 5 mj, 1 fj [2 inds., HMNH] (Zohoori 2007); – Mâniân cave [5], 33 km E Jahrom (Akmali et al. 2011a). – H o r m o z g â n: Namakdún [= Namakdân] [8], on the south coast of the island of Kishm [= Qeshm], abundant in caves excavated in rock salt (Blanford 1876 [as *Cynonycteris amplexicaudata*]), Kishm Island, Persian Gulf, taken in the Nemakdun Salt-caves, 1872: 1 ma, IMC (Dobson 1876 [as *C. amplexicaudata*], Anderson 1881 [as *C. amplexicaudata*]), Kishm Island, large salt-caves, shot several inds. (Blanford 1888 [as *Xantharpyia amplexicaudata*]), I. Kishm (Trouessart 1897 [as *Cynonycteris amplexicaudata*], 1904 [as *Rousettus amplexicaudatus*]); – Qeshm [27], Qeshm Island, 11 inds. [August 2006: 1 fj, HMNH] (Zohoori 2002a, b, Zohoori et al. 2005, 2007); – Kâboli Orchard [28], Qeshm Island, 22–27 April 2002: obs. (Zohoori 2002a, b, Zohoori et al. 2005); – Ramakân [29], Qeshm Island, 30 April – 2 May 2002: coll. 1 f, 3 inds. (Zohoori 2002a, b, Zohoori et al. 2005), 2006: coll. 1 m, 3 f (Zohoori 2007); – Turgân Orchard [30], Qeshm Island, 2001: obs. (Zohoori 2002a, b, Zohoori et al. 2005). – K e r m â n: Hur-e Pâsefid [31], Fâriâb, Jiroft, 2005: 1 f (Sepahi-Rad 2005). – S i s t â n v a B a l u c h e s t â n: Chazan [32], near Sarbâz, Irânshahr, 3 m, 2 f [19 May 2006: 1 fs, HMNH] (Zohoori 2007); – Tiss [33], [9 km. from] Châh’bahâr, agricultural garden, March 1967: obs. some inds. on the fig trees (Etemad 1969, DeBlase 1980), 8 March 1975: 2 f (Etemad 1984); – Iran-Belutschistan, January 1954: 1 ma, SMNS (Eisentraut 1959), Baluchistan (no exact locality), 1 ind., BMNH (DeBlase 1980). – Iran (undef.): Perse (Trouessart 1879 [as *Cynopterus amplexicaudatus*]).

Distribution. *Rousettus aegyptiacus* is a rather common and widespread bat in the southern part of Iran; concerning the whole country, it also belongs to very frequent bats – at least 33 record sites are known from Iran (Fig. 2). Similarly as the few records summarised by DeBlase (1980), all new records come from the southernmost portion of the country, south of 31° N and mostly from the areas adjacent to the coasts of the Persian Gulf and Gulf of Oman and to the rather arid south-Iranian mountain ridges (not exceeding 1500 m a. s. l.). In terms of area, the Iranian range represents a substantial portion of the south-Asian part of the species distribution range, continuing southward in south-eastern Arabia across the Strait of Hormuz (Oman and UAE) and marginally also eastward in southern Pakistan, which is the eastern border of the species range (Roberts 1997, Mahmood-ul-Hassan et al. 2009, Benda et al. 2011a). However, in general *R. aegyptiacus* represents an Afro-tropical faunal element which stretches to the Palaearctic only in a small part of a distribution range (Bergmans 1994, Kwiecinski & Griffiths 1999).

DeBlase (1980) reported the occurrence of *R. aegyptiacus* from three rather separated regions of southern Iran; the central Fars province (three sites), Qeshm island (one site) and southern Baluchestan (one site). New records here reviewed interconnect these three occurrence spots; the final picture shows more or less continuous distribution from the easternmost edge of Iranian Mesopotamia, via the south-Iranian uplands and coastal areas to the Mekran area of southern Baluchestan. However, as expected already by DeBlase (1980), *R. aegyptiacus* was evidenced in numerous desert oases (Bam, Espakeh, Manian, Podonu, Zangard, etc.) with established fruit (namely date) productions. The record of a mummy from Bam (Fig. 6; in the basin of the Dasht-e Lut Desert) represents the most inland site of occurrence of this species in Iran (ca.

280 km from the sea coast) and continental Asia as well. The record comes from an area with the most continental climate of the Iranian range of distribution of *R. aegyptiacus* and – due to the harsh winter conditions in the area – possibly delineates the climatic/geographical limits for the fruit bats' ability to survive in long-term (cf. Benda et al. 2011a).

Most of the new records of *R. aegyptiacus* (70%) come from the Fars and Hormozgan provinces, where they more abundantly depict the species' distribution range and its natural limits. The records from the western part of the Fars province and from the provinces of Bushehr and Kohgiluye va Boyer Ahmad represent a newly discovered area of occurrence of the species in Iran, prolonging its known range by some 350 km to the north-west from the Jahrom region of Fars (cf. DeBlase 1980). Similarly, the records from the continental part of the Hormozgan province represent a newly documented range section extending also to the southeast of the Kerman province. DeBlase (1980) reviewed only one record from Baluchestan, from a garden in Tis near Chabahar on the coast of the Gulf of Oman (Etemad 1969; besides two unspecified Baluchestani specimens in BNMH and SMNS, see Records). The present review shows wider distribution in southern Baluchestan, comprising also the basins of the Sarbaz and Kaju rivers.

The oldest record available from the Iranian territory is known from the Namakdam salt karst system in the south-western part of the Qeshm Island in the Strait of Hormuz (Blanford 1876). The existence of the fruit bat colony in this area has been recently confirmed by a Czech speleological expedition examining the phenomena of salt karsts in southern Iran (another similar record was made in the salt cave system of Kuh-e Namak, Bushehr province). The recent record of a large colony from the Espar cave near Gachsaran (Kohgiluye va Boyer Ahmad province) represents the westernmost and northernmost evidence of *R. aegyptiacus* in Iran as well as in the whole region surrounding the Persian Gulf (30° 36' N, 50° 45' E). The species still remains unknown from Mesopotamia *per se*, both in the Iranian (Khuzestan, Ilam) and Iraqi parts (see Harrison & Bates 1991, Benda et al. 2011a).

Field notes. Vast majority of the Iranian records of *Rousettus aegyptiacus* referers to particular roosts, only exceptionally this bat was netted or found in owl pellets. Roosts inhabited by colonies of *R. aegyptiacus* were found at least at ten sites in Iran; in most instances the colony size was restricted to several tens of bats only, however, large colonies were also observed. Perhaps the largest colony of the fruit bats was found in a large cave above the Sasan spring at Bishapur (Fars); ca. 500 bats were observed there in April 2000 and about 300 individuals in October 2011. The cave is rather poorly accessible, situated in a rock wall about 40 m above the bottom of a valley with a stream and fruit orchards (Fig. 14). The colony roosted in ca. 30 m long, dark corridor leading from the large entrance hall (ca. 50×60×20 m). The corridor about 2 m wide and more than 3 m high was almost without daylight, while the hall was partially under daylight from two huge openings, an entrance portal (ca. 20×10 m; see Fig. 14) and a window in the hall ceiling. Another colony of ca. 300 bats was found in a small cave in a very arid landscape at Darukhan (Baluchestan) on 4 October 2011. A large colony of some 500 individuals was found in the Espar cave in the south-western Zagros Mts. (Kohgiluye va Boyer Ahmad) in September 2010.

About a hundred individuals were observed in a small cave in the Tang-e Zorok valley on the northern slope of the Gorm Mts. (NW of Jahrom, Fars) on 22 November 2009, a group of seven individuals was found in a small cave (see Benda et al. 2011a: 24, Fig. 23) in the Tang-e Tekhe valley, parallel to the former site, on 8 October 2011. The group was hanging in a ceiling niche (short chimney) some 4 m above the cave floor (Fig. 3); the cave is a shallow cavity, some 10 m deep, completely under daylight. Although the observed number of bats was rather low, the deposit of guano on the cave bottom indicated past appearance of a larger colony of fruit bats and a long-time use of the cave. Another indication of the traditional use of this cave by fruit bats

Fig. 3. A group of *Rousettus aegyptiacus* (Geoffroy, 1810) roosting in a small cave in the Tang-e Tekhe valley (Fars). Photo by A. Reiter.

was a written mark on the rock at the cave entrance evidencing fumigation of the cave in the late 1960s (Fig. 4).

A smaller colony of *R. aegyptiacus* was found in a system of artificial underground spaces (disused sandstone mines) of Sang Eshkan in a hill at the southern margin of the town of Jahrom (Fars) in November 2009 and October 2011; the system consists of a checkered arrangement of square-shaped excavated spaces (chambers) and 'columns' (rests of the unexcavated material), some of the chambers with broken and fallen ceilings, creating a number of smaller spaces, fissures and crevices, well useful as roosts (Figs. 60, 61). A group of ca. 50 bats was repeatedly observed in the deepest part of the system. Although the general character of this roost is a cave, the locality represents one of two artificial roost sites of *R. aegyptiacus* documented from Iran.

Another colony of fruit bats was found in a cave in a rock wall above the oasis of Manian (33 km WNW of Jahrom; Fig. 13) in November 2009; during another visit in October 2011, only guano and other traces of a former large colony of fruit bats were observed there. The cave is a tunnel-like space with two openings, but only one of them is accessible for people; the cave is ca. 40 m long and 15 m wide, but only about 2–3 m high. This low ceiling probably enabled to exterminate fruit bats from the cave, perhaps by inhabitants of the close oasis below the rock.

A colony of some 50 bats was found in a rock crevice at the western margin of the town of Nikshahr (Baluchestan) on 23 November 2011. From a similar habitat, an arid rocky landscape at

Bongaru in the Hezarmani Mts. (near Dehbarez, Hormozgan), there is the only finding of a colony of fruit bats from natural pseudo-karst conditions; the group of about 40 individuals was localised in a deep crevice (crack) between huge boulders and on surrounding walls of these boulders during two visits in 2011 (see Benda et al. 2011a: 24, Fig. 25).

In other roosts, only individuals or small groups of *R. aegyptiacus* were observed. A group of some 20 bats was found in an almost impassable corridor with an underground stream in the salt karst of the Kuh-e Namak Mts. near Kormuj (Bushehr) on 28 March 2009. Finding of a small group of about 15–20 individuals in a cave 1.6 km west of Jahrom (Fars) on 31 December 1962 was reported by Lay (1967); he also added (p. 131): "a colony […] hung clustered in the hot, humid apical chamber of the cave", describing the cave as follows (p. 82): "a large orifice led up to and terminated in an apex 15–20 m. above the bottom of the opening. The apical chamber was totally dark and over 80° F. [= 26.7 °C] in contrast to indirect light and cool temperatures approaching the 50° to 60° F. [= 10.0–15.6 °C] of the lower chamber."

The same author mentioned another record: "a smaller colony of five or six bats occupied the highest retreat in the ceiling of the large cave at Ahmad Mahmoudi" on 1 January 1963 (Lay 1967: 132); he described the cave as follows: "[it] consisted of one room roughly 30 m. long and 15 to 20 m. wide with an opening 15 m. wide by 5 m. high. The anterior half was very dry, and about halfway in, the floor inclined sharply toward the rear. Water dripped from the ceiling creating a slippery coating of mud and guano. A cluster of eight [?] *R. aegyptiacus* occupied the largest of several cone-shaped pockets in the roof, and left the cave upon disturbance. Uniformly moderate temperatures prevailed in this cave." (p. 83).

A small group of only three fruit bats was observed to roost in a small cave in the Bushigan Deilami area near Bishapur (Fars) on 7 October 2011; the cave is a shallow overhang in a dry shrubland landscape (Fig. 5), about 10 m deep, bats hung in a cluster in a small niche of the cave ceiling. The observed number of bats was low, however, the deposit of guano found on the cave

Fig. 4. A mark on the rock at the cave entrance evidencing fumigation in the small cave in the Tang-e Tekhe valley. Photo by A. Reiter.

Fig. 5. Bushigan Deilami valley (Fars), a habitat and a roost of *Rousettus aegyptiacus.* Photo by A. Reiter.

floor indicated a former higher number of fruit bats in the cave and/or its long-time use. One fruit bat was found by DeBlase (1980: 43–44) in a cave situated 5.3 km south-west of Jahrom on 12 November 1968: "the specimen […] hung in a high, dark dome above a large, light chamber just inside the wide cave entrance. The cave did not penetrate beyond this single large room, but the high ceiling contained several domes approximately 4 ft. in diameter. Beneath three of the unoccupied domes were accumulations of guano, but there was no guano beneath the dome occupied by the fruit bat. This cave was the largest of many located in one of the several canyons extending in a north-south direction through the group of flat-topped hills WSW Jahrom […]. The entire area was nearly devoid of vegetation, with the closest fruit and water (?) located in Jahrom." More or less similar characteristics can be used for description of most of the roosts of *R. aegyptiacus* and their position in the landscape within the Fars province. Since small numbers of fruit bats were documented in a number of rather small cavities and in some places only guano was found in the southern Zagros Mts., the groups (or even colonies) of fruit bats seem to use a larger number of alternative roosts (at least seasonally) in smaller groups of individuals, rather than one traditional roost in large aggregation. This may reflect frequent disturbances by people in the roosts.

A mummy of a juvenile individual (most probably already able to fly) was found in a ceiling fissure of a soil-constructed house within the ruined fortress town of Arg-e Bam (Kerman) on 8 April 2000 (Figs. 6, 130). The finding represents the second evidence of a man-made roost site of *R. aegyptiacus* in Iran.

Blanford (1876: 18–19) reported a finding of fruit bats at the Qeshm island, Persian Gulf, which he described as follows: "I found this species abundant in caves excavated in rock salt at a spot called Namakdún, on the south coast of the island of Kishm […]. […] The circumstance of this bat living on molusca [!] explains the occurrence of a species belonging to the *Pteropidæ* in so dreary a desert as the island of Kishm, where a fruit-eating bat could scarcely exist." At the same place, in the Namakdan hill in the south-eastern part of the Qeshm island, in the natural "3-N cave", a group of less than ten fruit bats was observed in spring 2005, in conditions similar to the Kuh-e Namak Mts. of the Bushehr province (see above). There is a question whether the cave system is identical with that visited by Blanford or whether Blanford really visited man-made cavities remaining after salt mining. Blanford's opinion (with a reference to Dobson) that fruit bats without a supply of plants in sufficient distance to their roost feed on marine "mollusca left exposed by the tide on the sea coast" (Blanford 1876: 19) is also noteworthy. However, the north-eastern part of the Qeshm island, covered by villages with gardens and other crop production and fringed by extensive mangrove forests, provide sufficient food basis for *R. aegyptiacus* (cf. Zohoori et al. 2007), thus, fruit bats from the Namakdan caves certainly do not have to wait for low tide for shellfish harvesting.

Findings of individuals or small groups of *R. aegyptiacus* in various caves were also reported by some other authors (Etemad 1967, 1984, Akmali et al. 2011a), however, they did not specify the date or season of their records neither details concerning the records (number, sex and/or age of the recorded bats).

In several roosts, *R. aegyptiacus* was observed along with other bat species. Lay (1967) described a finding of fruit bats together with *Rhinopoma microphyllum* and *R. hardwickii* [in fact, *R. hardwickii* s.str. and *R. muscatellum* were identified among collected samples of the latter species from the site; van Cakenberghe & de Vree 1994] in the large cave at Ahmad Mahmoudi. From the cave situated 1.6 km (or 4 km) west of Jahrom, Lay (1967) reported presence of *Rousettus aegyptiacus* and *Rhinopoma hardwickei* [= *R. muscatellum*; DeBlase et al. 1973]. In the large cave above the Sasan spring at Bishapur, about 300 individuals of *R. aegyptiacus* were found to roost in a mixed colony with ca. 2000 *Myotis blythii* during the visit in April 2000, while during

Fig. 6. A mummy of a juvenile *Rousettus aegyptiacus* (Geoffroy, 1810) found in the ruined fortress town of Arg-e Bam (Kerman). Photo by A. Reiter.

Fig. 7. Oasis at Zangard (Hormozgan), an area of foraging of *Rousettus aegyptiacus*, *Asellia tridens*, *Rhyneptesicus nasutus*, and *Pipistrellus kuhlii*. Photo by M. Andreas.

the visit in October 2011, no individuals of *M. blythii* were observed, however, colonies of three other species were recorded to share the roost, viz. *Rhinopoma microphyllum*, *R. muscatellum*, and *Miniopterus pallidus*. In the artificial cave system of Sang Eshkan at Jahrom, the colony of *R. aegyptiacus* shared the roost with colonies of *Rhinopoma microphyllum*, *R. muscatellum*, *Asellia tridens*, and *Taphozous perforatus*. In the cave above the oasis of Manian, also small colonies of *Rhinopoma microphyllum* and *R. muscatellum* were recorded. In the ruined fortress town of Arg-e Bam, numerous roosting individuals of *Eptesicus bottae* and *Pipistrellus kuhlii* were discovered along with the finding of the *R. aegyptiacus* mummy.

Foraging individuals of *R. aegyptiacus* were netted only exceptionally in Iran, solely in palm oases surrounded by very dry deserts without any significant traces of vegetation. In the oasis of Podonu near Dehbarez (Hormozgan), four fruit bats were captured using a net exposed over a small pool below a spring, surrounded by date palms, on 10 October 2011 (Fig. 183). This small oasis was situated in a narrow and rather deep valley, covering an area less than one hectare; along with *R. aegyptiacus*, also *Pipistrellus kuhlii* and *Otonycteris hemprichii* were recorded there. In the oasis of Zangard near Bastak (Fig. 7), even smaller than the former oasis and situated in an open area of desert, five individuals of *R. aegyptiacus* were caught into nets stretched below date palms near a small pool on 9 October 2011 (and foraging calls of three other species were detected, viz. *Asellia tridens*, *Rhyneptesicus nasutus* and *Pipistrellus kuhlii*). In an extensive oasis near Espakeh, composed of a mosaic of date palm groves and small rice fields, the fruit bats were netted into several nets installed above rice fields filled with water and shaded by the palms on 10 April 2000; in this oasis also the presence of *Asellia tridens* and *Otonycteris hemprichii* was recorded. At Isin, where ten individuals of *R. aegyptiacus* were shot, also one *Myotis emarginatus* and five *Eptesicus pachyomus* were netted.

At two other sites, individuals of *R. aegyptiacus* were netted during the evening emergence from their roosts, in the large cave above the Sasan spring at Bishapur and in the system of artifi-

Table 2. Basic biometric data on the examined Iranian samples of *Rousettus aegyptiacus* (Geoffroy, 1810), *Taphozous perforatus* Geoffroy, 1818, and *T. nudiventris* Cretzschmar, 1830. For abbreviations see p. 171

	Rousettus aegyptiacus					*Taphozous perforatus*					*Taphozous nudiventris*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	24	**133.9**	115	146	8.602	3	**77.0**	73	82	4.583	2	**109.0**	107	111	2.828
LCd	24	**16.5**	12	23	3.134	3	**28.3**	26	30	2.082	2	**39.5**	39	40	0.707
LAt	44	**88.59**	81.5	92.9	2.530	5	**63.90**	63.3	64.6	0.543	2	**81.10**	79.5	82.7	2.263
LA	24	**21.30**	18.6	23.0	0.975	3	**22.00**	20.5	23.2	1.375	2	**27.85**	27.8	27.9	0.071
LT	–	–	–	–	–	3	**5.97**	5.7	6.4	0.379	2	**6.55**	6.3	6.8	0.354
LCr	22	**39.99**	38.00	41.63	1.113	2	**20.27**	19.80	20.73	0.658	3	**29.56**	29.13	29.83	0.379
LOc	–	–	–	–	–	5	**20.56**	20.28	20.93	0.304	4	**29.97**	29.18	31.09	0.876
LCb	22	**38.42**	36.14	40.08	1.158	–	–	–	–	–	–	–	–	–	–
LCc	–	–	–	–	–	5	**19.25**	18.88	19.54	0.300	4	**26.37**	25.84	26.73	0.416
LaZ	22	**24.63**	23.42	26.42	0.891	5	**11.64**	11.20	11.91	0.284	4	**17.14**	16.24	17.72	0.634
LaI	22	**7.79**	7.34	8.48	0.319	5	**5.69**	5.45	5.92	0.179	4	**8.09**	7.84	8.23	0.182
LaPO	22	**7.81**	6.97	8.98	0.526	5	**4.26**	4.04	4.51	0.203	4	**4.94**	4.71	5.13	0.202
LaInf	22	**9.36**	8.78	10.41	0.458	5	**5.42**	5.25	5.63	0.158	4	**7.61**	7.39	7.75	0.167
LaN	22	**16.47**	15.74	17.19	0.419	5	**9.38**	9.22	9.48	0.099	4	**12.35**	12.08	12.66	0.282
LaM	22	**15.08**	14.22	15.94	0.506	5	**10.45**	10.32	10.62	0.115	4	**15.32**	14.56	15.71	0.535
ANc	22	**12.15**	7.88	13.28	1.053	5	**7.42**	7.32	7.48	0.060	4	**8.94**	7.97	9.60	0.744
LBT	20	**4.25**	3.93	4.58	0.201	5	**4.50**	4.31	4.63	0.131	4	**5.59**	5.36	5.74	0.162
CC	21	**8.20**	7.68	8.93	0.371	5	**3.76**	3.56	3.88	0.125	4	**6.72**	6.57	6.97	0.175
M^3M^3	22	**12.17**	11.34	12.77	0.432	5	**8.32**	7.97	8.58	0.234	4	**11.43**	10.96	11.88	0.480
CM^3	22	**15.47**	14.30	16.21	0.525	5	**8.70**	8.53	8.81	0.105	4	**12.21**	11.97	12.48	0.233
LMd	22	**31.30**	29.68	32.89	0.993	5	**15.08**	14.43	15.43	0.409	4	**22.06**	21.76	22.18	0.201
ACo	22	**13.69**	12.38	14.74	0.699	5	**5.41**	5.22	5.61	0.139	6	**8.61**	8.38	8.86	0.187
CM_3	22	**16.38**	6.93	17.60	2.173	5	**9.54**	9.34	9.75	0.152	4	**13.77**	13.56	14.07	0.218

cial underground spaces of Sang Eshkan at Jahrom; the fruit bats were netted in the deep of these undergrounds mainly to register their reproduction status and parasitation, the netting sessions were stopped when a representative number of about ten bats was caught.

Certain data on reproduction of *R. aegyptiacus* are available from Iran. Both pregnant females and lactating females with non-volant juveniles were recorded in two seasons, in spring and in autumn. Six pregnant females were netted in the oasis near Espakeh on 10 April, each female contained one foetus of the crown-rump length 22.0–30.1 mm (mean 27.1 mm). Four pregnant females and two volant juveniles (one with LAt 76.5 mm) were recorded at Isin near Bandar Abbas (Hormozgan) at the break of April/May. In several sites, females in reproduction were recorded in the period of 6–11 October; two pregnant females and one lactating female with a juvenile on breast (LAt 58.8 mm [= 65.2% of the mother's LAt]) at Bishapur; one pregnant female and two volant juvenile males (LAt 81.9 and 86.9 mm) in Sang Eshkan at Jahrom; two volant juveniles (male LAt 77.4 mm; female LAt 86.1 mm) at Zangard; a volant juvenile female (LAt 80.3 mm) at Podonu; and one lactating female with a sucking non-volant juvenile at Bongaru. In all these catches, adult males with enlarged testes in scrotal positions were also present.

Similarly as in other regions of the Middle East (and also in the East African parts of the species distribution range), these records conform to the opinion concerning seasonal bimodality of reproduction in *R. aegyptiacus* (see the reviews by Benda et al. 2010, 2011b). In southern Iran, one parturition term might occur in spring (April and May) and the other one in the late summer or early autumn (September and October). In these periods, lactating females with very small non-volant juveniles as well as females in a high stage of pregnancy with large foeti were found, indicating close appearances of terms; but volant juveniles of almost adult size and at the age of several months were also recorded, indicating presence of births several months (ca. half a year) ago; and last but not least, adult males in reproduction were simultaneously caught, indicating mating periods. On the other hand, DeBlase (1980) reported no signs of current reproduction in dissected females collected in winter period (December and January) in the Jahrom region.

R. aegyptiacus was reported to represent a part of the diet of owls in several countries of the Middle East (Bonhote 1909, Dor 1947, Spitzenberger 1979, Qumsiyeh 1985, Benda & Horáček 1998, Benda et al. 2010, new data). In Iran, remnants of this bat were documented from owl pellets only exceptionally (Table 40). A skull remain from one fruit bat was found in *Strix butleri* pellets collected at Chahar Dahaneh (Hormozgan), representing 0.59% of all prey items (and 25% of mammal items) in the respective sample as well as in the whole analysed Hume's owl diet from Iran. Remains of two individuals of *R. aegyptiacus* were found in *Bubo bubo* pellets collected at Bishapur (Fars), making up 2.29% of all prey items (and 2.81% of mammal items) in the respective sample, but 0.025% of all prey items (0.033% of mammal items) in the whole analysed eagle owl diet from Iran.

Material examined. 1 ind. juv. (NMP 48375 [S+Sk]), Arg-e Bam (Kerman Prov.), 8 April 2000, leg. P. Benda & A. Reiter; – 1 ♂ (NMP 93873 [S+A]), Bishapur (Fars Prov.), 6 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♀ (HMNH 2007.3.13. [S+A]), Chazan near Sarbaz [Sistan va Baluchestan Prov.], 19 May 2006, leg. H. Zohoori; – 5 ♂♂, 5 ♀♀ (NMP 48377–48386 [S+A]), Espakeh (Sistan va Baluchestan Prov.), 10 April 2000, leg. P. Benda & A. Reiter; – 3 ♂♂, 6 ♀♀, 1 ind. juv (NMP 40467/1–40467/10 [S+B]), Isin (Hormozgan Prov.), 29 April & 2 May 1977, leg. B. Pražan; – 2 ♂♂ (NMP 93890, 93891 [S+A]), Jahrom (Fars Prov.), 8 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 2 inds. (HMNH 2007.3.14. [S+Sk], HMNH 2008.37.7. [S]), Jahrom, Simakan [Fars Prov.], 15 June 2006, leg. H. Zohoori; – 1 ♂ (NMP 93897 [S+A]), Podonu (Hormozgan Prov.), 10 October 2011, leg. M. Andreas, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♀ (HMNH 2007.3.12. [S+A]), Qeshm, Qeshm Island [Hormozgan Prov.], August 2006, leg. H. Zohoori; – 1 ♂ (NMP 93896 [S+A]), Zangard (Hormozgan Prov.), 9 October 2011, leg. M. Andreas, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rousettus aegyptiacus* are shown in Table 2. For the material examined see above.

The bats of the Iranian populations of *R. aegyptiacus* belong to the dimensionally smallest representatives of the species (see the comparison by Benda et al. 2006: 17, Table 2), they have been traditionally considered a part of the subspecies occurring in the south-eastern part of the Middle East, *R. aegyptiacus arabicus* Anderson, 1902 (Eisentraut 1959, DeBlase 1980, Bergmans 1994, Kwiecinski & Griffiths 1999, Benda et al. 2006, Karami et al. 2008); for a review see Benda et al. (2008, 2012). However, results of the recent revision of taxonomic status of the *R. aegyptiacus* populations from all main areas of the Palaearctic part of the species range (Benda et al. 2012) showed mosaic-like distribution of the particular size morphotypes throughout the range (NE Africa, Middle East, Pakistan) and, simultaneously, no apparent separation of lineages within the examined mitochondrial genes. Therefore, all Palaearctic populations of *R. aegyptiacus*, including the Iranian ones, are suggested to be regarded as the nominotypical subspecies being phylogenetically separated from the African sub-Saharan populations (Benda et al. 2012).

Echolocation. Echolocation calls of *Rousettus aegyptiacus* are composed of very short paired tongue clicks (Kulzer 1956, Möhres & Kulzer 1956, Yovel et al. 2011). Calls recorded in experimental conditions lasting 0.1–1.0 ms only are emitted between 12–70 kHz with the peak frequency between 19–34 kHz (Herbert 1985, Waters & Vollrath 2003, Holland et al. 2004). Within the Middle East, the frequency range recorded in Sinai was 7–60 kHz, with the call duration 0.3–0.6 ms (Dietz 2005, Dietz et al. 2007). In Iran, we recorded one echolocation sequence of a *R. aegyptiacus* individual flying near a rock wall inside the date palm oasis of Podonu (Hormozgan; Fig. 8); basic echolocation parameters are given in Table 3. Calls in the analysed sequence had longer duration

Table 3. Descriptive parameters of echolocation calls of bats from Iran. Explanations: n – number of individual calls analysed (in parentheses number of call sequences from which calls were obtained); SF – start frequency; FMAXE – frequency of maximum energy (peak frequency); EF – end frequency; PDUR – pulse duration; IPI – inter-pulse interval; upper lines – mean ±SD, lower lines – range. All values presented were obtained in the field except recordings made when the bat was handled in a resting position (*), hand-released at the capture site (†) and hand-released in a closed room (#); ‡ – second harmonic values

species	n	SF	EF	FMAXE	PDUR	IPI
Rousettus aegyptiacus	11(1)	29.7±3.5 25.7–31.8	23.4±4.0 19.1–26.9	30.7±3.9 23.3–35.0	1.4±0.2 1.0–1.5	29.8±16.5 7.0–66.3
Rhinopoma microphyllum	10(2)			29.0±1.3 27.3–31.8		
Rhinopoma microphyllum †	5(1)	29.8±0.6 29.0–30.4	25.3±0.2 25.0–25.5	27.1±0.4 26.8–27.7	7.9±0.3 7.6–8.3	114.6±7.9 106.5–127.2
Rhinopoma muscatellum †	21(4)	37.7±3.2 32.5–42.2	33.0±2.0 29.0–35.4	34.9±2.3 30.4–37.2	6.1±2.0 4.1–9.2	102.4±40.4 62.8–181.9
Rhinopoma hardwickii	4(1)	39.2±0.5 38.7–39.8	34.1±0.9 33.2–35.0	36.1±0.3 35.7–36.4		
Rhinopoma hardwickii †	14(2)	37.1±0.9 35.8–38.4	32.5±0.5 31.4–33.0	34.5±0.5 34.0–35.7	4.8±0.7 3.6–5.7	72.0±16.4 33.2–87.9
Rhinolophus ferrumequinum	21(2)	81.2±1.1 79.3–84.0	76.5±2.0 73.5–79.0	79.9±0.8 78.5–80.6	48.4±10.3 31.3–67.3	49.7±28.6 24.5–154.2
Rhinolophus hipposideros	18(2)	111.2±0.8 109.9–112.2	108.5±1.4 106.2–110.7	110.3±0.8 109.0–111.1	49.9±1.5 47.8–52.0	41.9±3.8 36.1–48.7
Rhinolophus blasii *	10(2)	94.0±0.1 94.2–94.4	92.0±0.1 91.8–92.1	93.1±0.1 93.0–93.3	48.6±9.4 40.1–68.3	109.3±5.6 103.1–117.1
Rhinolophus sp., medium-sized	28(2)	107.0±0.5 106.2–107.9	104.1±1.4 99.2–106.1	106.0±0.6 104.8–106.7	51.1±7.9 30.6–69.5	28.2±6.1 18.1–41.4
Asellia tridens	15(2)	118.4±0.6 117.5–119.0	117.1±0.6 116.3–118.0	117.9±0.6 117.0–118.5	10.3±2.1 6.8–13.1	32.3±15.7 13.4–55.9
Asellia tridens *	12(1)	122.3±0.4 121.7–122.8	119.7±4.1 112.5–123.0	122.0±0.4 121.3–122.6	9.0±0.4 8.4–9.3	28.0±7.7 19.3–38.4
Taphozous perforatus	9(2)	31.4±1.6 30.0–34.2	29.1±1.7 28.1–31.8	30.4±2.1 28.9–33.4		
Taphozous perforatus †	6(1)	35.9±0.5 35.3–36.6	29.9±0.5 29.4–30.8	32.5±0.3 32.1–33.0	4.8±0.3 4.5–5.2	47.3±26.8 12.5–81.3
Myotis blythii	4(1)	48.0±6.5 43.4–52.6	45.0±7.4 39.8–50.2	46.7±4.6 41.7–51.2	1.9±0.1 1.8–2.0	16.7±0.4 16.5–17.2
Myotis capaccinii	20(3)	66.0±12.3 53.1–87.1	48.9±2.0 46.6–52.6	52.9±1.9 49.9–55.3	5.3±0.7 3.9–6.3	49.1±20.4 19.4–84.4
Eptesicus serotinus	9(1)	37.2±1.4 35.4–39.1	24.4±0.5 23.9–25.3	27.4±1.4 25.5–30.0	11.2±1.8 7.2–12.4	180.3±58.1 83.3–246.5
Eptesicus anatolicus	6(1)			29.0±0.1 28.9–29.1		
Rhyneptesicus nasutus	13(3)	42.0±1.5 39.6–43.9	38.7±0.8 37.7–39.8	39.2±1.0 37.8–40.9	7.4±1.1 5.8–9.2	152.7±68.5 70.8–276.1
Hypsugo savii	5(1)	42.5±2.1 40.9–45.9	36.1±0.3 35.7–36.3	37.4±0.7 36.7–38.4	9.4±0.4 8.8–9.7	185.6±4.0 182.1–191.3
Pipistrellus pipistrellus	54(8)	57.1±4.2 50.2–60.8	46.6±2.2 42.6–50.8	48.6±2.4 44.1–54.0	6.8±1.5 3.4–10.4	100.5±26.5 62.3–162.7

Table 3. (continued)

species	n	SF	EF	FMAXE	PDUR	IPI
Pipistrellus kuhlii	37(7)	48.9±4.5 43.26–60.5	41.1±1.6 38.7–44.3	42.2±1.9 39.1–46.8	6.1±1.3 4.0–9.0	106.5±38.7 54.4–231.9
Nyctalus leisleri	20(3)	47.4±4.2 41.7–56.2	30.3±0.8 28.7–31.3	34.0±1.1 31.2–35.2	3.8±1.1 2.6–6.8	112.8±63.2 48.2–262.9
Nyctalus leisleri †	5(1)	43.3±2.7 40.4–46.7	26.3±0.8 24.8–26.8	28.4±0.4 28.0–28.9	6.1±0.3 5.7–6.5	106.2±2.0 104.9–109.3
Otonycteris hemprichii	10(2)	38.8±2.1 28.6–32.8	22.1±0.2 21.9–22.3	22.9±6.1 16.9–29.9	3.7±0.3 3.4–4.1	157.9±22.1 143.0–190.1
				47.6±3.7‡ 43.7–52.8		
Otonycteris hemprichii #	16(2)	35.0±2.2 30.5–38.6	20.1±0.7 19.0–21.2	26.2±2.6 23.5–32.3	2.6±0.5 1.7–3.6	44.4±19.3 26.8–80.5
				40.2±7.4‡ 33.9–49.1		
Barbastella darjelingensis A	4(1)	35.6±1.2 34.4–37.7	31.9±0.4 31.3–32.3	34.4±0.8 33.6–35.4	3.0±0.3 2.7–3.3	104.8±14.3 88.5–114.9
Barbastella darjelingensis B	2(1)			44.6±0.4 44.3–44.9	13.8±2.1 12.3–15.3	105.0±1.2 104.1–105.8
Plecotus macrobullaris	7(1)	33.3±0.1 33.2–33.4	29.8±0.3 29.6–30.0	32.1±1.3 30.8–34.7	2.2±0.1 2.1–2.3	54.6±27.2 40.6–95.4
Miniopterus pallidus	16(2)	59.7±0.7 58.5–60.5	52.4±8.4 30.0–56.4	56.7±0.8 55.5–57.9	5.5±0.5 4.8–6.2	62.9±27.3 36.7–109.3
Tadarida teniotis	14(5)	19.0±2.6 14.1–22.2	11.8±2.2 8.9–14.2	14.5±1.3 10.6–15.9	10.6±0.8 9.5–11.8	368.7±89.8 266.0–484.0

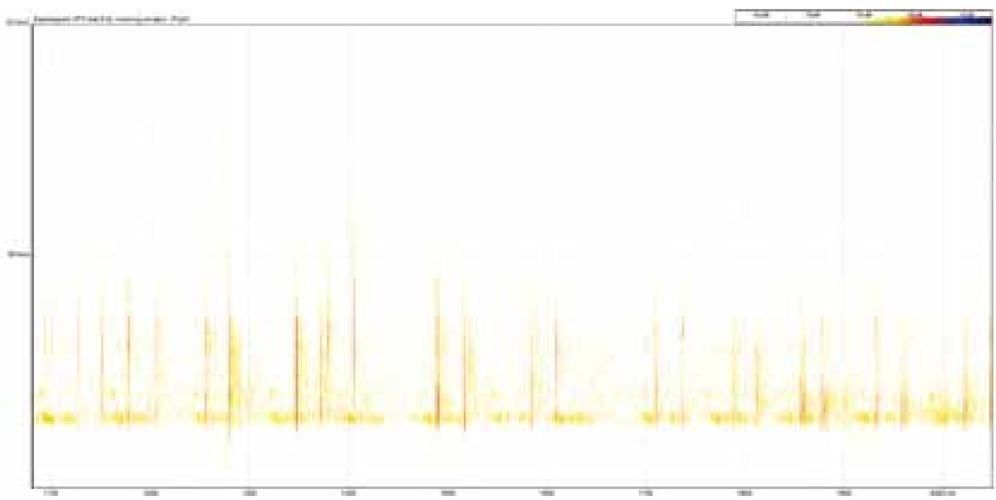

Fig. 8. Spectrogram of echolocation calls of *Rousettus aegyptiacus* (Geoffroy, 1810); an individual foraging in the palm oasis of Podonu (Hormozgan).

than previously described, interpulse intervals in this sequence varied considerably (7–66 ms), while the values of maximum frequency (23–35 kHz) conform to the published data.

Feeding ecology. *Rousettus aegyptiacus* is a herbivorous bat feeding on a variety of fruits, flowers, and leaves. Its food includes apple, apricot, banana, carob, date, fig, grape, jamba, litchi, loquat, mango, mulberry, orange, pawpaw, and peach (Kwiecinski & Griffiths 1999). Korine et al. (1999) recorded remnants of the carob, date, persimmon, arbutus, Persian lilac, pytanga, lantana, and namely, different sorts of figs, in the diet of this species in Israel; fruits constituted the bulk of the diet, although leaves and pollen were also consumed (Korine et al. 1999). Feeding of *R. aegyptiacus* on Persian lilac, fig, plum, loquat, apple, pomegranate, grape, persimmon, date, mulberry, cherry, peach, apricot, and citrus fruits was documented from Turkey (Albayrak et al. 2008). Persian lilac, mulberry and carob were found to be the items with the highest frequency of occurrence in the diet in Cyprus; loquat, fig and arbutus were of intermediate importance (Del Vaglio et al. 2011). As far as the other items in the diet of *R. aegyptiacus* are concerned, deliberate ingestion of garden fruit chaffer beetles (*Pachnoda sinuata*; Scarabaeidae) was observed in South Africa (Barclay et al. 2006). Some arthropods (Coleoptera, Lepidoptera larvae, Diptera, and Ixodida) were also recorded in the diet of *R. aegyptiacus* in Cyprus (Del Vaglio et al. 2011), but the authors supposed most of these arthropods were likely to be ingested accidentally. We did not analyse the composition of the diet of *R. aegyptiacus* in Iran, however, we observed the bats to feed on ripe dates (*Phoenix dactylifera*) in their foraging habitats (Podonu, Zangard; Fig. 9).

Records of ectoparasites. **Original data**: N y c t e r i b i i d a e: *Eucampsipoda aegyptia*: 19 ma, 13 fa (CMŠ [A]) from 2 ma, 5 fa, 1 fs, 1 ind. j, Bishapur, cave at the Sasan spring (Fars Prov.), 6 October 2011; – 8 ma, 2 fa (CMŠ [A]) from 2 ma, 1 mj, 3 fa (incl. NMP 93891), Jahrom (Fars Prov.), 8 October 2011; – 3 ma, 1 fa (CMŠ [A]) from 1 ma, 1 fa, 1 fj (incl. NMP 93897), Podonu, Chahar Dahaneh (Hormozgan Prov.), 10 October 2011; – 5 ma, 11 fa (CMŠ [A]) from 1 ma,

Fig. 9. A netted individual of *Rousettus aegyptiacus* (Geoffroy, 1810) in the oasis of Zangard; note the date released by the bat into the net pocket, which documents the consumption of these fruits in the oasis. Photo by M. Andreas.

1 mj, 2 fa, 1 fj (incl. NMP 93896), Zangard (Hormozgan Prov.), 9 October 2011. – S p i n t u r n i c i d a e: *Meristaspis lateralis*: 1 fa (CMŠ [P]) from 1 fa, Bishapur, cave at the Sasan spring (Fars Prov.), 6 October 2011; – 1 ma, 2 fa (CMŠ [P]) from 1 fa, Bongaru, Hazarmani Mts. (Hormozgan Prov.), 11 October 2011; – 1 ma, 1 fa (CMŠ [P]) from 1 ma, 1 fj (incl. NMP 93897), Podonu, Chahar Dahaneh (Hormozgan Prov.), 10 October 2011; – 4 ma, 4 fa (CMŠ [P]) from 1 ma, 1 mj, 1 fa, 1 fj (incl. NMP 93896), Zangard (Hormozgan Prov.), 9 October 2011. – **Published data**: N y c t e r i b i i d a e: *Eucampsipoda hyrtlii* [= *E. aegyptia*]: 55 ma, 56 fa from 10 inds., Isin, southern foot of Kuhhaye Genu Mts. [Hormozgan Prov.], 28 April – 6 May 1977 (Hůrka 1984a).

Comments on ectoparasites. *Rousettus aegyptiacus* is a permanent host of the bat fly *Eucampsipoda aegyptia* (Macquart, 1851). Based on the host presence in Iran, possible occurrence of this parasite in the country was suggested already by Kock & Nader (1979). Later on, Hůrka (1984a) proved this assumption. Other forms of ectoparasites originally coming from other cave-dwelling bats could also accidentaly parasite *R. aegyptiacus*, see e.g. *Nycteribia pedicularia* Latreille, 1805 and/or *N. schmidlii* Schiner, 1853 in Israel (Theodor & Moscona 1954). The recent records of *E. aegyptia* from Iran enlarge the known distribution range of the species, however, the easternmost occurrence of this bat fly could be expected in southern Pakistan, where the eastern margin of the host species range is situated (cf. Benda et al. 2011a).

The mite genus *Meristaspis* Kolenati, 1857 (together with *Ancystropus* Kolenati, 1856) belongs to the parasites suspected to be phylogenetically linked to the Pteropodidae family (Dusbábek 1969, 1971). *Meristaspis lateralis* Kolenati, 1857 is here reported from Iran for the first time (also from *Pipistrellus kuhlii*). Distribution range of this species has not yet been defined precisely; records are known from various fruit bats (*Cynopterus*, *Eidolon*, *Eonycteris*, *Rousettus*) as well as from other mammal genera (*Rhinopoma*, *Tupaia*) coming from southern Asia from the Middle East to the Philippines (cf. Rudnick 1960, Baker & Delfinado 1964, Prasad 1969).

In the Middle East, records of the argasid ticks *Ornithodoros salahi* (Hoogstraal, 1953) and *Argas vespertilionis* Latreille, 1802 are already available from *R. aegyptiacus* from Jordan (Benda et al. 2010).

Rhinopoma microphyllum (Brünnich, 1782)

Records. **Original data**: B u s h e h r: Bouchir [= Bushehr], Brazjan [Borazjan] [1], June 1968: coll. 1 ma (MHNG 1905.2; leg. A. Arata); – Qal'eh Sefid [2], 5 km N of Dâlaki, Mârâl caves (near abandoned Mârâl quarry), 18 November 2009: net. 1 ind. – F â r s: Bishapur [3], 19 km NW of Kâzerun, large cave above the Sâsân spring, 6 October 2011: obs. a colony of ca. 30 inds., net. 2 fs in the cave (Fig. 11), coll. 1 fs (NMP 93877), det. & rec. calls of several inds.; – Jahrom [4], Sang Eshkan, artificial caves, 8 October 2011: obs. a colony of ca. 10 inds.; – Mâniân [5], 33 km WNW of Jahrom, cave, 19 November 2009: obs. ca. 50 inds., net. 2 ma, 8 October 2011: obs. a small colony of 5–10 inds., coll. 1 ma (NMP 93886); – Tâdovân [6], 44 km NW of Jahrom, Tâdovân cave, 20 November 2009: obs. ca. 500 inds. of *Rhinopoma* spp., incl. *R. microphyllum*, 7 October 2011: obs. a colony of ca. 150 inds., net. 2 ma, 4 ms, 6 fa, 1 fs, det. & rec. several calls of foraging inds., coll. 2 fa (NMP 93878, 93879). – I l â m: karst cave 11 km SW of Mormori [7], 29 km E of Dehlorân, 17 October 2011: obs. a colony of ca. 30 inds., exam. 2 ma, 1 ms, 1 fa (Fig. 12), coll. 1 ma, 1 fa (NMP 93904, 93905); – Dehlorân cave [8], 5 km NE of Dehlorân, 17 October 2011: obs. a colony of ca. 1000 inds., exam. 4 ma, coll. 2 m (NMP 93907, 93908), det. & rec. calls of several inds.; – Mâzhin [9], 55 km NE Dehlorân, Mâzhin cave, September 2002: obs. several hundreds of inds. (cf. Faizolâhi 2004). – K h u z e s t â n: valley 2 km S of Sarkan [10], 9 km SW of Izeh, 13 October 1998: remnants of 2 inds. (right and left mandibles from different inds.) found in *Bubo bubo* pellets. – **Published data**: F â r s: 2 km SE Mansorabad [11], 24 July 1965: 1 f, USNM (Schlitter & DeBlase 1975, DeBlase 1980); – 8 km W Estahbanat [12], 7 July 1965: 2 m, USNM (Schlitter & DeBlase 1975, DeBlase 1980), Fars Prov., Estabanat, July 1965 (Maa 1968); – 10 km SE Kâzerun [13], 18 and 19 November 1963: 11 m, 3 f, USNM (Schlitter & DeBlase 1975, DeBlase 1980); – 11 km NW Darab [14], 10 and 11 July 1965: 2 f, USNM (Schlitter & DeBlase 1975, DeBlase 1980), Darab, 5 inds. (Akmali et al. 2011b); – Âbbârik Farm [15], 10 km NW Lâr, Âbbârik cave (Akmali et al. 2011a); – Ahmad Mahmoudi [16], cave, 1 January 1963: coll. 1 m, FMNH (Lay 1967, DeBlase 1980); – Bamu National Park [17], NE Shirâz, 1 m (Etemâd 1984); – Bânuj cave [18], 15 km SE Dârâb (Akmali et al. 2011a); – Canae Gabru Cave [= Tâdovân cave] [6], near the village of Tar Divon [= Tâdovân], ca. 65 km NE Jahrom, 10 November 1968: obs. hundreds of inds. of *Rhinopoma* spp., incl. *R. microphyllum*, coll. 17 m, 15 f, FMNH, 4 inds., IPT (Schlitter & DeBlase 1975, DeBlase 1980, van Cakenberghe & de Vree 1994), Tâdovân, Tâdovân cave (Akmali et al. 2011a), Tadovan, 5 inds. (Akmali et al.

2011b); – Juyom [19], Hasan Âbâd, 22 May & 15 June 2001: obs. several fG & fa+juvs. (Farâsat 2003); – Kazeron [20], 6 inds. (Akmali et al. 2011b); – Lâr [21], small man-made cave, 23 May 2001: 1 f (Farâsat 2003), Lar, 7 inds. (Akmali et al. 2011b); – Mâniân [5], Mâniân cave (Akmali et al. 2011a); – Shiraz [22], July 1966: 1 ms (Etemad 1969 [as *R. hardwickei*], 1984, DeBlase 1980). – H o r m o z g â n: 10 km WNW Bastak [23], 20 November 1968: 1 f, FMNH (Schlitter & DeBlase 1975, DeBlase 1980), Bastak, 1 ind. (Akmali et al. 2011b). – I l â m: Bisheh Derâz [24], 30 km NW Dehloran, Bisheh Derâz cave, 14 March 2002: obs. several hundreds (Farâsat 2003), Bishehderaz, 4 inds. (Akmali et al. 2011b); – Dârhamreh cave [25], 40 km NW Dehlorân (Akmali et al. 2011a); – Sarim Ab-Garma Cave [8], north of Dehloran, 1000 ft, 5 September 1968: obs. ca. 100 inds., coll. 4 m, FMNH (Schlitter & DeBlase 1975, DeBlase 1980), October 1970: obs. ca. 100 inds. (DeBlase 1980), Dehlorân, Khoffâsh cave (Natural Monument), 14 April 1999: obs. several hundreds, net. 6 m, 8 f, RUBC (Hemmati 2001), Dehloran, Khofash cave, maternity roost, large aggregation (Sharifi et al. 2002), Dehloran, 8 inds. (Akmali et al. 2011b). – K e r m â n: Jiroft [26], 4 inds. (Akmali et al. 2011b). – K e r m â n s h a h: Bisotun [27], rock crevice, 11 July 2000: shot 12 m, RUBC (Hemmati 2001), Bisoton, rock crevice, summer roost (Sharifi et al. 2002), Bisotun (Akmali et al. 2011a), Biston, 5 inds. (Akmali et al. 2011b); – Darvish Kâkmorâd cave [28], rock crevice, male summer roost (Akmali 2004), Darvish Kâkmorâd cave, 30 km N Kerend Gharb (Akmali et al. 2011a); – Hashilan [29], 7 inds. (Akmali et al. 2011b); – Khorin [30], Khorin crevice, 18 July 2000: 13 m, RUBC (Hemmati 2001), Khorin, rock crevice, summer roost (Sharifi et al. 2002); – Nojivarân cave [31], 10 km N Bisotun (Akmali et al. 2011a), Nojivaran, 6 inds. (Akmali et al. 2011b). – K h u z e s t â n: 3 km of Shushtar [32], 9–13 September 1970: 13 inds. (Farhang-Azad 1971 ex DeBlase 1980); – Dezful [33], April 1968: 1 m, IPHR (DeBlase 1980); – Gotvand [34], 25 km NW Shushtar, Gotvand cave (Akmali et al. 2011a), Gotvand, 7 inds. (Akmali et al. 2011b); – Meshrageh [35], ca. 85 km SE Ahvaz, 200 ft, 21 October 1970: shot 1 m, FMNH (Schlitter & DeBlase 1975, DeBlase 1980); – Shabarparak [36], Misham,

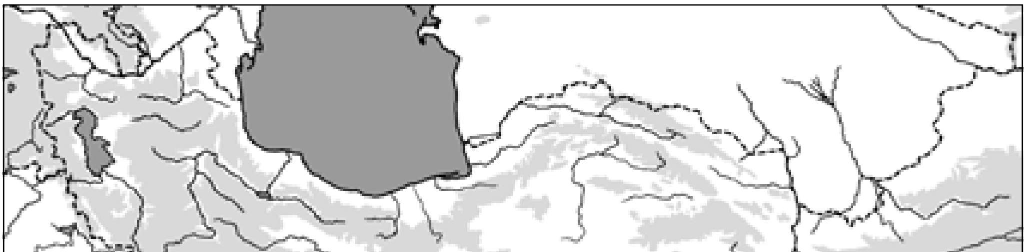

Fig. 10. Records of *Rhinopoma microphyllum* (Brünnich, 1782) in Iran.

Fig. 11. Portrait of *Rhinopoma microphyllum* (Brünnich, 1782) from Bishapur (Fars). Photo by A. Reiter.

Persian Gulf, 1906 ft, 1/9 [?] 1925: 1 m, BMNH (Gaisler 1970, Schlitter & DeBlase 1975, DeBlase 1980), Mishan, 1 ind., BMNH (van Cakenberghe & de Vree 1994); – Telespid [37], Shulistan, 3200 ft, SW Persia, 13 June 1902: 1 f, BMNH (Cheesman 1921, Gaisler 1970, Schlitter & DeBlase 1975, DeBlase 1980, van Cakenberghe & de Vree 1994). – Sistân va Baluchestân: Damen [38], 30 km N Iranshahr, 23–25 January 1963: 1 m, 6 f, USNM (Schlitter & DeBlase 1975, DeBlase 1980), Damin, 6 inds. (Akmali et al. 2011b). – Iran (undef.): Persia (Trouessart 1904), Perse (Trouessart 1905).

DISTRIBUTION. *Rhinopoma microphyllum* is a very common bat in the southern and south-western parts of Iran (Fig. 10). Concerning the whole country, this species belongs to very frequently recorded bats – at least 38 record sites are known from Iran. The here reviewed Iranian range covers an area almost identical with that described by DeBlase (1980), i.e. a belt of northern and eastern edges of the Mesopotamian lowland and of southern slopes of the south-Iranian mountains. Most of the records (71.1%) come from the provinces of Ilam, Khuzestan and Fars (Fig. 10). Very recently the occurrence of *R. microphyllum* has been documented (and also broadly studied) in the Kermanshah province (records 27–31; Hemmati 2001, Sharifi et al. 2002, Akmali 2004, Akmali et al. 2011a, b). This area – reaching the latitude of almost 35° N – represents the northernmost spot of *R. microphyllum* occurrence in Iran and of the whole species range as well, and also the northernmost spot of distribution known within the whole family Rhinopomatidae (cf. Harrison & Bates 1991, Schlitter & Qumsiyeh 1996, Bates & Harrison 1997). A relatively small number of records is available from the eastern part of southern Iran (Fig.), the few records perhaps delineate the northern margin of distribution in this area, although the species occurs in southern Afghanistan, i.e. in the area lying north-eastward (Gaisler 1970, Schlitter & Qumsiyeh 1996). Unlike *Rhinopoma muscatellum*, another mouse-tailed bat widely distributed in Iran (see Fig. 17), *R. microphyllum* has not yet been documented from the Seistan basin, neither of Iran nor Afghanistan (Bates & Harrison 1997). DeBlase (1980) expected broader occurrence of *R. microphyllum* in the Mesopotamian plain of the Khuzestan province, however, the records are available mainly from a relatively narrow belt of submontane regions (Fig. 10). DeBlase (1980) also speculated about possible occurrence of this bat in central deserts of Iran, however, such a distribution pattern was not confirmed in any *Rhinopoma* species; the harsh winter climate of these areas perhaps represents environmental limits for a long-term survival of these bats.

R. microphyllum is a widespread species in the eremic zone of the southern Palaearctic with extensions to the Afro-tropical and Oriental regions, from West Africa to the Sunda Archipelago, via the Middle East (Schlitter & Qumsiyeh 1996). It reaches southern margins of its distribution range in Senegal and Niger in the west and in Sumatra in the east, while in western Iran and northern Pakistan *R. microphyllum* reaches its northern distribution limits (see above). The Iranian area thus represents geographical centre of the species range in the latitudinal sense (van Cakenberghe & de Vree 1994).

In several sites of Iran, the presence of *R. microphyllum* was confirmed repeatedly, suggesting continual occurrence there over long periods, e.g. at Damin near Ranshahr (1963, before 2011), in

Fig. 12. Portrait of *Rhinopoma microphyllum* (Brünnich, 1782) from Mormori (Ilam). Photo by A. Reiter.

Fig. 13. Manian (Fars), an oasis and a cave (in the rock left in the background), a habitat and a roost of *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, and *R. muscatellum*. Photo by A. Reiter.

the Dehloran cave near Dehloran (1968, 1970, 1999, 2011), or in the Tadovan cave near Jahrom (1968, 2009, 2011).

Field notes. *Rhinopoma microphyllum* was recorded in Iran almost exclusively in its roosts, only several foraging individuals were collected (by shooting) and only exceptionally it was identified in owl pellets. Roosts of large colonies were documented mainly in the Ilam province; the largest colony, containing about a thousand bats, was found in the Dehloran cave close to Dehloran in October 2011 (Fig. 206). From this cave, known also as the Sarim Ab-Garma cave or Khoffash cave, large colonies of *R. microphyllum* were reported by several previous authors (DeBlase 1980, Hemmati 2001, Sharifi et al. 2002) in 1968, 1970, and 1999, but never such a high number. DeBlase (1980: 308–309) gave a detailed description of this cave: "[the cave is] located in the mountains just northwest of Dehloran. […] [It] has a huge entrance […]. The broad entrance passage […] slopes steeply upward and then opens into a relatively large room […]. This room has some piles of breakdown, and much of the ceiling is covered with small, sculptured domes about a meter or so in diameter. Left of the entrance passage, beyond a pile of breakdown […], a huge corridor […] opens off the back of the room. This corridor is about 5 m. wide and the walls converge gradually to meet about 35 m. above the floor." During DeBlase's visit in 1968, *R. microphyllum* "hung in large, smooth-sided domes in the low ceiling of a chamber near the entrance" (p. 52). While in DeBlase's (1980) and our catches only males were found, Sharifi et al. (2002) reported a maternity roost from the cave and Hemmati (2001) collected both sexes. Two other caves containing several hundred individuals were documented from the Ilam province in 2002, the Mazhin cave north-east of Dehloran and the Bisheh Deraz cave north-west of Dehloran (Farâsat 2003).

Another colony of *R. microphyllum* – mixed with *R. hardwickii* (together ca. 80 bats) – was found in a smaller cave near Mormori (east of Dehloran) on 17 October 2011; the cave is a narrow and low corridor (ca. 2 m wide, 2–4 m high; perhaps a temporarily dried underground river) several tens of metres long, the colony was dispersed in small domes in ca. 15 m long section, some 5 m from the cave entrance (Figs. 26, 27).

A large colony of *Rhinopoma* bats was repeatedly recorded from the Tadovan cave (Fars; Fig. 43; DeBlase 1980 used the name Canae Gabru Cave for this site), majority of the bats were *R. microphyllum* and a smaller number belonged to *R. muscatellum*. In 1968, DeBlase (1980) found 77% of *R. microphyllum* in the examined sample from the colony; during a visit in 2011, a proportion of some 75% of this species was estimated in the mixed colony. Both sexes of *R. microphyllum* were found to occupy the cave during the two visits. The Tadovan cave is a large and complex cave, its rather small entrance within a rocky overhang is situated in a steep cliff on the left, eastern side of the Qarah Agaj river valley, about 30 m above the river. The cave is a series of well passable corridors and domes of different width (ca. 1–5 m) and height (ca. 2–7 m), at least 100 m long (the explored part); *Rhinopoma* bats occupied the initial parts of the cave. DeBlase (1980: 296–298) gave a more detailed description of the cave.

A colony of ca. 50 individuals of *R. microphyllum* was documented in a large cave above the Sasan spring at Bishapur (Fars; Fig. 14) on 6 October 2011, in the same corridor as the colony of *Rousettus aegyptiacus* (see under the latter species). In a cave above the Manian oasis near Jahrom (Fig. 13; see under *Rousettus aegyptiacus*), a colony of *R. microphyllum* was found on two occasions; some fifty bats in 2009 and a group of about 5–10 bats in 2011. A small colony of ca. 10 individuals occupying a system of artificial spaces of Sang Eshkan at Jahrom (Figs. 60, 61; see under *Rousettus aegyptiacus*) was found on 8 October 2011. Hemmati (2001) and Sharifi et al. (2002) reported on two summer roosts in the Kermanshah province, a rock crevice at Bisotun (from which 12 males were shot) and a rock crevice at Khorin (from which 13 males were collected); based on the examined individuals, the aggregations in the roosts seemed to be composed solely of males. Lay (1967: 134) described a record of an individual of *R. microphyllum* in its roost made on 1 January 1963 as follows: "our specimen inhabited a dry chamber of the cave at Ahmad Mahmoudi [Fars; see under *Rousettus aegyptiacus* for description of the cave] with a large number of *R. hardwickei* [= *R. hardwickii* and *R. muscatellum*]. The animal could scarcely fly and was captured when it fluttered weekly to the floor. This specimen, unlike its congeners of the same cave showed no body fat." Another single individual of *R. microphyllum* was collected by DeBlase (1980: 52, 335) on 20 November 1968 from a "small, dimly lit cave" situated 10 km WNW of Bastak (Hormozgan): "the cave was small and hot; it did not penetrate into the mountain deeply enough to lose twilight. Approximately 20 to 25 *Rhinopoma* hung just inside the cave entrance. We collected 17 *R. muscatellum* and one *R. microphyllum* from this cave. Large guano piles indicated the use of the cave by larger numbers of bats during the breeding season."

R. microphyllum was documented to share roosts with several other bat species at least in ten sites. Perhaps the richest community of cave dwelling bats – composed of ten species – was documented in the Tadovan cave north-west of Jahrom; besides *R. microphyllum*, also *R. muscatellum*, *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale*, *R. mehelyi*, *R. blasii*, *Myotis blythii*, *M. cappaccinii*, and *Miniopterus pallidus*, were found inside the cave. In the cave above the Sasan spring at Bishapur, along with *R. microphyllum* also *Rousettus aegyptiacus*, *Rhinopoma muscatellum*, *Myotis blythii* and *Miniopterus pallidus* were documented. A similar number of co-existing species was found in the artificial spaces of Sang Eshkan at Jahrom, viz. *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. muscatellum*, *Asellia tridens*, *Triaenops persicus*, and *Taphozous perforatus*. During various visits of the Dehloran cave, four species other than *R. microphyllum* were registered inside the cave, viz. *Rhinopoma muscatellum*, *R. hardwickii*, *Asellia tridens*,

Fig. 14. Large cave above the Sasan spring at Bishapur (Fars), a roost of *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. muscatellum*, and *Myotis blythii*. Photo by A. Reiter.

and *Miniopterus pallidus*. In two caves, *R. microphyllum* was registered together with *Rousettus aegyptiacus* and *Rhinopoma muscatellum*, in the cave above the Manian oasis and in the cave at Ahmad Mahmoudi (Lay 1967); in the latter cave also *R. hardwickii* was collected. *R. hardwickii* in the cave at Mormori (see above) and *R. muscatellum* in the caves at Bastak (see above) and at Juyom were found to share their roosts with *R. microphyllum*. In the Bisheh Derâz cave also *Rhinopoma muscatellum* and *Asellia tridens* were found in addition to *R. microphyllum*.

Only few data are available on the foraging activity of *R. microphyllum* in Iran. DeBlase (1980: 49) noted a remark perhaps from a label of the specimen collected at 'Shabarparak, Misham, Persian Gulf' in Khuzestan at the altitude of 1906 ft [= 581 m]; it was "shot while flying around Mishan bungalow". Another Khuzestani specimen was "shot along river at dusk" at Meshrageh, ca. 85 km SE Ahvaz, 200 ft [= 61 m] on 21 October 1970 (DeBlase 1980: 49); it was collected there together with *Rhinopoma muscatellum*, *R. hardwickii*, *Rhyneptesicus nasutus*, and *Pipistrellus kuhlii*. One individual of *R. microphyllum* was netted at the Maral cave near Qal'eh Sefid (Bushehr) on 18 November 2009, perhaps during evening emergence from the cave; along with this bat also *Rhinopoma muscatellum* and *Myotis emarginatus* were netted and a group of *Asellia tridens* was observed in the cave. These species probably shared the roost with *R. microphyllum*.

Rather scarce information is available on the reproduction of *R. microphyllum* in Iran. Several pregnant females and lactating females with juveniles were observed at Juyom (Fars) on 22 May and 15 June (Farâsat 2003) and one lactating female was collected near Darab (Fars) on 10 or 11 July (DeBlase 1980). These data conform to the conclusion that *R. microphyllum* is a mono-

Table 4. Basic biometric data on the examined Iranian samples of *Rhinopoma microphyllum* (Brünnich, 1782), *R. muscatellum* Thomas, 1903, and *R. hardwickii* Gray, 1831. For abbreviations see p. 171

	Rhinopoma microphyllum					*Rhinopoma muscatellum*					*Rhinopoma hardwickii*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	8	**79.1**	71	85	4.883	36	**59.1**	53	65	2.596	4	**63.3**	56	69	5.620
LCd	8	**59.4**	50	64	4.406	36	**64.6**	56	75	3.924	4	**71.8**	67	75	3.594
LAt	10	**67.87**	63.2	71.5	2.955	40	**51.84**	48.5	55.4	1.511	4	**58.65**	53.7	62.2	3.565
LA	8	**23.16**	21.7	24.0	0.835	36	**20.22**	18.3	22.4	1.039	4	**21.68**	21.0	22.3	0.670
LT	8	**8.41**	7.9	9.2	0.432	36	**6.87**	5.0	7.9	0.657	4	**7.08**	6.6	7.3	0.320
LCr	8	**20.69**	19.44	21.34	0.626	40	**16.48**	15.58	17.48	0.457	5	**17.51**	16.78	18.04	0.516
LOc	8	**20.32**	19.03	21.05	0.642	39	**16.02**	15.24	16.81	0.418	5	**17.20**	16.52	17.75	0.561
LCc	9	**18.70**	17.93	19.27	0.480	40	**14.66**	13.74	15.63	0.454	5	**15.70**	14.93	16.21	0.586
LaZ	9	**12.27**	11.39	12.68	0.389	40	**9.51**	8.95	10.03	0.275	5	**10.34**	9.64	10.76	0.439
LaI	9	**2.47**	2.34	2.68	0.120	40	**2.21**	2.00	2.49	0.110	5	**2.59**	2.44	2.81	0.139
LaInf	9	**5.36**	4.93	5.62	0.215	40	**4.80**	4.27	5.20	0.189	5	**4.82**	4.31	5.06	0.309
LaN	9	**8.70**	8.28	9.08	0.263	40	**6.86**	6.36	7.34	0.215	5	**7.34**	6.86	7.69	0.302
LaM	8	**10.19**	9.68	10.72	0.336	39	**8.36**	7.82	8.96	0.247	5	**8.74**	8.24	9.07	0.318
ANc	9	**7.27**	6.55	8.04	0.604	40	**5.00**	4.67	5.32	0.142	5	**5.53**	5.01	6.01	0.374
LBT	9	**4.99**	4.88	5.27	0.126	40	**4.87**	4.48	5.25	0.162	5	**4.75**	4.46	4.92	0.186
CC	9	**5.28**	4.67	5.89	0.371	39	**4.02**	3.65	4.51	0.219	5	**4.51**	3.94	4.99	0.424
M^3M^3	9	**9.14**	8.58	9.61	0.311	40	**7.21**	6.75	7.98	0.224	5	**7.62**	7.27	7.88	0.260
CM^3	9	**7.47**	7.21	7.72	0.157	40	**5.70**	5.32	6.05	0.174	5	**6.18**	5.93	6.37	0.199
LMd	10	**14.65**	13.97	15.27	0.441	41	**11.10**	10.37	11.82	0.358	5	**12.17**	11.48	12.58	0.469
ACo	10	**5.63**	5.31	5.97	0.195	41	**3.93**	3.52	4.53	0.205	5	**4.52**	4.21	4.74	0.193
CM_3	9	**8.12**	7.83	8.37	0.198	40	**6.05**	5.11	6.49	0.257	5	**6.72**	6.44	6.90	0.188

tocous and monovular species, presented by Schlitter & Qumsiyeh (1996) based on the studies of Indian populations. These authors also reported parturitions to occur in June to August in India; Roberts (1997) observed newborns in Pakistan in late May. From the limited data reviewed here, it seems that in the Iranian populations parturitions occur in a similar period as in Pakistan and slightly earlier than observed in India.

At one site in Iran, remains of *R. microphyllum* were recorded in the osteological material from owl pellets (Table 40). Remnants of two individuals were found in the pellets of *Bubo bubo* collected in a valley at Sarkan (Khuzestan), representing 0.64% of all prey items (and 1.48% of mammal items) in the respective sample and 0.025% of all prey items (0.033% of mammal items) in the whole analysed eagle owl diet from Iran. Previously, evidence of *R. microphyllum* in owl diet was available from Palestine and Morocco (Dor 1947, Benda et al. 2004d).

Material examined. 1 ♀ (NMP 93877 [S+A]), Bishapur (Fars Prov.), 6 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♂ (MHNG 1905.2 [A]), Bouchir, Brazjan [Bushehr Prov.], June 1968, leg. A. Arata; – 2 ♂♂ (NMP 93907, 93908 [S+A]), Dehloran cave (Ilam Prov.), 17 October 2011, leg. M. Andreas, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 2 inds. (JOC unnumbered [Sf]), Izeh (Khuzestan Prov.), 13 October 1998, leg. J. Obuch; – 1 ♂ (NMP 93886 [S+A]), Manian (Fars Prov.), 8 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♂, 1 ♀ (NMP 93904, 93905 [S+A]), Mormori (Ilam Prov.), 17 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 ♀♀ (NMP 93878, 93879 [S+A]), Tadovan cave (Fars Prov.), 7 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♀ (BMNH 2.10.1.6 [S+B]), Telespid [Khuzestan Prov.], Persia, date unlisted, leg. H. F. Ketherby.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rhinopoma microphyllum* are shown in Table 4. For the material examined see above.

Based on morphological examination of more than sixty specimens of *R. microphyllum* from Iran, Schlitter & DeBlase (1974) recognised two subspecies to occur in the country; a larger *R. m. microphyllum* (Brünnich, 1782) from higher altitudes of the Zagros Mts., and a smaller *R. m. harrisoni* Schlitter et DeBlase, 1974 (type locality: 10 km SE Kazerun, Fars, Iran; Schlitter & DeBlase 1974: 658) from lower areas of south-western Iran. This conclusion was also supported by the results of the analysis by Hill (1977). Status of the latter subspecies, reported solely from Iran (Hill 1977, DeBlase 1980, Nader & Kock 1983b), was doubted by van Cakenberghe & de Vree (1994) who considered it a synonym of the nominotypical subspecies. Nevertheless, Schlitter & Qumsiyeh (1996) distinguished altogether six named forms of *R. microphyllum* within its whole distribution range, including the two subspecies in Iran, defined by Schlitter & DeBlase (1974).

Recently, Akmali et al. (2011b) have analysed mtDNA (control region) of a representative set of *R. microphyllum* samples from Iran (n=71; 13 localities) and of a smaller set from other parts of the species range (n=12). The authors detected three geographically well-defined lineages among the analysed samples, which they co-identified with three subspecies, *R. m. microphyllum*

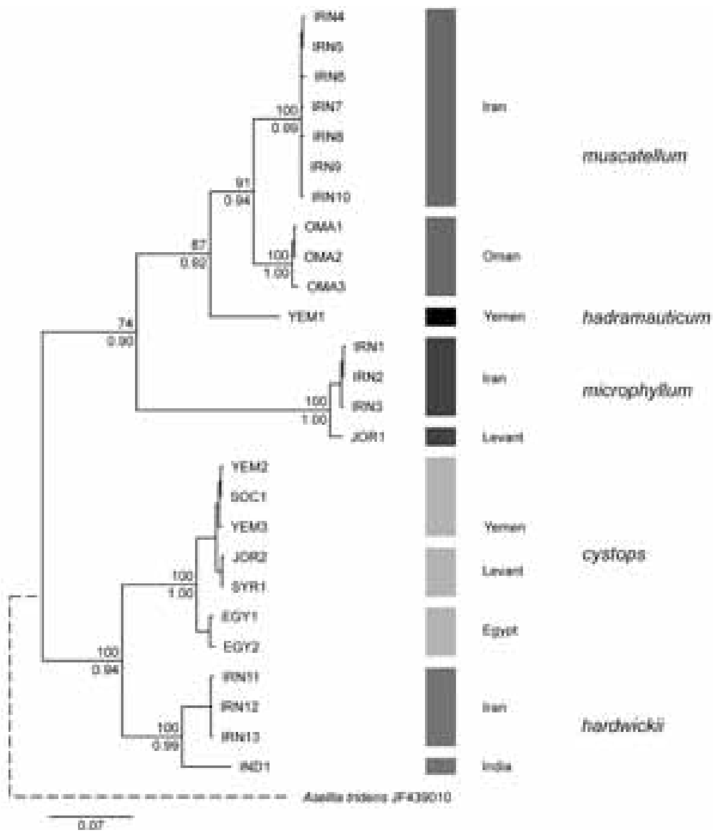

Fig. 15. Bayesian consensus tree showing positions of the Iranian *Rhinopoma* haplotypes (complete cytochrome *b* sequences). MP bootstrap support is indicated above and Bayesian posterior probability below the respective branches (see also Tables 5 and 6).

Table 5. Percent pairwise unncorrected genetic distances among and within reconstructed *Rhinopoma* phylogroups and an outgroup (see Fig. 15). Legend: *mus* = *R. muscatellum*, *had* = *R. hadramauticum*, *mic* = *R. microphyllum*, *cys* = *R. cystops*, *har* = *R. hardwickii*, IR = Iran, OM = Oman, AR = Arabia, AF = Africa, IN = India; outgroup = *Asellia tridens*

p [%]	*mus* IR	*mus* OM	*had* AR	*mic* IR	*mic* AR	*cys* AF	*cys* AR	*har* IR	*har* IN
mus IR	0.1–0.4								
mus OM	4.9–5.4	0.1–0.5							
had AR	7.8–8.2	7.5–7.6	–						
mic IR	12.5–12.8	12.0–12.3	12.5	0.1–0.3					
mic AR	12.5–12.7	12.0–12.3	12.2	1.7–1.8	–				
cys AF	11.6–12.2	12.5–12.7	12.8–13.2	12.9–13.1	13.1–13.3	0.1–0.7			
cys AR	11.4–11.8	12.5	12.7–13.1	13.6–13.7	13.5	2.3–2.7	0.5		
har IR	11.9–12.3	11.0–11.2	12.8–12.9	13.5–13.8	13.9–14.1	8.5–9.0	8.6–8.9	0.1–0.3	
har IN	12.0–12.3	11.1–11.2	12.5	13.2	13.2	8.9–9.1	8.9–9.2	4.6	–
outgroup	16.1–16.4	16.1–16.3	16.7	18.4–18.6	18.8	16.7–16.9	16.8	17.0–17.2	17.2

Table 6. GenBank Accession Numbers of the examined specimens of *Rhinopoma* (complete cytochrome *b* gene)

haplotype	GBAN	voucher	sex	collection site & date
Rhinopoma microphyllum				
IRN1	KF874535	NMP 93886	m	Iran, Manian, 8 October 2011
IRN2	KF874536	biopsy	f	Iran, Bishapur, 6 October 2011
IRN3	KF874534	NMP 93904	m	Iran, Mormori, 17 October 2011
JOR1	KF874533	NMP 47965	f	Jordan, Tabaqat Fahl, 4 July 1997
Rhinopoma muscatellum				
OMA1	KF874539	NMP 92652	f	Oman, Al Qarbi Ash Sharqiyah, 21 October 2009
OMA2	KF874540	NMP 92625	f	Oman, Al Aqar, 18 October 2009
OMA3	KF874538	NMP 92769	f	Oman, Muqal, 1 November 2009
IRN4	KF874544	biopsy	m	Iran, Bishapur, 6 October 2011
IRN5	KF874545	biopsy	f	Iran, Bishapur, 6 October 2011
IRN6	KF874541	NMP 48388	m	Iran, Mach Gur, 11 April 2000
IRN7	KF874542	NMP 48169	f	Iran, Sarkan, 12 October 1998
IRN8	KF874543	NMP 48172	m	Iran, Sarkan, 12 October 1998
IRN9	KF874546	NMP 48443	m	Iran, Hormoz, 17 April 2000
IRN10	KF874547	NMP 48422	m	Iran, Pir Sohrab, 12 April 2000
Rhinopoma hadramauticum				
YEM1	KF874537	NMP 92283	m	Yemen, Ash Shahr, 6 November 2007
Rhinopoma hardwickii				
IRN11	KF874523	NMP 48162	f	Iran, Sarkan, 12 October 1998
IRN12	KF874524	NMP 48163	f	Iran, Sarkan, 12 October 1998
IRN13	KF874525	NMP 93906	m	Iran, Mormori, 17 October 2011
IND1	KF874522	NMP 94428	m	India, Rajasthan, Gola-Ka-Baas, 3 April 2008
Rhinopoma cystops				
EGY1	KF874526	NMP 92605	m	Egypt, Luksor, Valley of Kings, 27 January 2010
EGY2	KF874527	NMP 90569	m	Egypt, Luksor, Karnak, 19 April 2002
JOR2	KF874528	NMP 92502	f	Jodan, Wadi Shu'ayb, 22 May 2009
SOC1	KF874532	NMP 90588	m	Socotra (Yemen), Wadi Darho, 13 May 2004
SYR1	KF874529	NMP 48269	m	Syria, Qala'at Nimrod, 18 July 1999
YEM2	KF874531	NMP pb3622	f	Yemen, Am Rija', 25 October 2007
YEM3	KF874530	NMP pb2923	f	Yemen, Ma'arib, 8 October 2005

in the Levant and Morocco, *R. m. kinneari* in India, and *R. m. harrisoni* in Iran. Since the Iranian samples form only one homogeneous group of haplotypes belonging to the lineage of its own, they recognised only one subspecies in the country. On the other hand, the genetic distances found among these three lineages ("subspecies") were rather low, only 2.14–2.76% of the mean K2p distance, representing only insignificant differences considering variation of the mitochondrial control region. Although Akmali et al. (2011b) suggested the lineages (or rather haplotype groups) to be considered as separate subspecies, the shallow differentiation among them rather indicates simple variation in local conditions and the isolation by distance model in *R. microphyllum* (as already suggested by Hulva et al. 2007a).

The simple comparison of complete sequences of the cytochrome *b* gene from Iranian samples of *R. microphyllum* with one representative from the Levant, presumably of the nominotypical population (Jordan; Fig. 15), showed only shallow divergence of 1.7–1.8% of uncorrected *p* distances between these two populations (Table 5). Neither this low value supports the separate subspecific position of the Iranian population of *R. microphyllum*. The intraspecific variation in this species could be thus solved solely by an analysis of geographically well representative samples, covering the species range without significant gaps, unlike the available analyses that have been presented so far.

Echolocation. Pattern of echolocation calls of *Rhinopoma microphyllum* was for the first time described under laboratory conditions in individuals originating from Cairo, Egypt (Schmidt & Joermann 1983). The species produces almost constant-frequency calls with several harmonics; among them the second harmonic contains the maximum energy, at 28 kHz on average. We made an analysis of 15 echolocation calls of *R. microphyllum* from two sites in Iran, from bats flying inside their cave roost (Tadovan cave) and from a hand-released individual (caught in the Dehloran cave; Fig. 16). Basic parameters of the echolocation signals are given in Table 3. Our findings conform to the published values obtained in Israel, Jordan and Morocco (Shalmon et al. 1993, Mendelssohn & Yom-Tov 1999, Dietz 2005, Benda et al. 2010).

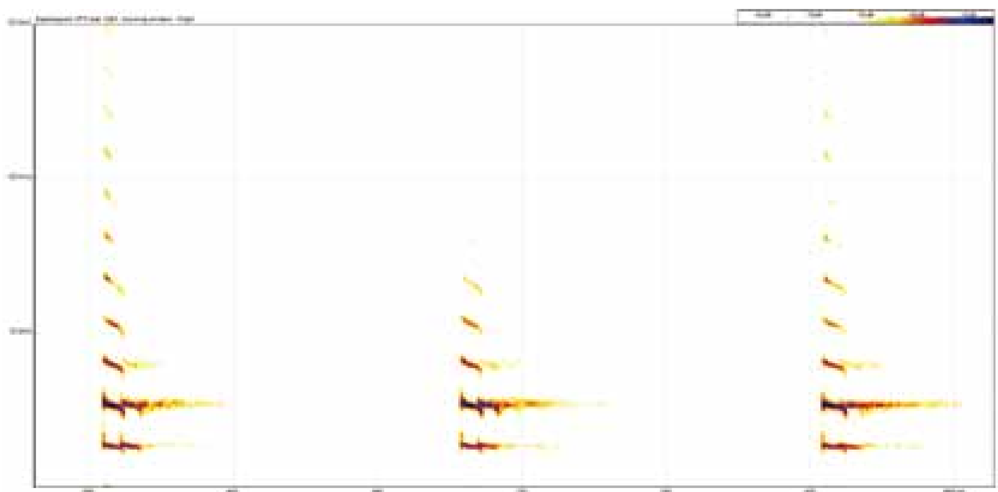

Fig. 16. Spectrogram of echolocation calls of *Rhinopoma microphyllum* (Brünnich, 1782); a hand-released individual caught in the Dehloran cave (Ilam).

Feeding ecology. *Rhinopoma microphyllum* is a large insectivorous bat species of the Saharo-Sindic zone (Schlitter & Qumsiyeh 1996). The foraging behaviour of this bat has not yet been described, but most probably all Rhinopomatidae species are fast flying aerial hawkers (cf. Neuweiler 1984). The diet composition of *R. microphyllum* was studied in India, Iran and Israel (Advani 1981, Sharifi & Hemmati 2002, Whitaker & Yom-Tov 2002). In India, Coleoptera and Lepidoptera were found to be the most important diet items, other remarkable food items included Hymenoptera, Orthoptera and Neuroptera; a high proportion of Isoptera was recorded within the monsoon season as these winged, soft bodied insects emerge in the form of swarms after the first few showers of rain in the desert (Advani 1981). The analysis of diet of *R. microphyllum* in northern Israel also showed Coleoptera as the most important food item (ca. 80% of volume), Lepidoptera represented the second most important part of the diet; Hymenoptera, Heteroptera, Homoptera, Isoptera, Diptera, and Trichoptera were also found, but did not contribute to the diet significantly (Whitaker & Yom-Tov 2002). From three colonies in Iran, Sharifi & Hemmati (2002) reported Coleoptera to be a dominant item of the diet (69.9–79.0% per sample volume), of which Scarabaeidae and Carabidae were most strongly represented (56.6–72.6% of the whole prey); Lepidoptera (3.6–17.5%), Odonata (2.4–14.5%) and Homoptera (1.6–10.8%) were found to be other important items of the diet.

From Iran, we analysed sample sets from two localities. Two sets of faeces (six and eight pellets, respectively) from the large cave above the Sasan spring at Bishapur (Fars) contained only ants (Hymenoptera, Formicoidea). One sample (one faecal pellet) collected from Mormori (Ilam) contained Coleoptera (60% of volume), Heteroptera (30%) and small nematoceran Diptera (10%). The diet composition of samples from Bishapur containing only ants differs remarkably from the results of previous studies. Nevertheless, the analysed sample is rather limited in size to allow for any general conclusions.

Records of ectoparasites. **Original data**: S t r e b l i d a e: *Brachytarsina flavipennis*: 1 ma (CMŠ [P]), from 1 fa (NMP 93878), Tadovan cave (Fars Prov.), 7 October 2011. – **Published data**: S t r e b l i d a e: *Brachytarsina alluaudi* [= *B. diversa*]: 1 ma, 1 fa from unknown number of inds., Fars Prov., Estabanat, July 1965 (Maa 1968).

Comments on ectoparasites. From *Rhinopoma microphyllum* in Iran, two ectoparasite species were documented, the bat flies *Brachytarsina flavipennis* Macquart, 1851 and *B. alluaudi* (Falcoz, 1923) [= *diversa* (Frauenfeld, 1857)] (Maa 1968). The former species rather occurs in the Mediterranean zone, it parasitises namely the bats of the genus *Rhinolophus*, rarely it was collected from the genera *Myotis* and *Miniopterus* (Theodor 1975). The latter species parasitises namely Pteropodid bats, however, in the Middle East it prefers bats of the genus *Rhinopoma* as hosts (Theodor 1968), while in Africa it was found also in the bat genera *Rousettus* (DR Congo; Jobling 1954), *Epomophorus* and *Hipposideros* (Kenya, Botswana; Theodor 1968). Eastern margin of distribution range of both streblid species lie in Afghanistan (Aellen 1959, Hůrka & Povolný 1968). Findings of two other streblid bat flies, *Ascodipteron namrui* Maa, 1964 and *A. rhinopomatos* Jobling, 1952 are also known from *R. microphyllum* from the western part of the Middle East (Israel, Egypt; Maa 1965b).

From neighbouring Afghanistan, mites of the family Macronyssidae were additionally collected from this bat (Dusbábek 1970), viz. *Macronyssus leucipe* (Domrow, 1959) and *Steatonyssus afer* Radovsky et Yunker, 1963 (from a bat collection mixed of *R. microphyllum* and *R. hardwickii*). From the latter country, records of the chigger mites *Sasatrombicula rhinopoma* (Vercammen-Grandjean, 1963) and *S. multisternalae* (Vercammen-Grandjean, 1963) were also reported from *R. microphyllum* (Vercammen-Grandjean 1963). All these mites could be expected to parasitise also the Iranian populations of this host. Despite the apparent endemism of the chigger mite species (Daniel et al. 2010), records of the genus *Sasatrombicula* can be expected from *R. microphyllum* also in Iran.

Rhinopoma muscatellum Thomas, 1903

Records. **Original data**: B u s h e h r: Bandar Siraf [1], 30 km SE of Bandar Kangan, necropolis, 13 October 2011: obs. a colony of ca. 50 inds., coll. 2 fa (NMP 93898, 93899); – Jâshak (Salt Domes Natural Monument) [2], 20 km N of Âbdân, Namak cave, 18 November 2009: obs. ca. 15 inds., net. 1 ind.; – Qal'eh Sefid [3], 5 km N of Dâlaki, Mârâl caves (near abandoned Mârâl quarry), 18 November 2009: net. 3 inds. – F â r s: Bishapur [4], 19 km NW of Kâzerun, large cave above the Sâsân spring, 6 October 2011: obs. a colony of ca. 50 inds. of *Rhinopoma* spp., net. 3 ma, 2 ms, 1 fa, 3 fs inside the cave (Fig. 18), coll. 1 ma, 1 fs (NMP 93875, 93876); – Jahrom, Sang Eshkan [5], artificial cave, 21 November 2009: obs. ca. 20 inds., net. 1 ind., 8 October 2011: obs. a colony of ca. 100 inds., net. 1 ma, 1 fa (NMP 93888, 93889); – Mâniân [6], 33 km WNW of Jahrom, cave, 19 November 2009: obs. ca. 50 inds. (mostly males), net. 1 ind., 8 October 2011: obs. a colony of ca. 20 inds., coll. 1 fa (NMP 93887); – Tâdovân [7], 44 km NW of Jahrom, Tâdovân cave, 20 November 2009: obs. ca. 500 inds. of *Rhinopoma* spp., net. 1 ind., 7 October 2011: obs. a colony of ca. 50 inds., net. 2 ma, det. & rec. several calls of foraging inds. (coll. 1 m; NMP 93880). – H o r m o z g â n: rock cliff 6 km E of Tujak [8], 53 km SSE of Sirik, rocky crevice, 15 April 2000: obs. a colony of 5 inds., remnant of 1 ind. (left mandible) found in *Athene brama* pellets; – Hormoz island, salt caves near the NW sea shore, 4 km SW of Hormoz [9], 17 April 2000: net. and/or coll. 1 ma, 2 ms, 1 fs (NMP 48443–48446; cf. Benda et al. 2004a, 2009a, Hulva et al. 2007a). – K h u z e s t â n: Kul-e Farah [10], 7 km NE of Izeh, rocky crevice, 12 October 1998: obs. a colony of ca. 50 inds.; – valley 2 km S of Sarkan [11], 9 km SW of Izeh, small cave, 12 October 1998: obs. a colony of ca. 50 inds., coll. 9 ms, 1 fs (NMP 48164–48172, JOC unnumbered; cf. Benda et al. 2004a, 2009a, Hulva et al. 2007a). – L o r e s t a n: 14 km NW of Pol-e Tang [12], 33 km SE of Pol-e Dokhtar, 11 April 1977: coll. 1 ma, 1 fa (NMP 48463, 48464; leg. B. Pražan, cf. Benda et al. 2004a, 2009a). – S i s t â n v a B a l u c h e s t â n: Mach Gur [13], 63 km SE of Irânshahr, small cave, 11 April 2000: obs. a colony of ca. 30 inds., coll. 8 ms, 1 fs, 1 fa (NMP 48387–48395, JOC unnumbered; cf. Benda et al. 2004a, 2009a, Hulva et al. 2007a); – Pir Sohrab [14], 54 km NE of Chabahar, small loess cave, 12 April 2000: obs. a small colony, coll. 1 ma, 1 fs (NMP 48421, 48422; cf. Benda et al. 2004a, 2009a, Hulva et al. 2007a); – a cliff 1 km N of Tis [15], 8 km N of Chabahar, rocky crevice, 13 April 2000: obs. a colony of ca. 50 ind., coll. 1 fs, 1 ind. ad (NMP 48423, JOC unnumbered; cf. Benda et al. 2004a, 2009a). – **Published data**: B u s h e h r: Ahram [16], Zâr Ahmadi Mts. and Zangi Mts., two caves, 2 m, 1 f, BMNH (Etemad 1984, van Cakenberghe & de Vree 1994). – F â r s: 4 km. WSW of Jahrom [17], 31 December 1962 and 1 January 1963: obs. ca. 30 inds., coll. 7 m, 7 f, FMNH (Lay 1967 [as *R. hardwickei*], DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994); – 6.4 km. W Jahrom [18], 8, 12 and 14 November 1963: 6 m, 2 f, FMNH (DeBlase 1980, van Cakenberghe & de Vree 1994); – 10 km. SE Kazerun [19], 18 and 19 November 1963: 3 m, 1 f, USNM (DeBlase et al. 1973, DeBlase 1980); – Âbbârik Farm [20], 10 km NW Lâr, Âbbârik cave (Akmali et al. 2011a); – Âbgarm [21], 20 km S Qir, Âbgarm cave (Akmali et al. 2011a); – Ahmad Mahmoudi [22], 31 December 1962: obs. 15–20 inds., 1 m, 2 f, FMNH (Lay 1967 [as *R. hardwickei*], DeBlase et al. 1973, DeBlase 1980), 15 November 1968: 3 m, 2 f, FMNH (DeBlase 1980) [two specimens of the latter group of five bats were identified as *R. hardwickii* by van Cakenberghe & de Vree (1994)]; – Canae Gabru [= Tâdovân cave] [7], a cave near the village of Tar Divon [= Tâdovân], about 65 km. N Jahrom, 10 November 1968: 7 m, 5 f, FMNH (DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994), Tâdovân, Tâdovân cave (Akmali et al. 2011a); – Eshgeft-Raana cave 5 kms. north of Kazerun [23] (Etemad 1967 [as *R. hardwickei*], DeBlase 1980); – Jahrom [5] (Etemad 1967 [as *R. hardwickei*], 1984), Jahrom, Sang Eshkan, man-made cave (Akmali et al. 2011a); – Juyom [24], Hasan Âbâd, small and shallow cave, 22 May & 15 June 2001: obs. 10 inds. (Farâsat 2003); – Khesht [25], 30 km W Kâzerun, cave (Akmali et al. 2011a); – Lâr [26], tunnel, 23 May 2001: obs. a maternity colony of 30 inds. (Farâsat 2003); – Mâniân [6], Mâniân cave (Akmali et al. 2011a). – H o r m o z g â n: 10 km. E Chah Moslem [27], small cave, 25 November 1968: 9 m, FMNH (DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994); – 10 km. NW Bastak [28], small cave, 20 November 1968: 9 m, 8 f, FMNH (DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994); – Qeshm Island, Irânzamin cave [29], 7 August 2001: net. several inds. ad+sad [coll. 1 ma, 1 fa, HMNH], 13 April 2002: some inds. (Zohoori 2002b); – Qeshm Island, 11 km S Qeshm, Kharbas cave [30], December 1999: obs. 4 inds., April 2000: obs., 2 August 2001: net. 1 ind. sad, 29 April 2002: net. 1 ind. sad (Zohoori 2002b). – I l â m: 64, resp. 65 km. S Ilam [31], 1 and 4 September 1968: 6 m, 7 f, 1 ind. (4 inds. shot, 10 inds. coll. from a cave), FMNH (DeBlase et al. 1973, DeBlase 1980) = Amirabad, 5 mi S, 4 inds., FMNH (van Cakenberghe & de Vree 1994); – Bisheh Derâz [32], 30 km NW Dehlorân, Bisheh Derâz cave, 14 March 2002: 1 ind. (Farâsat 2003); – Dârhamreh cave [33], 40 km NW Dehlorân (Akmali et al. 2011a); – Dehlorân [34], Khoffâsh cave (Natural Monument), 13 March 2002: 1 ind. (Farâsat 2003). – K h u z e s t â n: Gotvand [35], 25 km NW Shushtar, Gotvand cave (Akmali et al. 2011a); – Meshrageh [36], about 85 km. SW Ahvaz, 11 inds., FMNH (DeBlase et al. 1973), 17 and 19 October 1968: shot 1 m, 1 f, FMNH (DeBlase 1980). – S i s t â n v a B a l u c h e s t â n: 20 km. southwest of Zabol (Kuh-i-Khwjah) [37], 22 November 1962: 6 m, 16 f, FMNH (Lay 1967 [as *R. hardwickei*], DeBlase et al. 1973, DeBlase 1980), Kuh-i-Khwaja, 7 inds., FMNH (van Cakenberghe & de Vree 1994), Kuhe-Khaje (Zabol), 1 ind. (Akmali et al. 2011b); – Baluchistan (Iranshar) [38], 1 ind., SMNS (van Cakenberghe & de Vree 1994); – Damen (= Damin), 30 km. N Iranshahr [39], 22–25 January 1963: 19 m, 16 f, USNM (DeBlase et al. 1973, DeBlase 1980); – Sib [40], S. E. Persia, near the Perso-Beluchistan frontier, 1 fa, BMNH (Thomas 1920b [as *R. pusillum*], Wroughton 1920 [as *R. pusillum*], van Cakenberghe & de Vree 1994, Benda et al. 2009a); – Seistan [41], 1 fa, BMNH (Thomas 1913, DeBlase et al. 1973, Benda et al. 2009a); – Tiss [15], 9 km. north of Chahbahar, cave, March 1967: several specimens, resp. 1 m, 1 f, resp. 2 m, 1 f, IPHR (Etemad 1969 [as *R. hardwickei*], 1984, DeBlase 1980); – Baluchistan [undef.] [*42*], February 1956: 1 f, SMNS (Lay 1967, DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994).

Distribution. *Rhinopoma muscatellum* is an extremely frequent bat in the southern part of Iran. Concerning the whole country, it also belongs to common bats – at least 41 record sites are known from Iran (Fig. 17). The here reviewed distribution range in the country is in accordance with that presented already by DeBlase (1980). New records only more accurately delineate the previously described range (cf. DeBlase 1980), quite newly documented areas are represented by the islands in the Strait of Hormuz (Qeshm, Hormoz) and by the southern parts of Hormozgan and Baluchestan. *R. muscatellum* is the only *Rhinopoma* species being known from the Seistan basin (records 37, 41; Thomas 1913, Lay 1967) and remaining unknown from the Kermanshah province (Fig. 17). Occurrence of the species in Iran thus reaches only the latitude of ca. 32° N, markedly less to the north than in the other two *Rhinopoma* species (Figs. 10, 24). It corresponds with the northern margins of its distribution in Afghanistan and Pakistan (Qumsiyeh & Knox Jones 1986, van Cakenberghe & de Vree 1994, Bates & Harrison 1997).

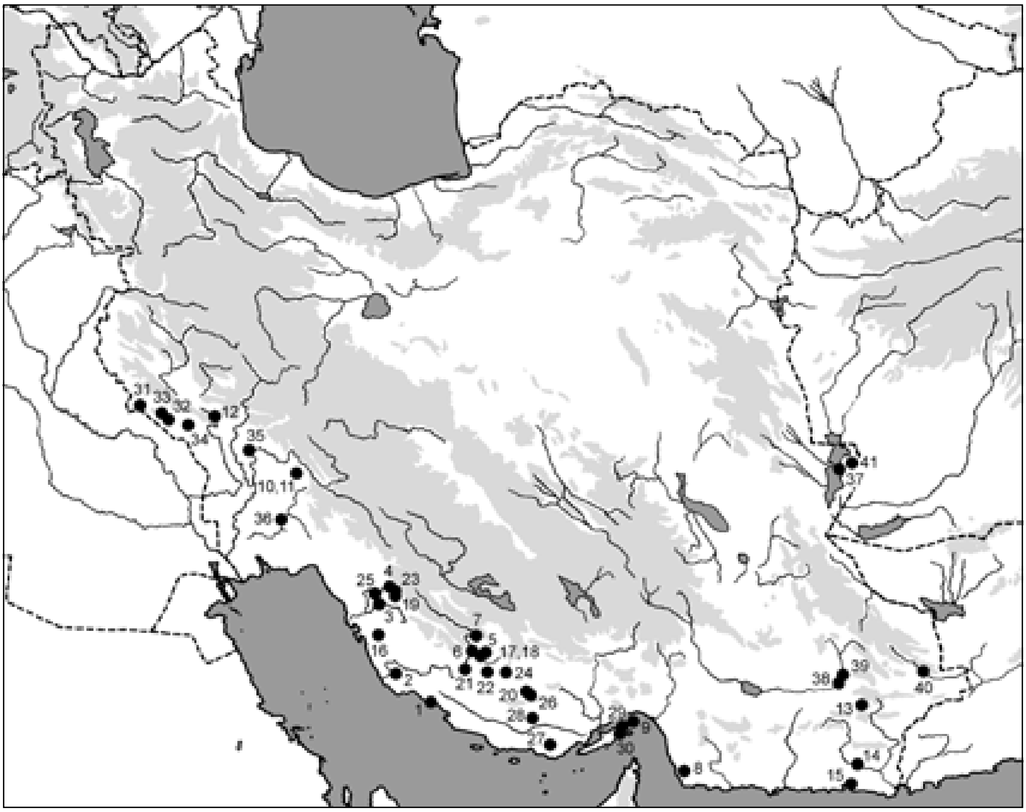

Fig. 17. Records of *Rhinopoma muscatellum* Thomas, 1903 in Iran.

Fig. 18. Portrait of *Rhinopoma muscatellum* Thomas, 1903 from Bishapur (Fars). Photo by A. Reiter.

Geographically, the Iranian occurrence of *R. muscatellum* represents the westernmost known extension as well as a large part (ca. a half) of the species distribution range, which continues to UAE and north-eastern Oman over the Strait of Hormuz and to Afghanistan, Pakistan and India in the east, but not to Iraq in the west (Qumsiyeh & Knox Jones 1986, Harrison & Bates 1991). Since the records of this bat from the provinces of Khuzestan and Ilam lie very close to the Iraqi border, occurrence of *R. muscatellum* could be certainly expected in the eastern parts of Iraq.

In several sites, the presence of *R. muscatellum* was confirmed repeatedly and suggested continual occurrence over long periods, e.g. in the Tadovan cave near Jahrom (1968, 2009, 2011), in Jahrom (before 1967, 2009, 2011) or in Tis near Chabahar (1967, 2000).

Field notes. *Rhinopoma muscatellum* was recorded in Iran almost exclusively in its roosts, only several foraging individuals were collected (by shooting) and only once it was documented from owl pellets. DeBlase (1980: 63) summarised his observations of roosting preferences in this species: "[it] has been found roosting only in small, dimly lit, hot caves or in twilight zone at the entrances to larger caves". Our experience mostly conforms to this opinion, however, with at least two exceptions; it seems, that *R. muscatellum* can use a wide range of roost types in Iran, from narrow crevices and temporary cavities to different parts of huge and long karst caves, from hot sites strongly exposed to sun to mild and dark parts of caves.

Colonies of 20–50 individuals of *R. muscatellum* were subsequently documented in a large cave above the Sasan spring at Bishapur (Fig. 14), in the same deep dark corridor as the colony of *Rousettus aegyptiacus* and *Rhinopoma microphyllum* (see also under these species). A colony of up to 100 individuals was found in the deepest and darkest part of a system of artificial spaces of Sang Eshkan at Jahrom in October 2011 (Fig. 60, 61; see under *R. aegyptiacus*).

Other roosts of *R. muscatellum* more or less correspond with the description given by DeBlase (1980), see above. Perhaps the largest aggregation from Iran was reported by Lay (1967: 112), he found a colony of ca. 200 bats of this species in the Kuh-i-Khwjah area (also spelled as Kuh-i--Khwaja) lying some 20 km south-west of Zabol (Sistan) on 22 November 1962: "A small cave located on the southwest side of Kuh-i-Khwaja, created by a natural slide of weathered basalt, housed a colony […] in its bone-dry chambers. On the opposite side of this basalt dome a lone specimen hung in a darkened room, one of many existing about halfway up the eastern side of the mountain which archaeologists produced in excavating the ancient village of Kaha-Kaha."

In other roosts, rather smaller numbers of *R. muscatellum* were found aggregated in colonies (Lay 1967, DeBlase 1980, Farâsat 2003, new data). Lay (1967) reported finding of a group of ca. 30 individuals from a cave situated 4 km west-south-west of Jahrom (Fars) twice in winter 1962–1963 and another group of some 15–20 bats in a cave at Ahmad Mahmoudi (Fars) on 31 December 1962; see under *Rousettus aegyptiacus* for the comments on both caves. Large colonies of *Rhinopoma* were repeatedly recorded from the Tadovan cave (see under *Rhinopoma microphyllum* for description of the cave; Figs. 43, 44; cf. DeBlase 1980), however, from these

Fig. 19. Necropolis at Bandar Siraf (Bushehr), a roost of *Rhinopoma muscatellum*. Photo by A. Reiter.

colonies only about a quarter of individuals was identified as *R. muscatellum* (approximately 50–100 bats); DeBlase (1980) observed roosting of the colony in the entrance part of the cave in 1968; during a visit in 2011, *R. muscatellum* was registered mainly deep inside the cave, but some bats also only in its initial part.

DeBlase (1980) reported on a finding of nine males of *R. muscatellum* in a cave in the escarpment east of Chah Moslem (Hormozgan) on 25 November 1968 and 17 individuals in a cave north-west of Bastak (Hormozgan; see under *R. microphyllum*) on 20 November 1968. Another record from a roost was described by DeBlase (1980: 307) as follows: "On 4 September [1968], at a point about 64 km. S of Ilam on this same road, we found a small slit-like cave […] penetrating a clay hill a few meters to the left (east) of the road. The tall, narrow cave opened on both ends and reached only a dim twilight in the center. About 50 *Rhinopoma* hung high on the walls of the simple passage. We threw chunks of dried clay at them and collected 10 *R. muscatellum* in handnets as they flew about the cave."

A colony of some 50 individuals of *R. muscatellum* was observed in the necropolis of Bandar Siraf (Bushehr) on 13 October 2011; the bats were dispersed over several tombs (deep 1–3 m) in a narrow valley (Fig. 19). Other colonies of a similar size were observed near Izeh (Khuzestan) on 12 October 1998 – in a crevice in a rock wall at Kul-e Farah and in a small cave, ca. 10 m deep, above a valley near Sarkan. In a cave above the oasis of Manian (Fars; see under *Rousettus aegyptiacus*; Fig. 13) the colony was observed twice, in 2009 and 2011, consisting of approximately 20 and 50 individuals, respectively. While these colonies were situated in dry shrubland landscapes in the southern part of the Zagros Mts., another group of colony roosts of *R. muscatellum* was documented from semi-desert and desert areas of Baluchestan and Hormozgan. A small colony of several bats was observed in a cavity in a loess wall of the valley of the Kaju river at the oasis of Pir Sohrab (Baluchestan; Fig.148) on 12 April 2000; this vertical cavity created by water erosion was ca. 5 m deep and ca. 1.5 m wide, with two openings above each other. A small colony of several individuals occupying deep narrow caves in the salt karst on the Hormoz island were found on 17 April 2000. A colony of ca. 50 individuals of *R. muscatellum* was discovered in a narrow crevice of rocky cliff at Tis on the sea shore near Chabahar on 13 April 2000. A similarly positioned roost of a small colony was found in a crevice in rock cliff at Tujak on 15 April 2000. Another colony of some 30 bats was discovered in a small cave localised high in the rocks some 70–100 m above the Sirbaz river valley at Mach Gur (Fig. 20) on 11 April 2000. All these crevice roosts were situated in very extreme sites, in apical parts of rocks, heavily exposed to sun light and heat.

A large part of the above mentioned roosts were inhabited solely by *R. muscatellum*. However, several shelters were shared with some other bat species, most frequently with its congeners. Large underground systems, used as roosts by *R. muscatellum*, were found to be occupied also by several other bat species; the artificial spaces of Sang Eshkan at Jahrom by *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *Asellia tridens*, *Triaenops persicus*, and *Taphozous perforatus*; the Tadovan cave by *Rhinopoma microphyllum*, *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale*, *R. mehelyi*, *R. blasii*, *Myotis blythii*, *M. capaccinii*, and *Miniopterus pallidus*; the Dehloran cave by *Rhinopoma microphyllum*, *R. hardwickii*, *Asellia tridens* and *Miniopterus pallidus*; the large cave above the Sasan spring at Bishapur by *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *Myotis blythii*, and *Miniopterus pallidus*; and the small cave at Ahmad Mahmoudi by *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, and *R. hardwickii*.

In other roosts, represented mostly by smaller caves, only one or two additional species were found to roost along with *R. muscatellum*. In the cave above the oasis of Manian, *Rousettus aegyptiacus* and *Rhinopoma microphyllum* were also documented and in the Bisheh Deraz cave there were *Rhinopoma microphyllum* and *Asellia tridens*. A single additional species sharing the roost with *R. muscatellum* was found in the cave at Chah Moslem and at Sarkan near Izeh (*Rhinopoma hardwickii*), in the cave at Bastak, the cave at Damen and at Juyom (*Rhinopoma microphyllum*), in the cave 4 km west-south-west of Jahrom (*Rousettus aegyptiacus*), in the Iranzamin cave on the Qeshm island (*Taphozous perforatus*) and in the Kharbas cave on the same island (*Asellia tridens*). In summary, *Rhinopoma muscatellum* was found to share roosts with *R. microphyllum* in ten sites, i.e. twice more than with *Rousettus aegyptiacus*; with *Rhinopoma hardwickii* and *Asellia tridens* it was found at four sites.

Only few data are available on the foraging activity of *R. muscatellum* in Iran. DeBlase (1980) reported on two records of foraging *R. muscatellum*; one in the Ilam province: "On the evening of 1 September 1968 […] [we] shot four *R. muscatellum* at dusk along the [Meymeh] river about 64 km. S of Ilam on the road to Mehran." (p. 307); the other one at Meshrageh in Khuzestan: "Each night at dusk numerous bats flew along the river drinking and feeding on insects. Between 17 and 21 October 1968 we shot one *R. microphyllum*, nine *R. hardwickei*, two *R. muscatellum*, 10 *E.*[= *Rhyneptesicus*] *nasutus*, and one *P. kuhli* as they flew along the [Jahriri] river." (p. 322). Three *R. muscatellum* were netted at the Maral cave near Qal'eh Sefid (Bushehr), perhaps during evening emergence from the cave on 18 November 2009; along with this bat also *Rhinopoma microphyllum* and *Myotis emarginatus* were netted and a group of *Asellia tridens* was observed in the cave. These species seemed to share the roost with *R. muscatellum*.

No data are available on the reproduction of *R. muscatellum* in Iran. No pregnant and/or lactating females nor colonies containing non-volant juveniles were documented; adult females without any signs of pregnancy or lactation were collected in April and October. *R. muscatellum* remains among the last bat species of Iran, for which information on reproduction is still missing (cf. DeBlase 1980, Qumsiyeh & Knox Jones 1986). However, Harrison & Bates (1991) reported

Fig. 20. Mach Gur (Baluchestan), a foraging habitat of *Rhinopoma muscatellum*. Photo by A. Reiter.

on findings of pregnant females in north-eastern Oman in late June and early July, and lactating females in late August and early September. Similar periods of reproduction can be expected also in Iranian populations of the species.

At one site in Iran, a remain of *R. muscatellum* was documented in the material from owl pellets, which represents the first record of this species in owl diet. A mandible was found in a pellet of *Athene brama* collected in a rock cliff near Tujak (Hormozgan); it represented 0.15% of all prey items (and 5.56% of mammal items) in the respective sample and 0.07% of the all prey items (0.82% of mammal items) in the whole analysed diet of the spotted owlet from Iran (Table 40).

Material examined. 2 ♀♀ (NMP 93898, 93899 [S+A]), Bandar Siraf (Bushehr Prov.), 13 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 1 ♀ (NMP 93875, 93876 [S+A]), Bishapur (Fars Prov.), 6 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 3 ♂♂, 1 ♀ (NMP 48443–48446 [S+A]), Hormoz island (Hormozgan Prov.), 17 April 2000, leg. P. Benda & A. Reiter; – 1 ♂, 1 ♀ (NMP 93888, 93889 [S+A]), Jahrom (Fars Prov.), 8 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 8 ♂♂, 2 ♀♀ (NMP 48387–48395 [S+A], JOC unnumbered [S+Sk]), Mach Gur (Sistan va Baluchestan Prov.), 11 April 2000, P. Benda, J. Obuch & A. Reiter; – 1 ♀ (NMP 93887 [S+A]), Manian (Fars Prov.), 8 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♂, 1 ♀ (NMP 48421, 48422 [S+A]), Pir Sohrab (Sistan va Baluchestan Prov.), 12 April 2000, leg. P. Benda & A. Reiter; – 1 ♂, 1 ♀ (NMP 48463, 48464 [S+A]), Pol-e Tang (Lorestan Prov.), 11 April 1977, leg. B. Pražan; – 1 ♂, 1 ♀ (HMNH 2007.3.5. [S+A], HMNH 2007.3.6. [A]), Qeshm island, Iranzamin cave [Hormozgan Prov.], 7 August 2001, leg. H. Zohoori; – 9 ♂♂, 1 ♀ (NMP 48164–48172 [S+A], JOC unnumbered [S+Sk]), Sarkan near Izeh (Khuzestan Prov.), 12 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ind. (BMNH 6.1.2.2 [S+B], holotype of *Rhinopoma muscatellum seianum* Thomas, 1913), Seistan [Sistan va Beluchestan Prov.], date unlisted, don. Calcuttahues; – 1 ♀ (BMNH 20.1.19.3 [S], holotype of *Rhinopoma pusillum* Thomas, 1920), Sib, Pers. Baluchestan [Sistan va Beluchestan Prov.], date unlisted, leg. J. E. B. Hotson; – 1 ♂ (NMP 93880 [S+A]), Tadovan cave (Fars Prov.), 7 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♀, 1 ind. (NMP 48423 [S+A], JOC unnumbered [S+Sk]), Tis (Sistan va Baluchestan Prov.), 13 April 2000, leg. J. Obuch; – 1 ind. (JOC unnumbered [Sf]), Tujak (Hormozgan Prov.), 15 April 2000, leg. J. Obuch.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rhinopoma muscatellum* are shown in Table 4. For the material examined see above.

Originally, *R. muscatellum* was proposed by Thomas (1903) as a full species, but this opinion was refused by Ellerman & Morrison-Scott (1951) who considered this form a subspecies of *R. hardwickii* Gray, 1831. Based on the morphological comparison of numerous material of *Rhinopoma* from Iran, DeBlase et al. (1973) suggested the species status of *R. muscatellum* again, because of its sympatric occurrence with the (then) conspecific *R. hardwickii* s.str. This conclusion was generally accepted and/or re-confirmed by most of subsequent authors (Hill 1977, Qumsiyeh & Knox Jones 1986, Harrison & Bates 1991, Koopman 1993, 1994, van Cakenberghe & de Vree 1994, Roberts 1997, Kock et al. 2001, Simmons 2005, Hulva et al. 2007a, Benda et al. 2009a, etc.).

A series of authors (DeBlase et al. 1973, Hill 1977, Qumsiyeh & Knox Jones 1986, Koopman 1994) recognised two subspecies of *R. muscatellum* in Iran, a smaller *R. m. muscatellum* Thomas, 1903 occurring in a large part of the Iranian range along the south-western and southern areas of the country, and a larger *R. m. seianum* Thomas, 1913 living only in the Seistan basin in eastern Iran (besides the occurrence in southern Afghanistan, Pakistan and India; type locality: Seistan [Iran/Afghanistan]; Thomas 1913: 90). On the other hand, van Cakenberghe & de Vree (1994) recognised only the nominotypical form in Iran, as they considered individuals of the Seistani populations too small in their body size to be a part of the large-sized *R. m. seianum*. However, the latter authors accepted the existence of the ssp. *seianum* in the Afghanistani part of the Seistan basin, which suggests co-occurrence of both named forms (*muscatellum* and *seianum*) in the area.

A third taxon was proposed from Iran by Thomas (1920b), based on the specimen from Sib (Baluchestan), *R. pusillum* Thomas, 1920. However, this name has been mostly considered a synonym of the nominotypical subspecies of *R. muscatellum* (DeBlase et al. 1973, Hill 1977, Qumsiyeh & Knox Jones 1986, van Cakenberghe & de Vree 1994, Simmons 2005).

Hulva et al. (2007a) first revised taxonomy of the genus *Rhinopoma* with the help of a molecular genetic analysis. They found *R. muscatellum* being in a sister position to *R. microphyllum* (instead of *R. hardwickii* and *R. cystops* Thomas, 1903, as suggested by previous authors, see also Fig. 15), and consisting of two lineages, Iranian and Yemeni, differing in 8.2–9.0% of uncorrected *p* distances from each other (in partial sequences of the cytochrome *b* gene), which suggested their separate species positions. While the former lineage was co-identified with *R. muscatellum* s.str., the Yemeni lineage was later described as a separate species, *R. hadramauticum* Benda, 2009 (Benda et al. 2009a). This conclusion was confirmed by the analysis of the mitochondrial control region by Akmali et al. (2011b).

However, until now no data have been available on genetic relations between the Iranian and Omani populations (the species was described from Oman; type locality: Wadi Bani Ruha, Muscat [Sultanate of Oman]; Thomas 1903: 499) and similarly, between the nominate subspecies *muscatellum* and *seianum*.

Our comparisons based on the complete sequences of the cytochrome *b* gene from *R. muscatellum* samples coming from Iran and Oman (Fig. 15) showed a relatively deep divergence between these populations, representing separate lineages; they differed in 4.9–5.4% of uncorrected *p* distance (Table 5), although within each of the compared populations only a shallow variation was revealed (0.1–0.5%). In the light of the above mentioned opinions expecting close taxonomic relations between these populations it is a rather surprising result which indicates their separate taxonomic status (such a deep divergence is frequently considered a good reason for splitting of species). On the other hand, the morphometric comparison of Iranian and Omani samples of *R. muscatellum* (Table 7, Fig. 21) did not reveal any considerable metric differences between them in skull dimensions. Similar results were obtained by morphometic comparison between the latter

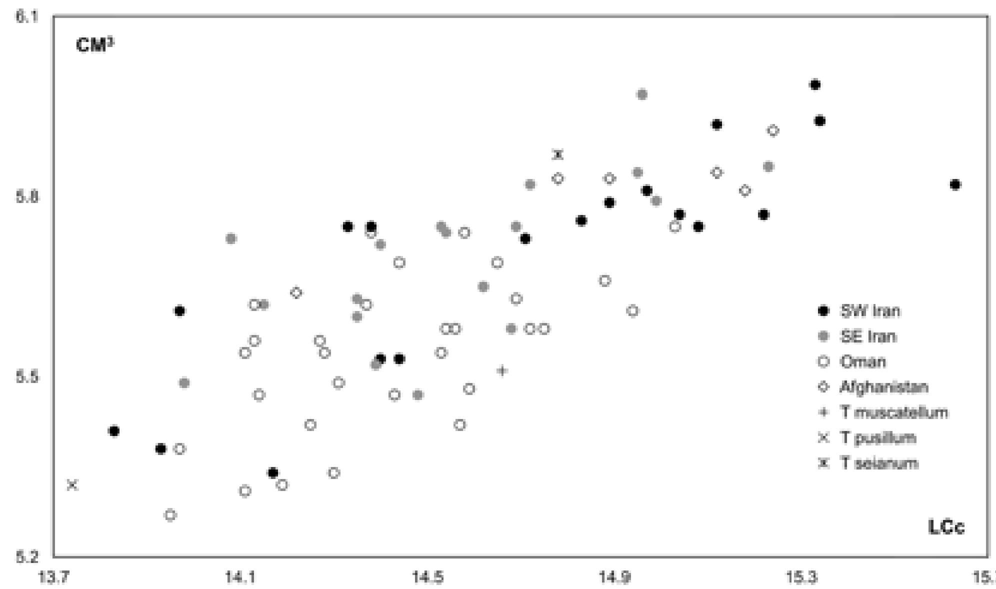

Fig. 21. Bivariate plot of the examined Iranian and comparative samples of *Rhinopoma muscatellum* Thomas, 1903: condylocanine length of skull (LCc) against the length of upper tooth-row (CM^3). T = type specimen.

Table 7. Comparison of biometric data on four sample sets of *Rhinopoma muscatellum* Thomas, 1903 and on type specimens from the *Rhinopoma muscatellum* species rank. For abbreviations see p. 171; relative dimensions: I = LaInf/CM^3, II = LBT/CM^3, III = LaInf/LCc, IV = LBT/LCc; * – after van Cakenberghe & de Vree (1994)

	SW Iran					SE Iran					NE Oman				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LAt	24	**51.63**	49.2	53.9	1.214	16	**52.14**	48.5	55.4	1.875	41	**48.99**	47.2	52.1	1.275
LCr	19	**16.46**	15.25	17.48	0.570	18	**16.41**	15.73	17.07	0.342	31	**16.11**	15.54	16.66	0.316
LCc	19	**14.72**	13.83	15.63	0.530	18	**14.56**	13.98	15.23	0.334	30	**14.43**	13.95	15.03	0.283
LaZ	19	**9.57**	9.03	10.03	0.264	18	**9.50**	8.99	9.90	0.261	30	**9.28**	8.74	9.88	0.257
LaI	19	**2.24**	2.11	2.49	0.102	18	**2.19**	2.00	2.38	0.112	31	**2.14**	1.93	2.34	0.093
LaN	19	**6.89**	6.36	7.17	0.236	18	**6.88**	6.65	7.34	0.182	31	**6.54**	6.27	6.83	0.164
ANc	19	**5.04**	4.75	5.32	0.122	18	**4.96**	4.67	5.13	0.138	30	**4.85**	4.58	5.11	0.107
LBT	18	**4.90**	4.65	5.25	0.179	18	**4.85**	4.65	5.18	0.131	31	**5.00**	4.76	5.36	0.157
CC	19	**4.03**	3.65	4.51	0.246	17	**4.01**	3.69	4.37	0.210	30	**3.87**	3.53	4.29	0.191
M^3M^3	19	**7.21**	6.75	7.58	0.184	18	**7.23**	6.82	7.98	0.271	31	**6.98**	6.63	7.38	0.199
CM^3	19	**5.70**	5.34	5.99	0.186	18	**5.70**	5.47	5.97	0.136	31	**5.54**	5.27	5.75	0.130
LMd	19	**11.17**	10.44	11.82	0.369	18	**11.07**	10.37	11.64	0.349	31	**10.86**	10.44	11.51	0.257
ACo	19	**3.99**	3.72	4.22	0.146	18	**3.90**	3.52	4.53	0.247	31	**3.98**	3.69	4.35	0.172
CM_3	19	**6.05**	5.11	6.49	0.330	18	**6.05**	5.74	6.30	0.155	31	**5.91**	5.56	6.27	0.153
I	18	**0.844**	0.784	0.877	0.029	18	**0.845**	0.810	0.896	0.023	31	**0.835**	0.766	0.890	0.028
II	18	**0.861**	0.797	0.904	0.029	18	**0.852**	0.812	0.899	0.024	31	**0.903**	0.866	0.947	0.023
III	18	**0.328**	0.307	0.339	0.009	18	**0.331**	0.318	0.346	0.008	30	**0.321**	0.302	0.343	0.008
IV	18	**0.334**	0.312	0.351	0.010	18	**0.333**	0.324	0.340	0.005	30	**0.347**	0.332	0.366	0.007

	Afghanistan					type *muscatellum*	type *seianum*	type *pusillum*
	n	**M**	min	max	SD	BMNH 94.3.9.17.	BMNH 6.1.2.2.	BMNH 20.1.19.3.
LAt	3	**54.20**	53.4	54.8	0.721	48.9*	–	46.2*
LCr	6	**16.55**	16.02	17.08	0.398	16.12	16.37	15.58
LCc	6	**14.91**	14.22	15.24	0.379	14.66	14.78	13.74
LaZ	6	**9.80**	9.42	10.17	0.242	9.37	9.42	9.12
LaI	6	**2.05**	1.92	2.24	0.124	2.17	2.09	2.34
LaN	6	**6.99**	6.91	7.04	0.056	6.72	6.79	6.50
ANc	6	**5.03**	4.83	5.12	0.107	4.88	4.75	5.08
LBT	6	**4.86**	4.63	5.02	0.133	5.17	4.96	4.48
CC	6	**4.00**	3.77	4.36	0.224	4.01	4.12	3.93
M^3M^3	6	**7.38**	7.24	7.58	0.126	7.24	7.32	7.11
CM^3	6	**5.81**	5.64	5.91	0.090	5.51	5.87	5.32
LMd	6	**11.36**	10.96	11.76	0.307	10.88	11.18	10.40
ACo	6	**4.13**	3.82	4.34	0.210	3.91	3.88	3.54
CM_3	6	**6.20**	5.93	6.51	0.185	5.87	6.46	5.86
I	6	**0.845**	0.842	0.851	0.002	0.902	0.831	0.870
II	6	**0.836**	0.821	0.849	0.011	0.938	0.845	0.842
III	6	**0.329**	0.324	0.336	0.005	0.339	0.330	0.337
IV	6	**0.326**	0.318	0.329	0.005	0.353	0.336	0.326

pair of samples and the samples from Afghanistan, nominately representing the form *R. m. seianum* (see above). All these groups of samples conform in most of their metric traits. The only, rather slight difference between these populations was found in forearm lengths (Table 7). However, these differences represent rather a clinal shift of the forearm size between the populations, from the south to the north, being the smallest in Oman, medium in Iran, and the largest in Afghanistan.

Therefore, we do not consider the minute metric differences between the particular populations to be sufficient for separation of taxa within the species rank of *R. muscatellum*. However, we consider the revealed differences in genetic traits to be certainly sufficient for taxonomic separation of the Iranian populations from the Omani ones. Since the prior name concerning the Iranian populations of the species is *R. muscatellum seianum* Thomas, 1913, we regard it to be the name of the populations living in the Asian continent (Iran, Afghanistan, Pakistan, and W India), with *R. pusillum* Thomas, 1920 as a synonym, while the name of the nominotypical subspecies, *R. m. muscatellum* Thomas, 1903, to be restricted only on the populations inhabiting the east of the Arabian peninsula (NE Oman and UAE).

Echolocation. Characteristics of echolocation calls of *Rhinopoma muscatellum* are almost unknown (cf. Qumsiyeh & Knox Jones 1986). From Iran, we analysed four call sequences from four hand-released bats captured in the Bandar Siraf necropolis (Bushehr; Fig. 22). Basic echolocation parameters are given in Table 3, the species produces quasi-constant-frequency signals with several harmonics. Range of peak frequency lies between ca. 30–37 kHz and overlaps with the values of *R. hardwickii* (see below). These two species overlap also in other values of echolocation calls, e.g. start and end frequencies (Table 3). Similar values of the frequencies of maximum energy as in *R. muscatellum* from Iran were observed also in the Omani populations (31–33 kHz; own unpubl. data).

Feeding ecology. *Rhinopoma muscatellum* is a medium- to small-sized insectivorous bat of the eastern part of the Saharo-Sindic zone (Qumsiyeh & Knox Jones 1986); little is known about its diet. A relatively well representative material of diet samples was analysed from Oman (nine sites, more than 150 pellets; own unpubl. data). Seven sample sets were dominated by ants (Hymenoptera, Formicoidea) and two by beetles (Coleoptera). Other identified diet items included Heteroptera, nematoceran Diptera, Lepidoptera, and Auchenorrhyncha. From Iran, we studied the diet of *R. muscatellum* from seven sites, covering most of the range of the species in the country; 79 faecal

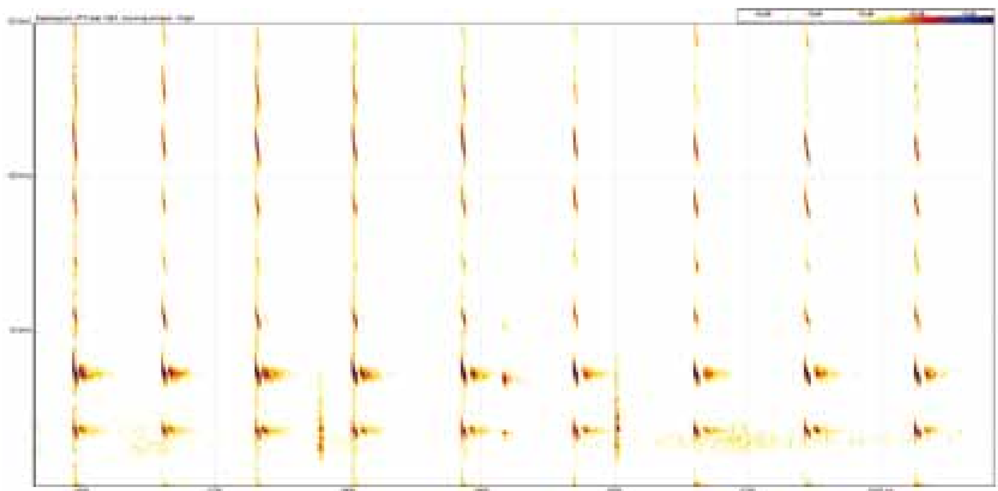

Fig. 22. Spectrogram of echolocation calls of *Rhinopoma muscatellum* Thomas, 1903; a hand-released individual caught in the Bandar Siraf necropolis (Bushehr).

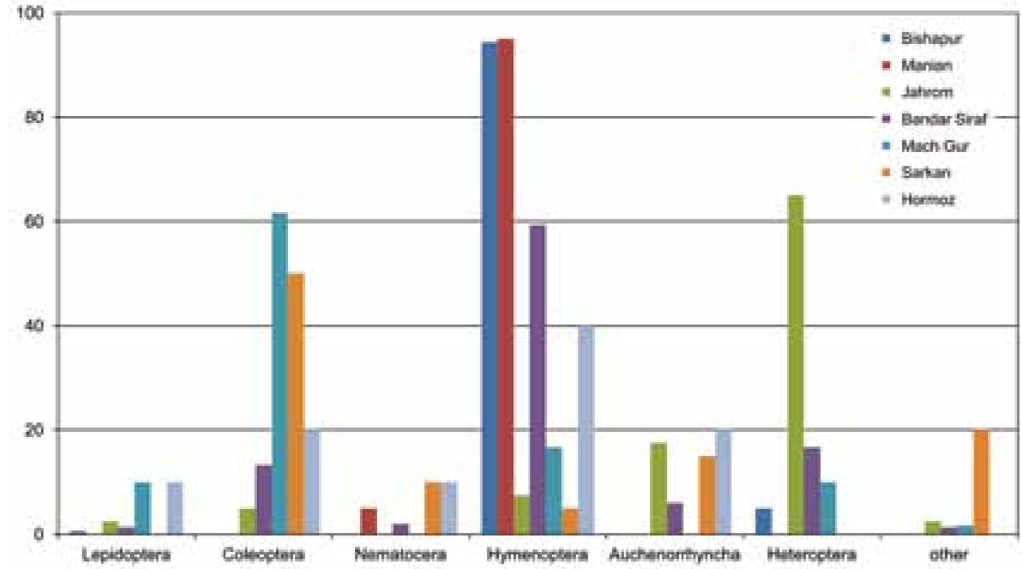

Fig. 23. Percentage volume of particular food items in the diet of *Rhinopoma muscatellum* Thomas, 1903 in Iran. Material analysed: Bishapur (12 faecal pellets / from four individuals), Manian (1 / 1), Jahrom (6 / 2), Bandar Siraf (40 pellets collected under a colony roost), Mach Gur (20 pellets collected under a colony), Hormoz island (four digestive tracts), Sarkan (nine digestive tracts); other = Blattodea, Sternorrhyncha, Neuroptera.

pellets and 13 digestive tracts were analysed (Fig. 23). The diet composition was dominated by ants (Hymenoptera, Formicoidea) at four sites and by beetles (mostly smaller Scarabaeidae and Carabidae, Harpalini) at two sites. At one site, the diet was dominated by Heteroptera.

Rhinopoma hardwickii Gray, 1831

Records. **Original data**: B u s h e h r: Chahak [1], 8 km NW of Bandar Genaveh, 14 October 1998: coll. a skeleton (NMP 48194). – I l â m: karst cave 11 km SW of Mormori [2], 29 km E of Dehlorân, 17 October 2011: obs. a colony of ca. 50 inds., exam. 2 ma, 1 fs, coll. 1 ma (NMP 93906). – K h u z e s t â n: valley 2 km S of Sarkan [3], 9 km SW of Izeh, small cave, 12 October 1998: obs. a colony of ca. 15 inds., coll. 1 fa, 1 fs (NMP 48162, 48163; cf. Benda et al. 2004a, 2006, 2009a, Hulva et al. 2007a); – Kuli Alireza [4], Ramhormoz, 17 October 2002: coll. 1 fa (JOC unnumbered; cf. Hulva et al. 2007a). – L o r e s t a n: 2 km NE of Jelugir [5], 19 km SE of Pol-e Dokhtar, small cave in a wadi wall, 11 October 1998: obs. a colony of ca. 20 inds., coll. 1 ms (NMP 48157; cf. Benda et al. 2004a, 2006, 2009a, Hulva et al. 2007a). – **Published data**: F â r s: 10 km. E Kazerun [6], cave, 17 and 18 November 1963: 2 m, USNM (DeBlase et al. 1973, DeBlase 1980); – Ahmad Mahmoudi, 1 mi NW [7], 15 November 1968: 2 inds., FMNH (DeBlase 1980 [as *R. muscatellum*], van Cakenberghe & de Vree 1994); – Lake Famur [8], 31 December 1962: 2 m, 1 f, FMNH (Lay 1967, DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994). – H o r m o z g â n: 10 km E. Chah Moslem [9], cave, 25 November 1968: 1 m, FMNH (DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994). – K e r m â n s h a h: Qasr-e Shirin [10] (Akmali 2004). – K h u z e s t â n: Gotvand (25 km NW Shushtar) [11], Gotvand cave (Akmali et al. 2011a), Gotvand, 1 ind. (Akmali et al. 2011b); – Meshrageh [12], 17 and 19 October 1968: shot 6 m, 3 f, FMNH (DeBlase et al. 1973, DeBlase 1980, van Cakenberghe & de Vree 1994).

Distribution. *Rhinopoma hardwickii* ranks among rather uncommon bats in Iran, only twelve record sites are known from a limited range of the south-western part of the country (Fig. 24). This range covers an approx. 1250 km long belt of the eastern edges of the Mesopotamian lowland and of the south-western slopes of the south-Iranian mountains, respectively. While DeBlase (1980) presented the confirmed records of *R. hardwickii* from the area between the Kuhuzestan and Hormozgan provinces (incl.) only, the here reviewed range in Iran has been prolonged by more than 500 km to the north-west along the south-western slopes of the Zagros Mts. (Fig. 24), up to Qasr-e Shirin in the westernmost Kermanshah province (Akmali 2004). The latter site represents the northernmost occurrence spot of *R. hardwickii* in the Middle East (Harrison & Bates 1991, van Cakenberghe & de Vree 1994).

The African, Levantine and south-Arabian populations, formerly considered a part of the species rank of *R. hardwickii*, are currently regarded as a separate species, *R. cystops* Thomas, 1903 (Hulva et al. 2007a). *R. hardwickii*, as a species propra, is recently considered an Asian faunal element, distributed from Iraqi Mesopotamia in the west, via southern Iran and Pakistan, to India and the Sunda Archipelago in the east (cf. Qumsiyeh & Knox Jones 1986, van Cakenberghe & de Vree 1994). Its Iranian occurrence area is a portion of the western part of the species distribution range representing a narrow belt adjacent to Mesopotamia and northern shore of the Persian Gulf, stretching from western Iraq to the western edge of the Strait of Hormuz in southern Iran (Fig. 24; Harrison & Bates 1991). This western part of the range (representing ca. 1500 km in the longitu-

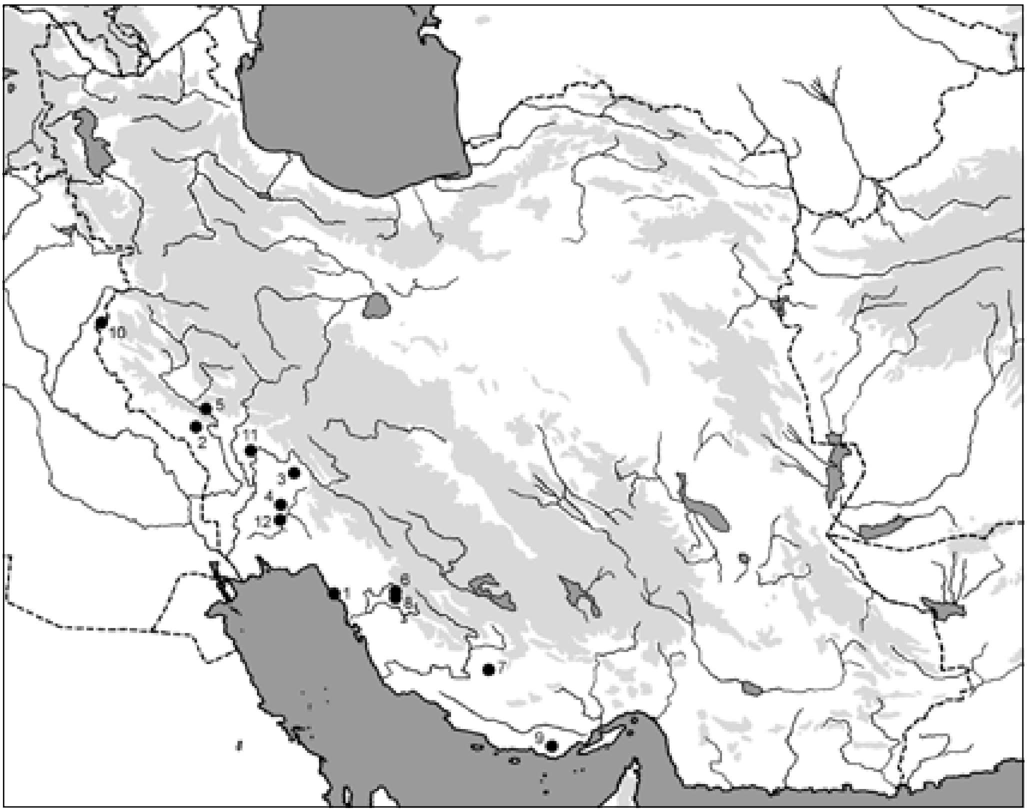

Fig. 24. Records of *Rhinopoma hardwickii* Gray, 1831 in Iran.

Fig. 25. Portrait of *Rhinopoma hardwickii* Gray, 1831 from Mormori (Ilam). Photo by A. Reiter.

dinal direction) is separated by a more than 1200 km wide gap from the Indian part of the range (covering ca. 2000 km in the longitudinal direction), spreading over the whole Indian subcontinent from Karachi in Pakistan to Calcutta in eastern India (Bates & Harrison 1997, Javid et al. 2012).

Field notes. *Rhinopoma hardwickii* was recorded in Iran almost solely in its roosts, with only one exception, when nine individuals were shot as they "flew along the [Jahriri] river drinking and feeding on insects" at Meshrageh in Khuzestan on 17 and 19 October 1968 (DeBlase 1980: 322), along with four other bat species (*Rhinopoma microphyllum*, *R. muscatellum*, *Rhyneptesicus nasutus*, *Pipistrellus kuhlii*). *R. hardwickii* has not been recorded in the osteological material from owl pellets collected in Iran (Table 40).

Only smaller aggregations of *R. hardwickii* were documented in their roosts; the colonies were found solely in small caves, both of erosion and karst origin. DeBlase (1980: 56) reported on a finding of a male of *R. hardwickii* from "a tall but shallow cave" in the escarpment 10 km east of Chah Moslem (Hormozgan) on 25 November 1968, in a numerous group containing also *Rhinopoma muscatellum*. A colony of some 50 individuals of *R. hardwickii* was discovered in a small karst cave near Mormori (Ilam) on 17 October 2011 (Fig. 26); the cave was inhabited also by a smaller colony of *Rhinopoma microphyllum* (see above) and both species were in mixed groups when disturbed (Fig. 27). A colony of 60–70 *Rhinopoma* bats was found in a small cave above the valley at Sarkan near Izeh (Khuzestan) on 12 October 1998, some 20% of them were estimated to belong to *R. hardwickii*, while the majority to *R. muscatellum* (see above). A small colony of some 20 individuals of *R. hardwickii* was observed in a cavity in a loess wall of the Simareh river valley at Jelugir (Lorestan) on 11 October 1998.

No information is available on the reproduction of *R. hardwickii* in Iran (cf. DeBlase 1980, Qumsiyeh & Knox Jones 1986). Bates & Harrison (1997) reviewed the occurrence of parturitions for Indian populations in late June and early July, with the lactation period lasting for about two months. Similar periods of reproduction can be expected also in Iranian populations of the species.

Material examined. 1 ind. (NMP 48194 [S+Sk]), Chahak (Bushehr Prov.), 14 October 1998, leg. J. Obuch; – 1 ♂ (NMP 48157 [S+A]), Jelugir (Lorestan Prov.), 11 October 1998, leg. J. Obuch; – 1 ♂ (NMP 93906 [S+A]), Mormori (Ilam Prov.), 17 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (JOC unnumbered [S+Sk]), Kuli Alireza, Ramhormoz (Khuzestan Prov.), 17 October 2002, leg. J. Obuch; – 2 ♀♀ (NMP 48162, 48163 [S+A]), Sarkan near Izeh (Khuzestan Prov.), 12 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rhinopoma hardwickii* are shown in Table 4. For the material examined see above.

R. hardwickii was for a long time considered a widespread and polytypic species, distributed from West Africa and Morocco to East Africa, Arabia and western Indochina (Ellerman & Morrison-Scott 1951, Kock 1969, DeBlase et al. 1973, Hill 1977, Qumsiyeh & Knox Jones 1986,

Fig. 26. Entrance to a karst cave near Mormori (Ilam), a roost of *Rhinopoma microphyllum* and *R. hardwickii* (see Fig. 27). Photo by A. Reiter.

Fig. 27. Mixed group of *Rhinopoma microphyllum* (Brünnich, 1782) and *R. hardwickii* Gray, 1831 in a small karst cave near Mormori (Ilam). Photo by A. Reiter.

Koopman 1993, 1994, Harrison & Bates 1991, van Cakenberghe & de Vree 1994, Bates & Harrison 1997, Simmons 2005, Kock et al. 2001, etc.). However, van Cakenberghe & de Vree (1994) first doubted this concept when showing morphological evidence sufficient to split *R. hardwickii* s.l. into two species and to consider its East African subspecies as a separate species, *R. macinnesi* Hayman, 1937. This taxonomic opinion was accepted by subsequent authors (Schlitter & Qumsiyeh 1996, Kock et al. 2001, Simmons 2005, Hulva et al. 2007a).

Later on, Hulva et al. (2007a) found significant differences in the mtDNA genome (partial cytochrome *b* gene) within the traditionally broadly recognised Afro-Asian species *R. hardwickii* s.l. and suggested the Iranian populations to represent the westernmost fringe of the range of an eastern, Irano-Indian species, *R. hardwickii* s.str., specifically distinct from the western, Afro-Arabian species, *R. cystops* Thomas, 1903. This separation was further confirmed by results of the analysis by Akmali et al. (2011b). However, in their revision, Hulva et al. (2007a) used only the genetic material from specimens originating from Iran (see Records) as comparative samples of *R. hardwickii* s.str., while the samples from the Indian subcontinent, from where this species was described (type locality: Bengal [India/Bangladesh]; Gray 1831: 37) were not available at that time. The assignation of the Iranian populations to *R. hardwickii* s.str. was thus only tentative.

The comparison of whole sequences of the cytochrome *b* gene from *R. hardwickii* samples coming from Iran and India showed their close position (Fig. 15) and confirmed their belonging to the same species, in accordance with the suggestion by Hulva et al (2007a). On the other hand, the comparison of the Iranian samples with one sequence from Rajasthan, western India, revealed a rather deep divergence between these populations, 4.6% of uncorrected *p* distance (Table 5). This difference suggests a separate taxonomic status of the western populations of *R. hardwickii*, living in Iraq and Iran, from the eastern populations of the Indian subcontinent, being well geographically separated (see Distribution) and pertaining presumably to the nominotypical form of the species. However, to be able to draw any relevant conclusions concerning the taxonomic position of bats from the western part of the species range, a more detailed morphological and genetic sampling and a more profound analysis are needed.

Echolocation. Similar to other species of the genus, *Rhinopoma hardwickii* emits quasi-constant-frequency calls with several harmonics. The second harmonic measured in Indian populations contained maximum energy at 30–40 kHz (Habersetzer 1981). In total, we analysed 18 echolocation calls from Iran (Fig. 28, Table 3). Our findings fully conform to previously published values.

Feeding ecology. *Rhinopoma hardwickii* is a medium-sized insectivorous bat of the eastern part of the Saharo-Sindic zone (Qumsiyeh & Knox Jones 1986, Hulva et al. 2007a). Neuweiler (1984) considered *R. hardwickii* as a rather fast flying bat preferring open spaces at medium level around tree tops and above the canopy. Habersetzer (1981) observed this bat to hunt insects at the height of ca. 10 m above ground.

The diet composition of *R. hardwickii* was previously studied in India (Advani 1982). Crickets (Orthoptera, Gryllidae) and beetles (mostly Scarabaeidae, Curculionidae, and Carabidae) dominated the diet. Moths (Lepidoptera), termites (Isoptera) and ants (Formicoidea) also played an important role in some parts of the season.

From Iran, we analysed the content of one digestive tract from a bat collected at Jelugir (Khuzestan). It contained beetles (Coleoptera) (50% of volume), namely Scarabaeidae (40%) and Carabidae, Harpalini (10%). The other food items included nematoceran Diptera (20%), Auchernorrhyncha (25%) and spiders (Araneae) (5%).

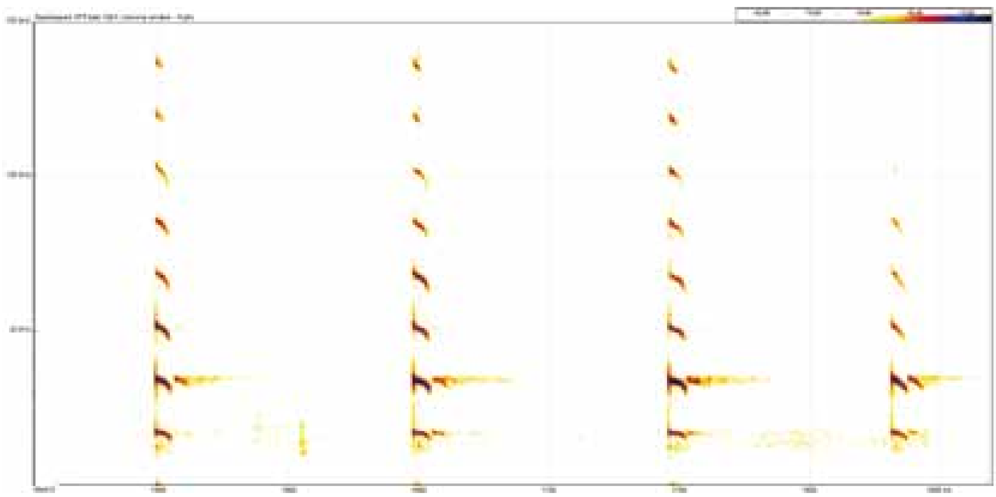

Fig. 28. Spectrogram of echolocation calls of *Rhinopoma hardwickii* Gray, 1831; a hand-released individual caught in a karst cave near Mormori (Ilam).

Rhinopoma sp.

Records. **Published data**: I l â m: Besha Daraz, 2 inds., BMNH (Lay 1967 [as *R. hardwickei*]). – K h u z e s t â n: 3 km. to Shushtar, 9–13 September 1970: 90 inds. (Farhang-Azad 1971 ex DeBlase 1980 [as *R. hardwickei*]), 3 km ot Šuštara [3 km of Shûshtar], 9 September 1970: 3 inds. (Kudrâšova 1975, Kudrâšova et al. 1978 [as *R. hardwickei*]). – L o r e s t a n: 10 km N. Malavy, 5–8 September 1970: 2 inds. (Farhang-Azad 1971 ex DeBlase 1980 [as *R. hardwickei*]). – S i s t â n v a B a l u c h e s t â n: Ispid Lamin, Persian Baluchistan, 1 ind. juv (Wroughton 1920 [as *Rhinopoma* sp.]).

Comments. Four *Rhinopoma* records were originally assigned to *R. hardwickii* s.l. However, the respective specimens were not available for identification with respect to the taxonomic changes introduced by DeBlase et al. (1973), see also DeBlase (1980) and van Cakenberghe & de Vree (1994). These records may thus represent one of the two small-sized *Rhinopoma* species from Iran, or in the case of more individuals from one site the records may be related to both species – *R. hardwickii* s.str. and *R. muscatellum*. The finding of the juvenile at Ispid Lamin (Wroughton 1920) could belong to any of the three Iranian *Rhinopoma* species, as the author did not give any additional data assisting the species identification.

Records of ectoparasites. **Published data**: T r o m b i c u l i d a e: *Chiroptella vavilovi*: 5 larvae (incl. holotype) from 3 inds. of *R. hardwickei* [= *R. hardwickii* s.l.], 3 km ot Šuštara [3 km of Shûshtar; Khuzestan Prov.], 9 September 1970 (Kudrâšova 1975, 1998, 2004, Kudrâšova et al. 1978).

Rhinolophus ferrumequinum (Schreber, 1774)

Records. **Original data**: A r d a b i l: Dâshkasan, 17 km SE of Meshginshahr, Dâshkasan cave [1], 11 December 2005: coll. 1 ma (HMNH 2007.30.2.; leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari), 29 September 2011: coll. 2 fs (NMP 93861, 94107) in the cave; – Dâshkasan, 17 km SE of Meshginshahr, Deimdeim cave [2], 31 August 2010: obs. 3 inds., net. 1 ind. – Â z a r b â i j a n - e G h a r b i: Bastam [3], 6 km W of Qarah Ziya'oddin, 30 September 1998: remain of 1 ind. (rostrum) found in *Bubo bubo* pellets; – rock valley 7 km SE of Chuplu [4], 10 km NW of Takab, small cave, 2 October 1998: coll. 1 ma (NMP 48122; cf. Benda et al. 2006, Rossiter et al. 2007); remnants of 2 inds. (2 left mandibles) found in *Bubo bubo* pellets; – rocks at the Oromiyeh lake bank [5], 3 km S of Soltan Abad, 28 km N of Oromiyeh, 19 October 1998: remnant of 1 ind. (right mandible) found in *Bubo bubo* pellets. – Â z a r b â i j a n - e S h a r q i: Vâyqân [6], 25 km W of Kalibar, Vâyqân cave, 14 December 2008: obs. 6 inds., exam. 1 ind. – C h a h â r M a h â l v a B a k h t i â r i: Omid Âbâd [7], 42 km W of Shahr-e Kord, Sarâb cave, Summer 2001: net. 2 inds. (cf. Ashrafi 2001), 13 August 2010: net. 1 f (cf. Faizolâhi et al. 2011). – E s f a h â n: Dangezli [8], 18 km E of Sisakht, Dangezli cave, 24 November 2010: obs. 1 ind. (cf. Faizolâhi et al. 2011). – F â r s: 5 km E of Sivand [9], 64 km NE of Shiraz, 30 April 1996: remnant of 1 ind. (left mandible) found in *Bubo bubo* pellets; – Bishapur [10], 20 km NW of Kâzerun, Shahpur cave, 3 May 1996: remnant of 1 ind. (mandible) found in *Bubo bubo* pellets; – Tâdovân [11], 44 km NW of Jahrom, Tâdovân cave, 21 November 2009: obs. 1 ind. in torpor, 7 October 2011: det. calls of 1 ind. emerging the cave. – G o l e s t a n: loess cave 2 km NW of Karim Ishan [12], 28 km SW of Maraveh Tappeh, 28 May 2006: obs. 2 roosting inds. – K e r m â n: small cave 5 km NNE of Deh Bakri [13], 40 km W of Bam, 8 April 2000: net. 1 ma (NMP 48352; cf. Benda et al. 2006, Rossiter et al. 2007). – K e r m â n s h a h: Bisotun [14], 28 km E of Kermanshah, small cave, 8 October 1998: net. 1 fs (NMP 48148; cf. Benda et al. 2006, Rossiter et al. 2007). – K h o r a s â n - e S h o m â l i: Zamân Sufi [15], 50 km W of Bojnourd, small mine at a natural spring, October 1999: 1 m (cf. Faizolâhi 1999). – K h u z e s t â n: valley 2 km S of Sarkan [16], 9 km SW of Izeh, 13 October 1998: remnants of 2 inds. (2 right mandibles) found in *Bubo bubo* pellets. – K o r d e s t â n: Karaftu cave [17], 22 km WSW of Takab, 18 October 2011: obs. 2 inds. torpid, coll. 1 ma (NMP 93911). – L o r e s t a n: 3 km S of Lenje Abad [18], 9 km SW of Dorud, 1 October 2011: det. & rec. calls of at least 1 ind. (2 recordings). – M â z a n d a r a n: Hotu cave [19], 3 km W of Behshahr, 14 May 1997: obs. 1 ind. roosting in the cave, skeletal remains of 1 ind. found in the cave deposit. – S e m n â n: Zap. Persiâ, Z. Harsan, Šahrud [= western Iran, western Khorasan, Shahrud] [20], 17 October 1905: coll. 1 m (ZIN 8099; leg. N. A. Zarudnyj; cf. Strelkov et al. 1978). – Z a n j â n: Golgik [21], 25 km W of Zanjân, Golgik cave, 8 October 2008: coll. 1 ma (HMNH 2009.46.4.; don. F. Hemmati); – Shâhneshin [22], 10 km SE of Âbbar, Kharmanesar cave, 22 November 2008: net. 15 inds. – Iran (undef.): Persiâ [= Iran], coll. 1 f (ZIN 5351; leg. Rock); – Farusk, 1885: coll. 1 ind. (ZIN 1519; leg. N. A. Zarudnyj). – **Published data**: A r d a b i l: Dâshkasan [1], 17 km E Meshginshahr, Dâshkahul cave, 31 October 2005: 5 m, 1 f (Sheikh-Jabbâri 2008); – Garmkhâneh [23], 20 km SW Khalkhâl, Haftkhâneh cave, 28 October 2005: 1 m, 1 f (Sheikh-Jabbâri 2008); – Jabdaragh [24], 15 km N Meshginshahr, Boyukkahul cave, 3 November 2005: 1 m (Sheikh-Jabbâri 2008); – Kojanagh [25], 20 km NW Meshginshahr, Kojanagh cave, 3 November 2005: 1 m, 5 f (Sheikh-Jabbâri 2008); – Qaraqiyeh [26], 20 km NE Meshginshahr, Qaraqiyeh cave, 3 November 2005: 2 m, 2 f (Sheikh-Jabbâri 2008); – Ardabil province [undef.], 1 ind. (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: Maku [27], in town, September 1962: 1 m, FMNH (Lay 1967, DeBlase 1980); – 6 km E Maku [28], small dark cave, 28 September 1962: 1 m, FMNH (Lay 1967, DeBlase 1980); – 13.7 km. SW Rezaiyeh [= Oromiyeh] [29], cave, 4 August 1968: coll. 1 f, FMNH (DeBlase 1980); – 16.1 km. NNW Rezaiyeh [= Oromiyeh] [30], small wet cave, 4 August 1968: coll. 1 ms, 3 fa, FMNH (DeBlase 1980); – 20 km. S Rezaiyeh [= Oromiyeh] [31], 28 August 1970: 1 m, 2 f, IPHR (Farhang-Azad 1971 ex DeBlase 1980); – Sakholan [= Sahulan] Cave near Sakholan [= Sahulan] Village [32], November 2005: 2 m, 2 f (Karataş et al. 2006). – B u s h e h r: Bushire [33], 26 November 1883: 1 m (Murray 1884). – E s f a h â n: Galateppeh [34], qanat, 21 December 1962: coll. 1 m, FMNH (Lay 1967, DeBlase 1980). – F â r s: Rostâgh [35], Sahlak, 65 km SE Dârâb, Mozaffar cave (Akmali et al. 2011a); – Shapour cave (near Kazerun, south Iran) [10], 1 m, resp. 3 m (Etemad 1967, 1984, DeBlase 1980), Shahpur Cave, 9 October 1968: coll. 2 m, 1 f, FMNH (DeBlase 1980); – Shiraz [36], 21 June 1919: 1 fa, 8 inds. sad, resp. 2 m, 3 f, BMNH (Cheesman 1921, Gaisler 1970, DeBlase 1980); – Tâdovân [11], 50 km NW Jahrom, Tâdovân cave (Akmali et al. 2011a). – G i l â n: "Gmelinus jun. etiam e montibus Mediae misit" [= S. G. Gmelin [see Gmelin 1774, 1784] added a record from mountainous Media] (Pallas 1811 [as *Vespertilio hippocrepis*]) = mountainous northern Iran (restricted to Elburz Mts. near Rasht [37], by Lay 1967, see also DeBlase 1980). – K e r m â n: about 50 km. E Sa'idabad [38], large cave, 6 December 1968: coll. 1 f, FMNH (DeBlase 1980). – K e r m â n s h a h: Mar Ab Canyon [39], 57 km. W Shahabad on Baghdad Rd., under huge jumbled boulders, 25 August 1968: obs. 90 inds., coll. 14 m, 8 f, 1 ind., FMNH (DeBlase 1980). – K h o r a s â n - e R a z a w i: Chelmir [40], above a small stream, 16 July 1968: net. 1 f, 1 fj, IPHR (Fahrang-Azad 1969, DeBlase 1980); – 71 km. SE Mashhad [41], 29 July 1969: coll. 1 ms, 1 fa, 2 fs, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – Mozduran cave 110 kms. east of Meshhad [42], 1 ind. (Etemad 1967, 1984), 96 km

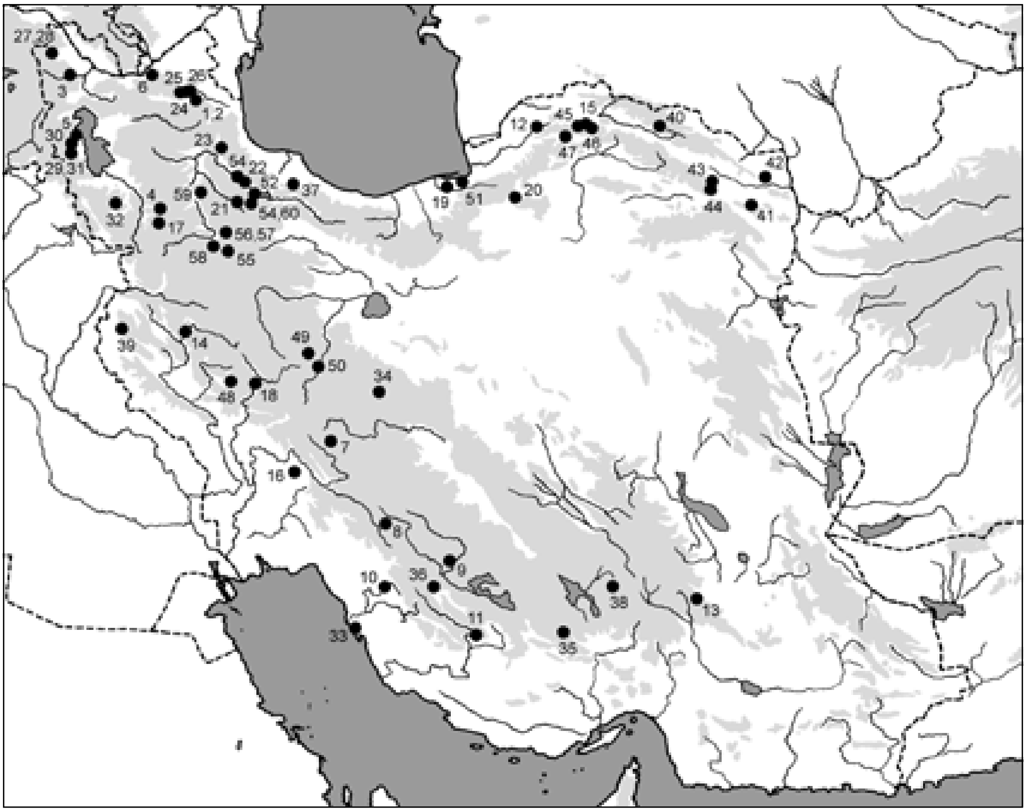

Fig. 29. Records of *Rhinolophus ferrumequinum* (Schreber, 1774) in Iran.

vostočnee Mešheda, peŝera Mozdoran vblizi Sarkasa [= Mozduran cave near Sarakhs, 96 km E of Mashhad], 29 July 1969: 4 inds. (Kudrâšova 1975, 1992, 1998, 2004, Kudrâšova et al. 1978), Mozduran, 4 October 1974: 2 m, SMF (Felten et al. 1977, DeBlase 1980, Kock 1983); – Shandiz village 34 kms. west of Meshhad [43], 19 August 1963: 2 m, IUM [= ? UIM] (Etemad 1967, 1984, DeBlase 1980); – Turbat-i-Haidari [44], N. E. Persia, 15 November 1910: 1 ind., BMNH (Cheesman 1921, DeBlase 1980). – K h o r a s â n - e S h o m â l i: Chaman Bid [45], qanat, 13 November 1962: obs. numerous hibernating inds., coll. 5 m, 4 f, FMNH (Lay 1967, DeBlase 1980); – Ganjah Kuh Cave [46], 12 November 1962: obs. numerous hibernating inds., coll. 1 m, 3 f, FMNH (Lay 1967, DeBlase 1980); – Robat-i-Qarabil [47], qanat, 9 November 1962: obs. numerous hibernating inds., coll. 3 m, 3 f, FMNH (Lay 1967, DeBlase 1980). – K o r d e s t â n: Karaftu [17], 45 km NW Divândarreh, Karaftu cave (Akmali et al. 2011a). – L o r e s t a n: 3.2 km. N Khurramabad [48], cave, 13 September 1968: obs. 12 roosting inds., coll. 1 m, 2 f, FMNH (DeBlase 1980). – M a r k a z i: Âzâd-Khân cave in Mahalat [= Senje Bâshi, 12 km W Mahallât] [49], 1 f (Etemad 1967, 1984, DeBlase 1980); – Bâbâ-Jâber cave in Mahalat [= Judân, 18 km S Mahallât] [50], 1 m, 1 f (Etemad 1967, 1984). – M â z a n d a r a n: Tir Tash [51], loft of Tobacco Institute, 4 September 1970: coll. 2 m, 7 f, 1 ind., MMTT, BMNH (DeBlase 1980). – Q a z v i n: Altinkosh [52], 25 km SW Rudbâr, Katale Khor cave (Akmali et al. 2011a); – Dizehjin [53], 50 km E Zanjân, Dizehjin cave, 2 May 2009: 1 f (Hemmati 2009). – Z a n j â n: Aresht [54], 15 km W Âbbar, Aresht cave (Salt cave), 28 May 2008: 1 m (Hemmati 2009); – Ghalah Kord Cave [55], 5 inds. (Flanders et al. 2009); – Karasf [56], 5 km SW Qeydâr, Barfi cave, 30 May 2008: 1 m (Hemmati 2009); – Karasf [57], 12 km SW Qeydâr, Karasf cave, 28 May 2008: 1 f (Hemmati 2009); – Kataleh Khor Cave [58], 1 ind. (Flanders et al. 2009); – Minân [59], 15 km E Mâhneshân, Qara Dâgh cave, 28 May 2008: 1 f (Hemmati 2009); – Parangin, Chameh [60], 45 km E Zanjân, Esm Gholâm cave, 28 May 2008: 2 m, 4 f (Hemmati 2009); – Shâhneshin [22], 10 km SE Âbbar, Kharmanesar cave, 26 May 2008: obs. 300–400 inds., exam. 6 m, 1 f, 28 February 2008: obs. hibernating inds. (Hemmati 2009).

Distribution. *Rhinolophus ferrumequinum* is a very common bat in Iran, at least 61 record sites are known from the country (Fig. 29). Although the present review lists over twice more localities than DeBlase (1980) (see Table 1), the recent geographical pattern of distribution in Iran remains almost identical with that given by the latter author. The species occurs throughout the country, with the exceptions of the central deserts, Baluchestan and Mesopotamia, i.e. the most arid parts of Iran. Most of Iranian records of *R. ferrumequinum* (70%) are available from northern areas of Iran, the provinces of Ardabil, Azarbaijan, Gilan, Golestan, Khorasan, Kordestan, Mazandaran, Semnan, Qazvin and Zanjan, and this broad region can be considered as a core area of occurrence of this species in south-western Asia. Almost 90% of the Iranian records come from the altitudes above 1500 m (Fig. 29), i.e. from regions with a relatively temperate climate. Thus, the records of *R. ferrumequinum* more or less accurately delineate the range of the Mediterranean bat species in Iran (comp. e.g. Figs. 42, 70, 157, and/or 202). Concerning other possible areas of occurrence in Iran, *R. ferrumequinum* has not yet been documented from the eastern mountain ranges, although it may really occur there, considering the known distribution in the neighbouring Afghanistan (Bates & Harrison 1997).

R. ferrumequinum is a west-Palaearctic (Mediterranean) faunal type (Horáček et al. 2000). The Iranian range continues in the west and northwest to Transcaucasia, Turkey and northern part of Iraq (where it continues to the Levant, southern and central Europe and north-western Africa), in the east and north-east to West Turkestan, Afghanistan and central and northern Pakistan (Harrison & Bates 1991, Bates & Harrison 1997). The Iranian occurrence of *R. ferrumequinum* in the provinces of Bushehr and Fars represents the southernmost extension of the species distribution range (cf. Horáček et al. 2000, Gaisler 2001a).

Field notes. *Rhinolophus ferrumequinum* was recorded in Iran most frequently in or at its roosts, only few findings represent foraging individuals; several records (about one tenth of the total number) are findings of osteological remains in owl pellets and cave deposits.

Caves are the absolutely prevailing type of *R. ferrumequinum* roost in Iran, serving as roosts of maternity colonies, hibernacula as well as roosts used in the transient periods of the year. Despite the high number of cave records, only two of them can be attributed to nursery colonies with a certain probability. DeBlase (1980: 92) reported on a finding of *R. ferrumequinum* in a small

Fig. 30. A roosting individual of *Rhinolophus ferrumequinum* (Schreber, 1774) in the Karaftu cave (Kordestan), see Figs. 31–33. Photo by A. Reiter.

cave situated 16.1 km north-northwest of Oromiyeh (Azarabaijan) on 4 August 1968: "About 12 to 15 of these bats were observed at the rear of a small wet cave. […] From the sex and age structure of the [collected] sample and from the size and activity of the population, I assume that this was a nursery colony." DeBlase (1980: 344) described the cave as follows: "The cave entrance was about 6 m. wide and 2 m. tall […], and a portion of it was walled off for a domestic animal shelter. Two passages opened from the entrance area. The left and larger of the two was about 6 m. wide and 3 m. high. About 12 m. into this passage the floor level rose abruptly about 2 m., forming a ledge across the width of the cave. From the edge, the passage continued back approximately 12 m. more until the floor and ceiling met. The ceiling was wet throughout this section of the cave and water dripped in several places. Light from the entrance was visible at the rear of the cave. Approximately 15 *R. ferrumequinum* were present in the rear of the cave. […] The right-hand passage was small and contained no bats." Another finding, which can be also considered as a record of nursery colony, was reported by Hemmati (2009), who observed an aggregation of 300–400 bats in the Kharmanesar cave at Shahneshin (Zanjan) on 26 May 2008.

DeBlase (1980) reported a record of an immature female of *R. ferrumequinum* collected by a local boy from a cave 13.7 km south-west of Oromiyeh on 4 August 1968, which he naturally suggested to represent a sample from a nursery colony. Another report by Hemmati (2009) gives a finding of six bats, four of them females, from the Esm Gholâm cave at Chameh (Zanjan) on 28 May 2008; this small aggregation may also represent a nursery colony. Similarly, two other literature records suggest evidences of nursery colonies concerning the date and age structure of the collected bats, however, they do not specify the type of roosts (although caves can be presumed); Cheesman (1921) reported collection of an adult female and eight immature bats from Shiraz (Fars) on 21 June 1919; and Farhang-Azad (1970a) reported collection of two adult females an three immature bats from a locality lying 71 km southeast of Mashhad (Khorasan) on 29 July 1969.

A lot of other findings of *R. ferrumequinum* were made in caves in the period of presumable existence of nursery colonies, i.e. from the end of April to early August (cf. Harrison & Bates 1991, Gaisler 2001a). However, these reports do not give those numbers of bats suggesting real existence of a colony, although it cannot be excluded with certainty. Hemmati (2009) reported on observations/collections of single individuals from caves in the Qazvin (Dizehjin cave) and Zanjan provinces (Aresht, Barfi, Karasf, Qara Dagh caves) made on 2–30 May. At least two records of *R. ferrumequinum* made in natural caves in May certainly represent findings of solitary bats in their roosts and not parts of nursery colonies; one individual was observed to roost (torpid?) in the Hotu cave at Behshahr (Mazandaran) on 14 May 1997 (for description of this cave see Coon 1952). Two roosting bats were observed in a cavity in a loess escarpment near Karim Ishan (Golestan) on 28 May 2006. This 'cave' was an erosion drainage tunnel created perhaps by rain water through the loess escarpment from a plateau to a valley, the cavity was some 40 m long and ca. 2 m wide, varying in height from some 2 m to ca. 30 cm in the lowest point.

Hibernation records of *R. ferrumequinum* from Iran are available from some dozen sites, considering the hibernation period from the end of October to early March. Three such findings were reported from qanats (tunnelled irrigation channels), all other hibernacula are natural caves. All the qanat observations were reported by Lay (1967: 138); one "colony occupied the horizontal duct of a qanat at Chaman Bid [Khorasan; on 13 November 1962]. The first collecting foray into this place produced a few *R. ferrumequinum* […]. A later visit added 30 more bats, almost all *ferrumequinum*." Another similar finding was described as follows: "A single individual hibernated in a horizontal qanat duct at Galatappeh [Esfahan; on 21 December 1962]." Lay (1967: 74) added a description of the latter site: "Water approximately 0.3 m. deep flowed through this duct hollowed from compacted gravel at least 10 m. below the surface. The water, channeled several kilometers from the mountains, remained warm and maintained a humid, warm atmosphere within the duct." Lay (1967) reported another qanat hibernaculum from Robat-i-Qarabil (Khorasan), where numerous bats were found on 9 November 1962.

Cave hibernaculum of *R. ferrumequinum* was first reported from Iran by Lay (1967: 138): "At Ganjah Kuh cave [Khorasan] […] a few *R. ferrumequinum* hibernated [on 12 November 1962], but never hung in clusters. One *R. ferrumequinum* near the tunnel's outside exit, where the temperature was 10° or 20° F. [= 5–11 °C] colder than that deep inside, displayed unusual activity in flying about." Lay (1967: 105–106) described the hibernaculum as: "a large limestone cave in the mountain known locally as Ganja Kuh, which lay north of Jochdi. […] The cave (1220 m.

high) opened into a narrow gorge that was vegetated with *Acer*, *Juniperus*, and *Berberis*. A tunnel roughly 6 m. long and 1.5 m. high and wide led into a rounded room about 9 m. by 9 m., beyond which was an elongated chamber roughly 16 m. by 6 m. Water dropped constantly from the ceiling and collected in clear pools on the floor." DeBlase (1980: 94) reported one female of *R. ferrumequinum* hibernating in a large cave located about 50 km east of Sa'idabad (Kerman) on 6 December 1968, it "was collected from where it hung in deep torpor on the entrance area." The hibernaculum was (p. 313): "a large and complex cave […]. […] From the entrance the cave sloped sharply downward as a very wide slit with a flat floor and ceiling. […] About 30 m. down the slope from the entrance, we found a single female *Rhinolophus ferrumequinum* hanging from the wall, deep in torpor. The slope continued for about 30 m. more, and then the chamber split into many small passages."

Sheikh-Jabbâri (2008) reported observations of 1–6 individuals of hibernating *R. ferrumequinum* from five caves in the Ardabil province made in late October and early November 2005 (Boyukkahul, Dashkahul, Haftkhaneh, Kojanagh, and Qaraqiyeh caves). In the Tadovan cave (Fars; Figs. 43, 44; see under *Rhinopoma microphyllum* for description of the cave), one individual of *R. ferrumequinum* in torpor was observed on 21 November 2009; another individual was observed in the Dangezli cave (Esfahan) on 24 November 2010; six bats were found in the Vayqan cave near Kalibar (Azarbaijan) on 14 December 2008; and several hibernating *R. ferrumequinum* were observed in the Kharmanesar cave at Shaneshin (Zanjan) on 28 February 2008. In the HMNH collection, a specimen collected from the Dashkahul cave (Ardabil) on 11 December 2005 has been discovered, most probably it was taken in a torpid stage from this smaller cave (see below). The specimens used by Karataş et al. (2006) for karyological investigations were also collected in the hibernation period (Sakholan [= Sahulan] cave, Azarbaijan, November 2005).

Several records of *R. ferrumequinum* in Iran were made also in the transient season of the year, after the disintegration of nursery colonies and before the beginning of hibernation, approximately between late August and early October. Similarly as in the case of other seasonal types of roosts, most of the roosts from the transient period come from caves. These caves are represented both by extensive and smaller spaces. Lay (1967: 89–90) reported on a finding of one male hanging in a small cave situated 6 km east of Maku (Azarbaijan) on 28 September 1962, the cave "consisted of several interconnected, cylindrical tunnels, which extended approximately 45 m. into the mountain. These cool, dark tunnels were found to be entirely dry. A solitary *Rhinolophus ferrumequinum* hung from the ceiling of one darkened connecting tube." DeBlase (1980: 93) reported: "we observed about 12 of this species in a cave 3.2 km. N Khurramabad [Khoramabad, Lorestan; on 13 September 1968]. The bats hung singly along a small, dark, damp passage terminating in a small chamber into which light filtered through spaces between jumbled rocks." The cave and its visit are described as follows (pp. 331–332): "The cave consisted of two passages opening side by side to the exterior. The right-hand chamber was small and long. […] I went through a crawlway at the back of this passage and found about 12 *R. ferrumequinum* in a small low chamber. Three of these bats were collected and the others flew through small openings in the rear of the chamber through which daylight could be seen. The lefthand passage opened into a small but very high chamber that did not penetrate beyond the twilight zone."

The Shahpur cave, a very famous Iranian cave frequently visited by tourists, has been also identified as a transient roost of *R. ferrumequinum*; DeBlase (1980: 94) reported: "on this date [9 October 1968] we found one male and one female *R. ferrumequinum* hanging together in deep torpor in a room that contained large numbers of *Miniopterus schreibersii* [= *pallidus*] and a few

←
Figs. 31–33. Karaftu cave at Takab (Kordestan), a roost of *Rhinolophus ferrumequinum*, *R. mehelyi*, *Myotis blythii*, and *Miniopterus pallidus*. Photos by A. Reiter & M. Uhrin.

Myotis capaccinii. Another male, also in deep torpor, was collected from another part of the cave. When the 1962 Street Expedition visited this cave on 29 December [1962], no *R. ferrumequinum* were found […]. I must assume that while this huge cavern is used as a prehibernation roost, it is not used as a hibernaculum." The cave can be shortly described as follows (DeBlase 1980: 300): "Shahpur Cave is one of the largest and most majestic caves in Iran, and it harbors a large and varied bat fauna. To date seven species are known from it. […] The entrance chamber […] is dominated by a huge statue of King Shahpur […] that looks over the valley below. The entrance is 44 m. wide and 15 m. high. From it the passage slopes down through a room 91 m. long, 45 m. wide, and 30 to 45 m. high […], where […] groves channeled the water into several large rectangular storage pools in a large rotunda-like room […]. [… behind it, there] is [a] large chamber about 30 m. in diameter and 23 m. high […]. [… at the end of this chamber] the 1968 Street Expedition found […] two *R. ferrumequinum*. All bats were in torpor as we approached, though this area at the top of the slope was quite warm. [… in the passage going to right from the main room] one *R. ferrumequinum* […] hung in torpor […] directly from the ceiling."

Two torpid individuals of *R. ferrumequinum* were observed in the Karaftu cave complex (Kordestan; see under *Myotis blythii* for description of this roost; Figs. 30–33) on 18 October 2011; one torpid bat was collected from a small cave (ca. 10 m long) in a steep side of the valley below Chuplu (Azarbaijan) on 2 October 1998. Two transient roosts of *R. ferrumequinum* were documented at Dashkasan (Ardabil) in caves on the northern slope of Mt. Sabalan; three bats were found in the Deimdeim cave on 31 August 2010 and two individuals in the Dashkasan cave on 29 September 2011. The latter cave is a relatively small cavity, ca. 15 m long, with high entrance (ca. 10 m; Fig. 200). Collections of two specimens in the Mozduran cave (Khorasan) on 4 October 1974 reported by Felten et al. (1977) and of one specimen found in the Golgik cave (Zanjan) on 8 October 2008, discovered in the HMNH collection, can be also considered as records of *R. ferrumequinum* from a cave transient roost. Some authors (Etemad 1967, 1984, Flanders et al. 2009, Akmali et al. 2011a) mentioned findings of *R. ferrumequinum* in caves (see Records), however, they did not specify the season/date of the record nor details concerning the recorded bats (number, sex and/or age of the recorded bats).

A relatively high proportion of transient roosts of *R. ferrumequinum* was found in other structures including artificial ones. DeBlase (1980: 92–93) described finding of a colony in the Mar Ab Canyon (Kermanshah) on 25 August 1968: "One narrow steep-side section of this canyon, through which a stream named Mar Ab flows, is filled with a jumble of huge boulders […], the largest of which are the size of small houses. As we approached one of these boulder piles, about 100 bats flew out of the space at the base of a pile (space ranging to 20 ft. [= 6.1 m] in height) and flew to another pile. […] The guano deposits were not large enough to indicate the presence of these bats throughout the summer and the rocks are too exposed for a hibernaculum. I assume that this locality is used as a temporary roosting site after the breeding season and before hibernation." One male *R. ferrumequinum* was discovered in a small mine (large man-made room around a natural spring) at Zaman Sufi (Khorasan) in October 1999. A small group of nine *R. ferrumequinum* (including seven females) was found in the loft space of the Tobacco Institute in Tir Tash (Mazandaran) on 4 September 1970 (DeBlase 1980). Although DeBlase did not give any close details concerning this record (see DeBlase 1980: 334), it cannot be excluded that this record represents a rest of former maternity colony in a house attic; in that case it is the only example of such type of artificial roost of *R. ferrumequinum* from Iran and also of very few known from the whole Middle East (cf. Benda & Horáček 1998). Such roost preference is known rather from northwards lying parts of the species distribution range, mainly from Europe north of the Alps (Horáček 1984, Gaisler 2001a). However, considering the unrare records of *R. ferrumequinum* from attic spaces known from Transcaucasia (Perov 1980, Rahmatulina 2005), it is possible that also in northernmost Iran, where climatic conditions and density of human settlements are similar to Transcaucasia (Gilan, Mazandaran), the populations of *R. ferrumequinum* might tend to this roost preference.

Majority of the above mentioned roosts were inhabited solely by *R. ferrumequinum*. However, approximately one third of the shelters were shared with some other bats. DeBlase (1980) reported five bat species found together in the large Shahpur cave during one visit in October 1968, besides *R. ferrumequinum* also *Rhinolophus hipposideros*, *Myotis capaccinii*, *Pipistrellus pipistrellus*, and *Miniopterus pallidus*. Five bat species were collected also from the Mozduran cave on 4 October 1974 (Felten et al. 1977, Kock 1983); in addition to *R. ferrumequinum* also *Rhinolophus euryale*, *R. blasii*, *Myotis blythii*, and *Miniopterus pallidus*. This number of bat species was reported by Etemad (1967, 1984) from the Azad-Khan cave, however, it is not clear whether all of them were present in the cave during the same visit; viz. *R. ferrumequinum*, *R. hipposideros*, *Myotis blythii*, *M. emarginatus*, and *Miniopterus pallidus*. A community of three species was documented in the Karaftu cave on 18 October 2011, where *M. blythii* and *M. pallidus* were found along with *R. ferrumequinum*. Etemad (1967, 1984) and Akmali et al. (2011a) mentioned two co-occurring species in roosts of *R. ferrumequinum* (*R. hipposideros* and *M. blythii* in the Katale Khor cave and *R. blasii* and *M. pallidus* in the Mozduran cave, respectively), however, simultaneous occurrence at these sites is not quite clear from their reports.

In more sites, *R. ferrumequinum* shared its roosts with one additional bat species. During the same visit, co-roosting with *Myotis blythii* was found a small cave 16.1 km north-northwest of Oromiyeh and in a cave 3.2 km north of Khurramabad (DeBlase 1980) (perhaps also in the Mozaffar cave, see Akmali et al. 2011a); with *R. blasii* in the Ganjan Kuh cave (Lay 1967) (and perhaps in the Baba-Jaber cave, see Etemad 1967, 1984); and with *R. hipposideros* in a small cave near Chuplu. Findings of *R. ferrumequinum* were reported also from several roosts, which were used by other species in different seasons (Golgik, Kojanagh, and Vayqan caves).

Besides these numerous caves, *R. ferrumequinum* was found to share also other types of roosts; Lay (1967) reported the finding of simultanously hibernating *R. ferrumequinum* and *R. blasii* in the qanat at Robat-i-Qarabil; DeBlase (1980) found several *Myotis emarginatus* in addition to several tens of *R. ferrumequinum* under boulders in the Mar Ab Canyon and also mentioned a collection of *R. ferrumequinum*, *M. emarginatus* and *P. pipistrellus* from the loft of the Tobacco Institute in Tir Tash.

Thus, *R. ferrumequinum* was found to share its roosts mainly with (ordered by frequency) *Myotis blythii*, *Miniopterus pallidus*, *Rhinolophus blasii*, *R. hipposideros*, *Myotis emarginatus*, *Rhinolophus euryale*, and *Pipistrellus pipistrellus*. However, while *R. ferrumequinum* was found with *M. blythii* in six roosts, with *R. euryale* and *P. pipistrellus* only in two roosts each.

Foraging individuals of *R. ferrumequinum* were recorded only in few sites, in most cases they represent bats emerging from or approaching caves and thus the records can be considered rather as evidences of roosts. However, two exceptions exist. Fahrang-Azad (1969) reported on netting carried out over a small stream at Chelmir within the main range of the Kopetdagh Mts. (Khorasan) in July 1968; during the netting session covering probably more evenings, an extremely rich community of bats was recorded, composed of nine species: along with two females of *R. ferrumequinum* (one reported as *R. bocharicus*, but see below), also *Myotis blythii*, *M. emarginatus*, *Eptesicus serotinus*, *E. ognevi*, *Hypsugo savii*, *Otonycteris leucophaea*, *Miniopterus pallidus*, and *Tadarida teniotis* were netted (Farhang-Azad 1969a, DeBlase 1980). Echolocation call of a foraging individual of *R. ferrumequinum* was recorded in the alluvial vegetation in the broad valley of the Dez river near Lenje Abad (Lorestan; Fig. 40) on 1 October 2011; during the same evening one individual of *Pipistrellus pipistrellus* was netted and calls of *Rhinolophus hipposideros*, *Asellia tridens*, *Pipistrellus kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis* were detected and recorded.

An adult male of *R. ferrumequinum* was netted in front of a small cave in the shrubland mountain ridge above Deh Bakri (Kerman) in the easternmost extent of the Zagros Mts. (Fig. 129) on 8 April 2000; at the same place, also *Myotis blythii* and *Eptesicus anatolicus* were netted. Two individuals of *R. ferrumequinum* were netted at the Sarab cave near Omid Abad (Chahar Mahal va Bakhtiari) in summer 2001 (along with *Myotis blythii* and *Miniopterus pallidus*) and one female in summer 2010 (along with *M. pallidus*). At a small cave in the rocky massif above the Bisotun village (Kermanshah), in the rock wall where also the ancient monument of Bisotun is present, a subadult female of *R. ferrumequinum* was netted; during this netting session on 8 October 1998, also *Myotis capaccinii*, *Eptesicus anatolicus*, *Miniopterus pallidus*, and *Tadarida teniotis* were recorded. Echolocation of one *R. ferrumequinum* emerging from the Tadovan cave was recorded on 7 October 2011, in this evening also *Rhinopoma microphyllum*, *R. muscatellum*, *Myotis blythii*, *M. capaccinii*, and *Miniopterus pallidus* were netted in front of the cave. Fifteen individuals of *R. ferrumequinum* were netted at the Kharmanesar cave on 22 November 2008, in the cave where also a large summer colony was present in the same year.

DeBlase (1980: 94) summarised ecological observations in *R. ferrumequinum* as follows: "in Iran *R. ferrumequinum* has been found in torpor in qanats on 9 and 13 November and 21 December 1962, and in caves on 12 November 1962, and 4 and 9 October and 6 December 1968. Active populations have been found on 4 and 24 August and 13 September. Hibernation apparently begins in late September. Small, damp, relatively light caves seem to be preferred as nursery sites, larger caves and jumbled boulders are utilized as temporary roosts, and large caves and qanats are utilized as hibernacula. The only habitats that have been described for the species in Iran include natural and man-made caves and cavernous spaces under boulders." In our summary, we can add that active foraging individuals of *R. ferrumequinum* were observed also in October and November. Even in the relatively very cold mountains of northern Iran, hibernation probably begins later than suggested by DeBlase (1980), on the break of October/November. The torpid individuals found in roosts during the autumn period (September, October) rather represent bats in a day lethargy than in a permanent hibernation stage, similarly as in other parts of the Middle East (see Benda et al. 2010). *R. ferrumequinum* was documented from a wide scale of roost types, including all types of caves (small and large, light and dark, wet and dry), and also from caverns under boulders, qanats, mines, and attics of buildings, although natural caves dominate the record.

Despite the large number of records of *R. ferrumequinum* in Iran, no direct observation documenting reproduction of this species is available. Findings of volant immature individuals are reported from late June over the rest of the season until October. This suggests parturitions to occur in Iran probably in (late) May to (early) July, similarly as in other parts of the south-west-Asian range of the species (see Rahmatulina 2005, Benda et al. 2006, 2010).

Osteological remains of *R. ferrumequinum* were recorded in Iran in the diet of only one owl species, *Bubo bubo*, but from six localities (Table 40). The remains of *R. ferrumequinum* made up 0.12–6.67% (mean 1.48%) per sample volume of all prey items (and 0.13–16.67% [mean 3.39%] of mammal items) in the respective samples and 0.10% of all prey items (0.13% of mammal items) in the whole analysed eagle owl diet from Iran. From the Middle East – besides Iran – *R. ferrumequinum* was found as owl prey also in Turkey, Syria and Jordan (Obuch 1994, 2011, Benda et al. 2006, 2010).

Material examined. 1 ind. (JOC unnumbered [Sf]), Bastam (Azarbaijan-e Gharbi Prov.), 30 September 1998, leg. J. Obuch; – 1 ♀ (NMP 48148 [S+A]), Bisotun (Kermanshah Prov.), 8 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 48122 [S+A]), Chuplu (Azarbaijan-e Gharbi Prov.), 2 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 inds. (JOC unnumbered [Sf]), Chuplu (Azarbaijan-e Gharbi Prov.), 2 October 1998, leg. J. Obuch; – 1 ♂ (HMNH 2007.30.2. [S]), Dashkahul cave, Dashkasan [Ardabil Prov.], 11 December 2005, leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari; – 2 ♀♀ (NMP 93861, 94107 [S+A]), Dashkasan cave, Dashkasan (Ardabil Prov.), 29 September 2011,

Table 8. Basic biometric data on the examined Iranian samples of *Rhinolophus ferrumequinum* (Schreber, 1774), *R. hipposideros* (Borkhausen, 1797), and *R. euryale* Blasius, 1853. For abbreviations see p. 171

	Rhinolophus ferrumequinum					*Rhinolophus hipposideros*					*Rhinolophus euryale*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	6	**71.7**	69	74	1.966	4	**44.0**	40	48	3.651	–	–	–	–	–
LCd	6	**40.8**	35	45	4.119	4	**29.5**	27	31	1.915	–	–	–	–	–
LAt	8	**58.69**	55.0	61.3	1.840	8	**39.01**	37.7	40.9	1.037	13	**48.04**	46.0	50.2	1.245
LA	6	**24.13**	22.4	25.8	1.244	4	**17.08**	15.8	18.6	1.153	–	–	–	–	–
LCr	8	**23.28**	22.58	23.58	0.367	5	**16.20**	16.12	16.31	0.098	7	**19.09**	18.57	19.58	0.349
LOc	7	**22.60**	21.46	23.04	0.556	6	**15.35**	14.93	15.61	0.226	4	**18.55**	18.44	18.67	0.095
LCc	8	**20.19**	19.08	20.70	0.530	7	**13.71**	13.29	13.96	0.237	12	**16.31**	15.88	16.74	0.216
LaZ	8	**11.86**	11.59	12.39	0.261	7	**7.43**	7.17	7.66	0.174	12	**9.32**	8.44	9.68	0.357
LaI	9	**2.59**	2.09	3.03	0.272	7	**1.58**	1.43	1.64	0.070	13	**2.31**	2.13	2.44	0.094
LaInf	9	**6.03**	5.86	6.22	0.108	6	**3.64**	3.53	3.75	0.094	7	**4.61**	4.41	4.76	0.118
LaN	8	**9.23**	8.90	9.44	0.202	7	**6.48**	6.18	6.73	0.211	13	**8.30**	7.92	8.68	0.202
LaM	8	**10.36**	10.02	10.68	0.219	7	**7.39**	7.26	7.49	0.101	6	**9.09**	8.57	9.48	0.342
ANc	8	**6.79**	6.61	7.02	0.135	7	**4.61**	4.34	4.82	0.198	12	**6.01**	5.87	6.35	0.157
LBT	8	**3.46**	3.33	3.68	0.121	7	**2.48**	2.31	2.92	0.208	6	**3.08**	2.97	3.32	0.124
CC	8	**6.16**	5.91	6.42	0.172	6	**3.58**	3.49	3.64	0.054	12	**4.47**	3.94	4.73	0.236
M^3M^3	9	**8.44**	8.28	8.63	0.135	6	**5.49**	5.42	5.58	0.072	13	**6.62**	6.06	6.97	0.245
CM^3	8	**8.39**	8.08	8.58	0.160	7	**5.50**	5.36	5.62	0.096	14	**6.33**	6.21	6.58	0.105
LMd	9	**15.30**	14.58	15.70	0.347	7	**9.78**	9.36	10.24	0.303	22	**11.72**	11.27	12.28	0.259
ACo	13	**3.82**	3.57	4.07	0.119	7	**2.00**	1.66	2.12	0.152	22	**2.53**	2.13	2.69	0.133
CM_3	8	**9.05**	8.63	9.24	0.204	7	**5.70**	5.47	5.93	0.156	14	**6.72**	6.54	6.93	0.101

leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 48352 [S+A]), Deh Bakri (Kerman Prov.), 8 April 2000, leg. P. Benda & A. Reiter; – 1 ♂ (HMNH 2009.46.4. [A]), Golgik cave [Zanjan Prov.], 8 October 2008, collector unlisted, don. F. Hemmati; – 2 inds. (JOC unnumbered [Sf]), Izeh (Khuzestan Prov.), 13 October 1998, leg. J. Obuch; – 1 ♂ (NMP 93911 [S+A]), Karaftu cave (Kordestan Prov.), 18 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (BMNH 20.2.9.3 [S+B], holotype of *Rhinolophus ferrumequinum irani* Cheesman, 1921), Shiraz, Persia [Fars Prov.], 21 June 1919, leg. J. E. Hotson; – 1 ind. (JOC unnumbered [Sf]), Sivand (Fârs Prov.), 30 April 1996, leg. J. Obuch; – 1 ind. (JOC unnumbered [Sf]), Soltan Abad (Azarbaijan-e Gharbi Prov), 19 October 1998, leg. J. Obuch.

MORPHOLOGY AND VARIATION. External and cranial dimensions of the Iranian specimens of *Rhinolophus ferrumequinum* are shown in Table 8. For the material examined see above.

Two subspecies of *R. ferrumequinum* have been reported from south-western Asia (see the reviews by DeBlase 1980 and Benda et al. 2006), besides the nominotypical form, *R. f. ferrumequinum* (Schreber, 1774), living in the Mediterranean habitats of the Levant, Turkey and Transcaucasia, also *R. f. irani* Cheesman, 1921 from the southern and eastern parts of the species range in the Middle East and from West Turkestan and Afghanistan (type locality: Shiraz, Persia [Fars, Iran]; Cheesman 1921: 576).

DeBlase (1980) examined a series of *R. ferrumequinum* specimens from a broad area of south-western Asia including 23 samples from Iran. Skull size was mentioned by DeBlase (1980) as the main discrimination criterion between the two subspecies, being larger in *R. f. ferrumequinum*, LCc 20.9–21.8 mm (mean 21.4 mm), and smaller in *R. f. irani*, LCc 19.8–20.9 mm (mean 20.3 mm). He assigned all Iranian bats to *R. f. irani*, while the samples from Turkey and from the Levant to the nominotypical subspecies (similarly as Felten et al. 1977). According to this comparison, DeBlase (1980: 84) designated the range of the latter subspecies as: "Iraqi Kurdistan, eastern Turkey(?), eastern Transcaucasia, Iran, Turkmeniya, Uzbekistan, southern Kazakhstan, Afghanistan, and Pakistan." While Nader & Kock (1983a) and Harrison & Bates (1991) situated the western margin of the distribution range of *R. f. irani* to the Iraqi Mesopotamia, the evidence reported by Benda et al. (2006) shifted this border westwards to the Mesopotamian lowland of eastern Syria. On the other hand, Chakraborty (1978) synonymised *R. f. irani* and *R. f. proximus* Andersen, 1905 under the latter name (type locality: Gilgit [Kashmir]; Andersen 1905b: 113).

The simple comparison of skull size characters of more than 200 specimens from south-western Asia (i.e. the Middle East incl. Cyprus, Transcaucasia, West Turkestan and Afghanistan; Fig. 34) including a limited series of Iranian samples (n=8; incl. the holotype of *R. f. irani*) showed a large variation in the respective populations of *R. ferrumequinum*. The Iranian representatives are small- to medium-sized (and the *irani* holotype specimen is one of the largest Iranian samples, LCc 20.70 mm), similarly as the Transcaucasian and West Turkestani samples; medium-sized samples are from Anatolia; large-sized bats were found in the Levant and Himalayas (types of *R. tragatus* Hodgson, 1835 and *R. f. regulus* Andersen, 1905), while small-sized bats in Mesopotamia and Afghanistan plus one bat available from Kashmir (the holotype of *R. f. proximus*; LCc 18.93 mm). However, the skull size ranges of the Transcaucasian and Turkestani bats overlap broadly with the medium-sized groups, namely the Iranian set (Fig. 34). These results suggest rather a clinal shift in size characters in a broad-scale aspect than categorial differences between particular populations in a local aspect.

Benda et al. (2006) speculated that the size variation in the populations of *R. ferrumequinum* within the Middle East could be perhaps humidity-dependent, individuals from the more humid areas being larger than individuals from arid areas. This hypothesis implies plasticity rather than

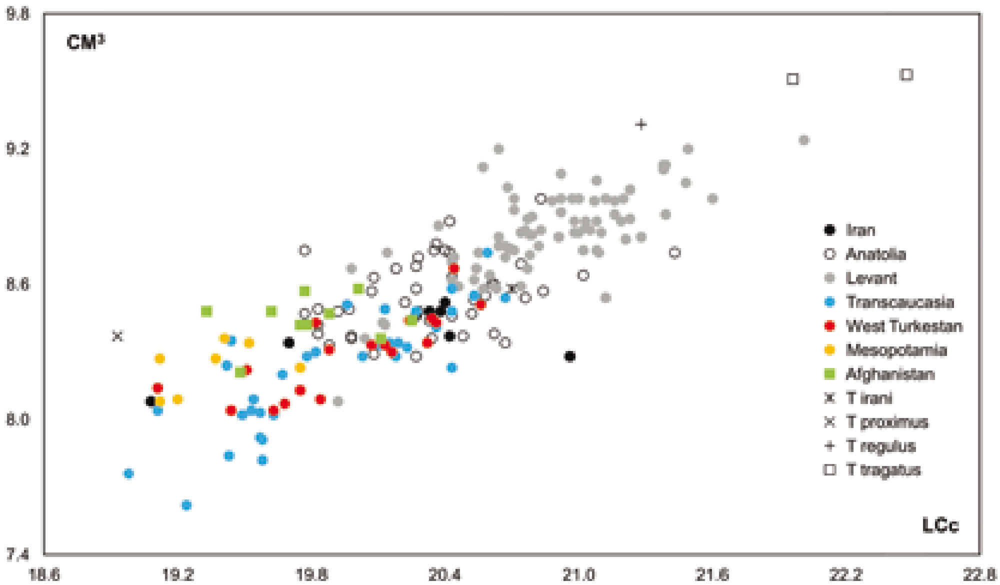

Fig. 34. Bivariate plot of the examined Iranian and comparative samples of *Rhinolophus ferrumequinum* (Schreber, 1774) from south-western Asia: condylocanine length of skull (LCc) against the length of upper tooth-row (CM^3). T = type specimen.

conservatism in morphological traits and thus a somewhat limited use of the size differences for taxonomic division of the species. However, the question whether there really are no categorial differences in the populations of the Middle East and the metric variation reflects relatively recent changes in ecological conditions, could be probably solved only by a genetic analysis. Indeed, the Middle Eastern populations of *R. ferrumequinum* including the Iranian samples were several times subjected to a molecular genetic analysis (Rossiter et al. 2007, Kůs 2008, Flanders et al. 2009, Benda & Vallo 2012). Results of these studies revealed two main lineages within the traditionally considered species rank, the western one and the eastern one, which were relatively deeply divergent in mtDNA uncorrected *p* distance (5.35% in the ND2 gene, Flanders et al. 2009; 4.7–5.4% in the cyt *b* gene, Benda & Vallo 2012). Since these two lineages are mutually more distant than the western lineage and some populations of *R. clivosus* Cretzschmar, 1828, the eastern lineage was considered by Benda & Vallo (2012) a separate species, *R. nippon* Temminck, 1835.

The above defined two lineages consisted of four geographically defined sublineages; (1) Europe and Maghreb, (2) Middle East (samples from Turkey, Syria, Cyprus, Lebanon, and Iran), (3) south-western and central China, and (4) southern and eastern China and Japan. However, while between the two eastern sublineages (i.e. of *R. nippon*), a rather pronounced divergence was found (3.45% in ND2 and 3.7–4.1% in cyt *b*; Flanders et al. 2009, Benda & Vallo 2012), between the western sublineages (i.e. of *R. ferrumequinum* s.str.) of Euro-Maghrebian and Middle Eastern origins there was only a shallow divergence of 1.16% and 0.9–1.1%, respectively. These results suggest two main implications for taxonomy of *R. ferrumequinum* in the western Palaearctic; (1) the Middle Eastern populations belong to one sublineage which does not support the former division into more taxa, and (2) the shallow genetic divergence between the two western sublineages does not support subspecific division of *R. ferrumequinum* either. However, when the subspecific status is accepted for the south-west-Asian populations (sublineage) of the species, perhaps the prior available names are *R. f. tragatus* Hodgson, 1835 (type locality: central region of Nipal; Hodgson 1835: 699) or *R. f. regulus* Andersen, 1905 (type locality: Masuri [Uttarkhand, India]; Andersen 1905b: 112), while *R. f. irani* certainly remains among synonyms. While Sinha (1973) regarded the forms *tragatus* and *regulus* to be synonymous, the name *R. f. tragatus* seems to be a valid name for the respective populations, if the subspecies is finally recognised.

Karataş et al. (2006) described karyotype from *R. ferrumequinum* specimens originating from north-western Iran (Azarbaijan): the diploid number of chromosomes 2n=58, the fundamental number of chromosomes NF=62, the number of autosomal arms NFa=58, X chromosome submetacentric, Y chromosome dot-like acrocentric.

Echolocation. *Rhinolophus ferrumequinum* shows echolocation calls with a long constant--frequency part. The values of maximum frequency recorded in the European populations were between 76–84 kHz (Heller & von Helversen 1989, Jones & Rayner 1989, Russo & Jones 2002, Obrist et al. 2004, Dietz et al. 2007, Papadatou et al. 2008). Benda et al. (2010) reported similar FMAX values from Jordan (81.1 kHz), while Shalmon et al. (1993) and Mendelssohn & Yom-Tov (1999) slightly higher values (83–85 kHz) from Israel.

We recorded only two call sequencies of *R. ferrumequinum* in Iran produced probably by a single foraging individual, flying around riparian vegatation near the Dez river at Lenje Abad (Fig. 35). Basic values of echolocation parameters are given in Table 3. Maximum frequency values of these calls were at 78.5–80.6 kHz, which fully conforms to previously published values. Thus, the rather low variation in this echolocation character within the whole *R. ferrumequinum* range has been confirmed also by data recorded from Iran. On the other hand, we measured slightly higher values of SF and EF, compared to the data obtained from European populations (see the above authors).

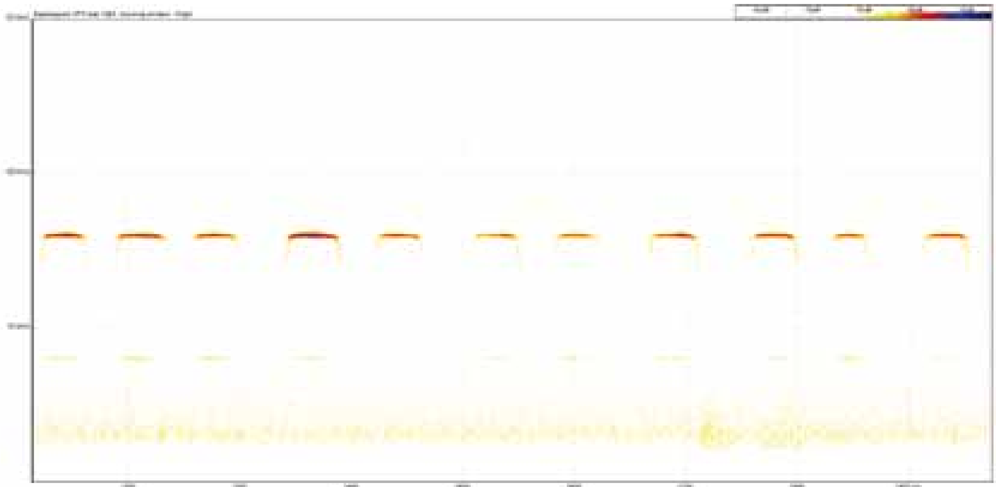

Fig. 35. Spectrogram of echolocation calls of *Rhinolophus ferrumequinum* (Schreber, 1774); an individual foraging near the riparian bush vegetation at Lenje Abad (Lorestan).

Feeding ecology. *Rhinolophus ferrumequinum* is a medium-sized insectivorous bat that uses several foraging strategies, viz. foraging close to foliage or other cluttered background, hawking in open air, 'flycatching' from perches, and/or taking a prey from surface (Norberg & Rayner 1987, Jones & Rayner 1989, Gaisler 2001a). The species diet was studied thoroughly in European populations and Lepidoptera, Coleoptera, Diptera, and Hymenoptera were found to represent the most important diet items (Jones 1990, Beck 1995, Flanders & Jones 2009). Coleoptera, Lepidoptera, and Diptera also dominated in the diet of *R. ferrumequinum* in Azerbaijan (Rahmatulina 2005).

As far as the populations in the Middle East are concerned, the species was studied in Turkey, Syria and Jordan; Coleoptera together with Lepidoptera were found to be the most important food items of *R. ferrumequinum* in the region (Benda et al. 2006, 2010, Whitaker & Karataş 2009). A similar diet pattern was observed in the populations from Crete and Lebanon (own unpubl. results). Solpugida recorded in the samples from Syria (Benda et al. 2006) suggested ground gleaning of the prey in *R. ferrumequinum*.

From Iran, the contents of three digestive tracts of *R. ferrumequinum* were analysed. The tract of the specimen collected at Chuplu (Azarbaijan) contained only larger moths (Lepidoptera); the specimen collected at Bisotun (Kermanshah) fed mostly on moths (Lepidoptera) (90% of volume), but also on brachyceran Diptera (5%) and on caddisflies (Trichoptera) (5%); the digestive tract of *R. ferrumequinum* collected at Deh Bakri (Kerman) contained only remnants of larger scarabaeid beetles. The recorded predominance of Lepidoptera and Coleoptera corresponds well with results of most of the previous diet analyses from other parts of the *R. ferrumequinum* range.

Records of ectoparasites. **Original data**: N y c t e r i b i i d a e: *Phthiridium biarticulatum*: 1 ma (CMŠ [A]) from 1 fs (NMP 94107), Dashkasan, Dashkasan cave (Ardabil Prov.), 29 September 2011. – A r g a s i d a e: *Argas vespertilionis*: 1 nymph (CMŠ [P]) from 1 fs (NMP 94107), Dashkasan, Dashkasan cave (Ardabil Prov.), 29 September 2011. – **Published data**: N y c t e r i b i i d a e: *Nycteribia schmidlii*: 1 fa from 2 m, Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.] (Kock 1983). – S t r e b l i d a e: *Brachytarsina flavipennis*: 2 ma, 1 fa from from 2 m, Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.], 4 October 1974 (Kock 1983). – T r o m b i c u l i d a e: *Willmannium aelleni*: 5 larvae from 4 inds., 96 km vostočnee Mešheda, peŝera Mozdoran vblizi Sarkasa [= Mozduran cave near Sarakhs, 96 km E of Mashhad; Khorasan-e Razawi Prov.], 29 July 1969 (Kudrâšova 1975, Kudrâšova et al. 1978 [as *Chiroptella mozdorani*], Kudrâšova 1992, 1998, 2004).

Comments on ectoparasites. *Phthiridium biarticulatum* (Hermann, 1804) is a bat fly parasitic on bats of the genus *Rhinolophus* (Hůrka 1964a). Its finding from *Rhinolophus ferrumequinum* in Iran is not surprising, it was previously recorded from the country from *R. euryale* and/or *R. blasii* (Kock 1983). Only two species of insect ectoparasites of *R. ferrumequinum* have been published from Iran so far, *Brachytarsina flavipennis* Macquart, 1851 and *Nycteribia schmidlii* Schiner, 1853 (Kock 1983). The former one prefers bats of the genus *Rhinolophus* as its hosts; on the other hand, the most preferred hosts of *N. schmidlii* are bats of the genus *Miniopterus* and only rarely of the genera *Myotis* and *Rhinolophus* (Theodor 1975).

In *R. ferrumequinum* from Iran, a finding of the soft tick *Argas vespertilionis* (Latreille, 1796) was also documented. Generally, this species parasitises mainly bats of the genus *Pipistrellus* (Beaucournu 1966, Dusbábek 1972) and it was also previously documented from this host group from Iran (Filippova et al. 1976). It occurs in the whole Old World south of 60° N and parasitises on a variety of hosts (Filippova 1966, Kolonin 2007). In Iran it was also collected from *Pipistrellus pipistrellus*, *P. pygmaeus*, and *Miniopterus pallidus* (see under these species).

The chigger mite *Willmannium aelleni* (Vercammen-Grandjean, 1963) was originally reported from Iran under the name *Chiroptella mozdorani* Kudrâšova, 1975, a species described on the basis of larvae specimens collected from *R. ferrumequinum* in the Mozduran cave (Khorasan). *W. aelleni* is known to occur in Iran, Afghanistan, and Kirghizstan, parasitising *Rhinolophus ferrumequinum*, *Myotis blythii*, and *Barbastella darjelingensis* (Kudrâšova 1992).

From neighbouring Azerbaijan, *Neotrombicula microchiropteri* Mulârskaâ, 1971 was described from *R. ferrumequinum* (Mulârskaâ 1971); occurrence of this chigger mite is thus well possible also in the Iranian part of the Caucasus region.

Rhinolophus bocharicus Kaŝenko et Akimov, 1917

Record. **Published data**: K h o r a s â n - e R a z a w i: Chelmir, over a stream, July 1968: net. 1 fj, IPHR (Fahrang-Azad 1969a).

Comments. From Iran, *Rhinolophus bocharicus* was reported only once, Farhang-Azad (1969a) mentioned netting of a [juvenile] female from Chelmir in the Kopetdagh Mts., northern Khorasan. Although Strelkov et al. (1978) clearly argued that the identification by Farhang-Azad (1969a) was erroneous as the dimensions given exceed those of adult *R. bocharicus* from Turkmenistan and correspond rather to juvenile individuals of *R. ferrumequinum*, a series of authors (Corbet 1978, DeBlase 1980, Rybin et al. 1989, Koopman 1994, Simmons 2005, Karami et al. 2008) accepted the record of *R. bocharicus* from Iran as justified.

DeBlase (1980: 95) examined the respective IPHR specimen and reported: "It is a very young female with epiphyses of the phalanges, the metacarpals, and even the radius and ulna completely separated from the bone shaft by soft cartilage. […] Even though the Iranian specimen is very immature, it is well within the size range of the other specimens [of *R. bocharicus*] and in certain dimensions (e.g., FA [= forearm length] and CBL [= condylobasal length of skull]) is one of the largest specimens listed. It is possible that this specimen is only an immature *R. ferrumequinum*, […]." Unfortunately, DeBlase (1980) did not mention dimensions of the specimen other than those given already by Farhang-Azad (1969a).

Our comparison of dimensional data on the Iranian horseshoe bat specimen published by Farhang-Azad (1969a) with the dimensions of samples of *R. bocharicus* from West Turkestan and samples of *R. ferrumequinum* from south-western Asia (between the Levant and West Tur-

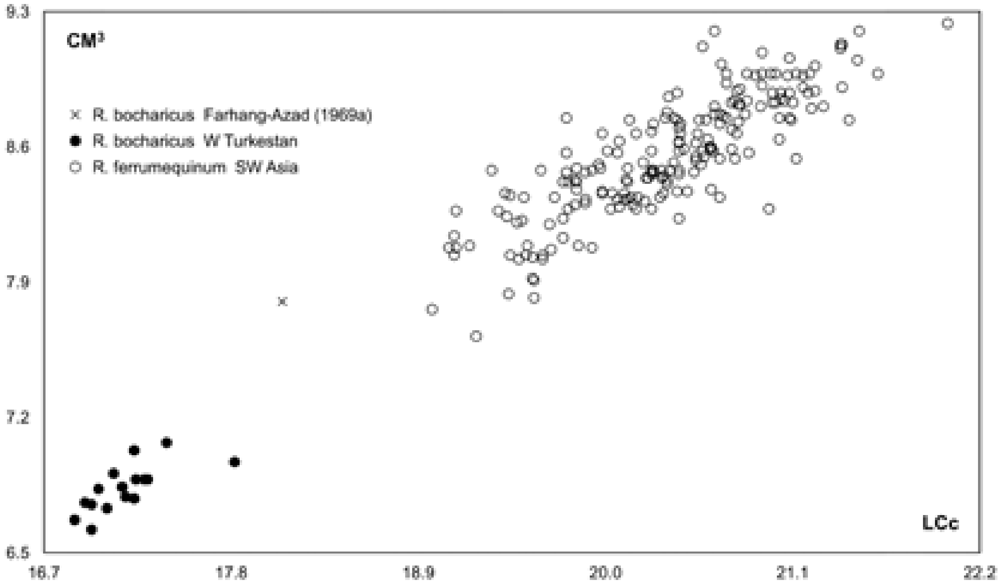

Fig. 36. Bivariate plot of the Iranian specimen assigned to *Rhinolophus bocharicus* Kaŝenko et Akimov, 1917 by Farhang-Azad (1969a) and the samples of *R. bocharicus* from West Turkestan and *R. ferrumequinum* (Schreber, 1774) from south-western Asia: condylocanine length of skull (LCc) against the length of upper tooth-row (CM^3).

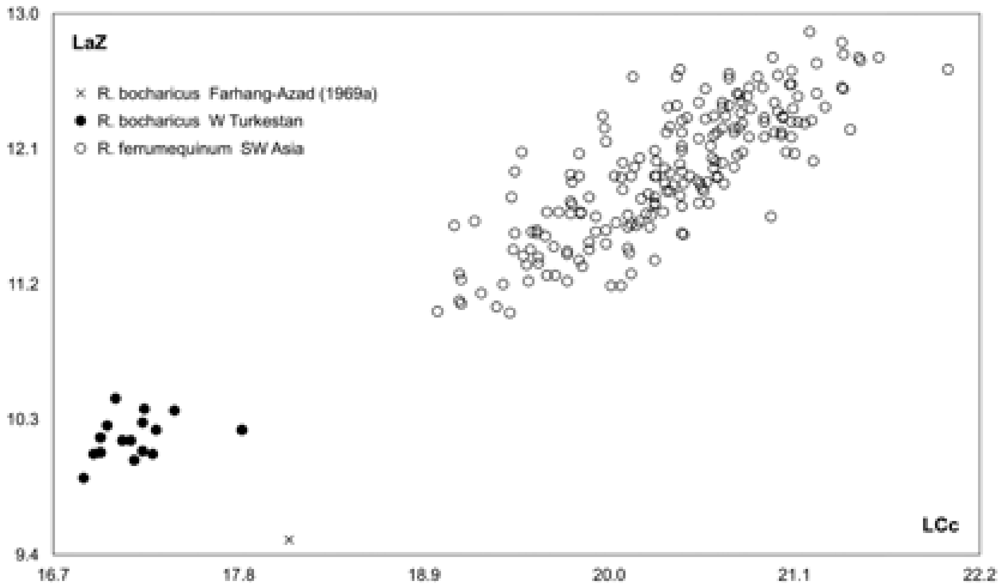

Fig. 37. Bivariate plot of the Iranian specimen assigned to *Rhinolophus bocharicus* Kaŝenko et Akimov, 1917 by Farhang-Azad (1969a) and the samples of *R. bocharicus* from West Turkestan and *R. ferrumequinum* (Schreber, 1774) from south-western Asia: condylocanine length of skull (LCc) against the zygomatic width (LaZ).

Table 9. Comparison of biometric data on the specimen assigned to *Rhinolophus bocharicus* Kaŝenko et Akimov, 1917 by Farhang-Azad (1969a) and sets of samples of *R. bocharicus* from West Turkestan and *R. ferrumequinum* (Schreber, 1774) from south-western Asia. For abbreviations see p. 171

	Rhinolophus bocharicus West Turkestan					*Rhinolophus ferrumequinum* SW Asia					'*Rhinolophus bocharicus*' Farhang-Azad (1969a)
	n	**M**	min	max	SD	n	**M**	min	max	SD	
LAt	15	**50.58**	49.4	52.5	0.937	192	**57.13**	52.3	61.3	1.934	52.0
LCc	16	**17.18**	16.88	17.82	0.227	203	**20.36**	18.93	22.01	0.601	18.1
LaZ	16	**10.18**	9.91	10.44	0.140	204	**11.95**	10.98	12.88	0.439	9.5
LaI	16	**2.44**	2.21	2.75	0.155	206	**2.49**	2.08	2.98	0.160	2.4
CM^3	16	**6.84**	6.62	7.07	0.123	206	**8.56**	7.62	9.31	0.314	7.8
LMd	15	**12.64**	12.28	12.93	0.208	204	**15.52**	14.27	16.78	0.534	12.8
CM_3	15	**7.41**	7.17	7.59	0.125	205	**9.20**	8.14	10.21	0.358	9.8

kestan, incl.; Table 9), showed the Farhang-Azad (1969a) juvenile specimen to be much larger in longitudinal skull dimensions (LCc, CM^3, CM_3) than adult *R. bocharicus*, in some dimensions at the upper range margin of the respective dimensions in *R. bocharicus* (LAt, LMd), and in the zygomatic width (LaZ) below the lower range margin of this dimension in *R. bocharicus* (Figs. 36, 37); on the other hand, the values of tooth-row lengths (CM^3, CM_3) of this specimen conform to the values in adult *R. ferrumequinum*. In other words, the respective specimen mentioned by Farhang-Azad (1969a) as *R. bocharicus* conforms in some dimensions to *R. ferrumequinum*, in other dimensions it is below the range of *R. ferrumequinum* but markedly exceeds that of *R. bocharicus*, and in other dimensions it is at the upper margin of the ranges of adult *R. bocharicus*. Thus, considering the unfinished growth of the specimen (see the above observations by DeBlase 1980), this comparison clearly indicates its identification as *R. ferrumequinum*.

Although it cannot be absolutely excluded that *R. bocharicus* actually occurs in Iran, the only specimen attributed to this species cannot be considered as an evidence of its real occurrence in the country. Moreover, in the Turkmenistani part of the Kopetdagh Mts., which represents the best known part of this country concerning the bat fauna (Strelkov et al. 1978), *R. bocharicus* has not yet been recorded. On the other hand, numerous records are available from foothills of the Kugitangtau Mts. (NW Turkmenistan) and upper parts of the Murgab valley (SE Turkmenistan) (Strelkov 1971, Strelkov et al. 1978); representatives of the latter population could be theoretically found in the north-easternmost part of Iranian Khorasan, as the closest records in Turkmenistan were made ca. 70 km from the Iranian border, in the Badkhyz Reserve (Strelkov et al. 1978). The Kugitangtau and Murgab records lie ca. 400 and 370 km, respectively, from Chelmir, the "*R. bocharicus* locality" erroneously reported by Farhang-Azad (1969a).

Rhinolophus hipposideros (Borkhausen, 1797)

Records. **Original data**: A l b o r z: Karaj river valley [1], 1934: 1 mj (NMP 39588; leg. Dr. Kargl). – Â z a r b â i j a n - e G h a r b i: rock valley 7 km SE of Chuplu [2], 10 km NW of Takab, small cave, 2 October 1998: obs. 1 roosting ind. – B u s h e h r: Bouchir [= Bushehr], Brazjan [Borazjan] [3], June 1968: coll. 1 fG (MHNG 1905.3; leg. A. Arata). – C h a h â r M a h â l v a B a k h t i â r i: Gandoman wetland [4], Eshkaft-e Zolaikhâ (Zolaikhâ crevice), Summer 2001: det. call of 1 ind. (cf. Ashrafi 2001); – Ma'dan (Sabzkuh Protected Area) [5], 20 km N of Lordegan, small cave, 14 August 2010: obs. 1 ind. (cf. Faizolâhi et al. 2011); – Omid Âbâd [6], 42 km W of Shahr-e Kord, Sarâb cave, Summer 2001: coll. 1 f (cf. Ashrafi 2001); – Sarkhun (Helen Protected Area) [7], 30 km NW of Lordegan, Roseh cave, 20 September 2010: net. 1 fs (cf. Faizolâhi et al. 2011). – E s f a h â n: Emamzadeh [8], 15 km W of Kashan, qanat, 1 May 1997: coll. 2 ms (NMP 48096, 48097), 6 April 2000: coll. 1 ma (NMP 48439; cf. Benda et al. 2011c). – G i l â n: Assalem [9], 3 October 2002:

coll. 1 ma (NMP 94427; leg. P. Hulva); – Seqâlaksâr [10], 12 km S of Rasht, attic of a mosque (ca. 5 m high), 23 October 2009: obs. 1 ind. – H o r m o z g â n: 3-N salt cave [11], SE Namakdân, 12 km ENE of Kani, Qeshm island, Spring 2005: obs. 1 ind. (leg. M. Filippi). – I l â m: Âsemân Âbâd [12], 30 km N of Ilâm, Tange Rad cave, September 2002: obs. several inds. (cf. Faizolâhi 2004). – K h o r a s â n - e R a z a w i: Moghân [13], Moghân cave, 30 km SW of Mash'had, October 1999: hand-net. 2 m, 1 f, coll. 1 ind. (NMP 93858; cf. Faizolâhi 1999, Benda et al. 2011c). – L o r e s t a n: river valley 3 km S of Lenje Abad [14], 9 km SW of Dorud, 1 October 2011: det. & rec. calls of 1 foraging ind. – S i s t â n v a B a l u c h e s t â n: mountain pass 15 km SW of Nosrat Abad [15], 100 km WNW of Zahedan, abandoned building, 7 May 1997: coll. 1 fG (NMP 48117; cf. Benda et al. 2011c). – **Published data**: A l b o r z: Gâjereh [16], 45 km NE Karaj, Hamalun cave, 1 m (Etemad 1984). – A r d a b i l: 2.6 km W Razi [17], 40 km NE Meshginshahr, Kânkahul cave, 2 June 2006: 1 f (Sheikh-Jabbâri 2008); – Tabnaq [18], 20 km NW Meshginshahr, Qushâ Dahaneh cave, 31 October 2006: 1 m (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: 2 km. E Maku [19], 22 August 1970: 6 ms, 8 fa, 6 fs, IPHR (Farhang-Azad 1971 ex DeBlase 1980); – 8 km. northwest of Maku [20], small dry cave, 29 September 1962: 1 fa, FMNH (Lay 1967, DeBlase 1980); – Urmi [21], 1 m[a], BMNH (Andersen 1905a, b, 1907, cf. Kuzâkin 1950). – F â r s: 10 km. SE Kazerun [22], 18 and 20 November 1963: 4 m, USNM (DeBlase 1980); – Canae Gabru Cave [= Tâdovân cave] *nr.* Tadovan [23], 10 November 1968: coll. 1 m, 1 f, FMNH (DeBlase 1980), Tâdovân, 50 km NW Jahrom, Tâdovân cave (Akmali et al. 2011a); – Schiras [= Shiraz], Fars [24], 1894: 1 ms, NMW (Spitzenberger 1979); – Shahpur Cave [25], 9 October 1968: 5 f, FMNH (DeBlase 1980). – H o r m o z g â n: Jask [26], Persian Gulf, 1 fa, BMNH (Andersen 1905a, b [as *R. midas*], Gaisler 1970, DeBlase 1980, Steiner & Gaisler 1994, Benda et al. 2011c). – I l â m: Âsemân Âbâd [12], 30 km N of Ilâm, Tange Rad cave, October 2002: obs. 60 inds., coll. 6 inds. (Akmali 2004). – K e r m â n s h â h: Biboneh

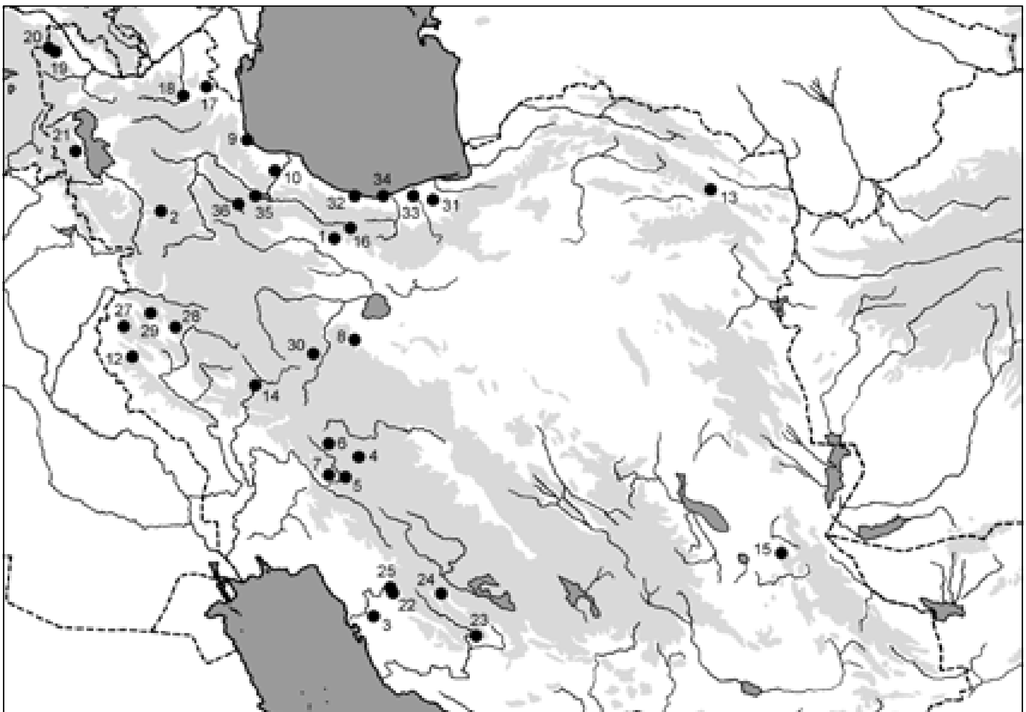

Fig. 38. Records of *Rhinolophus hipposideros* (Borkhausen, 1797) in Iran.

cave [27], 60 km NE Eslâm Âbâd (Akmali et al. 2011a); – 14.5 km. NE Kermanshah [28], 20 August 1968: 1 m, FMNH (DeBlase 1980); – Ravânsar [29], Benjo cave, tunnel, 9 May 2000: coll. 1 m, RUBC (Hemmati 2001). – M a r k a z i: Âzâd Khân Cave near Mahalat [= Senje Bâshi, 12 km W Mahallât] [30], 1 m, 1 f, resp. 2 m, 3 f (Etemad 1967, 1984, DeBlase 1980). – M â z a n d a r a n: Asporis village near Sari [= Esburez, 8 km SE of Sâri] [31], kiln, obs. a colony, coll. 1 ind. (Etemad 1967, 1984, DeBlase 1980); – 12 km. west, 2 km. south of Chalus [32], 4–6 September 1962: coll. 5 mj, 10 fa, 2 fj, FMNH (Lay 1967, DeBlase 1980); – Barforoush (= Babol) [33], house of the Imperial Bank of Persia, 5 July 1927: 1 ms, BMNH (DeBlase 1980); – Tamishan [34], 20 km. W Mahmudabad, 21 June 1963: 1 m, 1 mj, 1 fa, 1 fj, USNM (DeBlase 1980). – Q a z v i n: Altinkosh [35], 25 km SW Rudbâr, Katale Khor cave (Akmali et al. 2011a). – Z a n j â n: Golgik [36], 25 km W Zanjân, Golgik cave (Akmali et al. 2011a). – Iran (undef.): Mazandaran?, location unknown, 1970?, 1 m, MMTT (DeBlase 1980).

Distribution. *Rhinolophus hipposideros* ranks among rather common bats in Iran, at least 36 record sites are known from the country (Fig. 38). While DeBlase (1980) presented only 12 localities in several separated regions of the western half of Iran plus one site at the coast of the Gulf of Oman (Table 1), the present picture shows more or less continuous distribution in western Iran (32 sites in the provinces of Alborz, Ardabil, Azarbaijan, Chahar Mahal va Bakhtiari, Esfahan, Fars, Gilan, Ilam, Kermanshah, Lorestan, Mazandaran, Qazvin, and Zanjan) and also some records from the eastern half of the country, from which only the record from Jask (Hormozgan) was previously published (Andersen 1905a, b; one of two oldest known records from the country). Three other east-Iranian records were newly documented and give the evidence of rare but continuous occurrence of *R. hipposideros* in the whole country with an exception of central deserts (as predicted already by DeBlase 1980), but including Khorasan, Baluchestan and islands of the Strait of Hormuz. While the record from north-eastern Khorasan (Moghan cave) was well expectable with respect to the known distribution of *R. hipposideros* in the Turkmenistani part of the Kopetdagh Mts. (Strelkov et al. 1978), the record from near Nosrat Abad (Baluchestan) indicates a quite new area of occurrence of this bat. The closest few available records from eastern Afghanistan come from more northward localities (Bates & Harrison 1997) and do not seem to be a direct continuation of the Baluchestani part of the range.

The south-Iranian records from Hormozgan (Jask, Qeshm Island) represent the southernmost localities of *R. hipposideros* in its continental Asian part of the distribution range. The west-Iranian occurrence continues in the west to Transcaucasia, Anatolia and northern part of Iraq, where it connects the distribution range in the Levant, south-western Saudi Arabia, north-eastern and north-western Africa, and southern and central Europe (Harrison & Bates 1991, Horáček et al. 2000). The Iranian and Turkmenistani occurrences represent eastern margins of the Mediterranean part of the species distribution range (described in the latter sentence), which is separated by some 750–800 km wide gap from the Indian-Turkestani part of the range, covering a limited area of eastern Afghanistan, Kashmir, Tajikistan, eastern Uzbekistan, southern Kirghizstan and southern Kazakhstan (see the map by Benda et al. 2011c: 167, Fig. 6). However, a question arises whether this gap is caused by a real absence of *R. hipposideros* in the respective areas (western, northern and central Afghanistan, eastern Turkmenistan, southern Uzbekistan), or by a lack of available field data only.

Field notes. *Rhinolophus hipposideros* was recorded in Iran most frequently in or at its roosts, only very little evidence of foraging bats is available. *R. hipposideros* has not been detected in the bone material from owl pellets collected in Iran (Table 40), similarly as in most of the Middle East (Benda et al. 2006, but see Benda et al. 2010, Obuch 2011).

Most of the roosts of *R. hipposideros* recorded in Iran were natural caves, however, relatively numerous findings from artificial roosts were also reported, including some records from loft spaces of buildings. Moreover, the mentions from buildings prevail among the supposed roosts of nursery colonies. Although this type of colony was not recorded directly, circumstances of some findings (i.e. the date of record and/or sex and age composition of the recorded bat groups) indicate maternity aggregations. Besides the records of *R. hipposideros* in its roosts in the period of existence of nursery colonies, also records from the transient season were made (see definition under *Rhinolophus ferrumequinum*), however, no hibernation records are available.

All the supposed records of nursery colonies of *R. hipposideros* in their roosts were reported from the northernmost regions of Iran, the provinces of Mazandaran and Azarbaijan. Lay (1967: 137) reported on a finding of a colony roost in early September 1962: "bats observed near Chalus [Mazandaran] roosted by day in almost totally darkened lofts or rooms of little-used barns and charcoal sheds, usually hanging individually, though in close proximity to others. […] Six of the 15 prepared skins bear the gray juvenile pelage, but are virtually adult size. [… it] suggests that this may recently have been a maternal colony." These bats were examined also by DeBlase (1980: 107), who added some details: "Six of the 15 dry Chalus specimens […] have a slightly grayer pelage characteristic of young of the year, but the epiphyses [of wing bones] of these are almost completely ossified. The remaining 10 specimens [females] are all adults with fully ossified epiphyses." Thus, this record most probably represents a maternity colony, although its roost could be secondary in this part of season. A similar finding was made in a cave near Maku (Azarbaijan) on 22 August 1970 (DeBlase 1980), where a series of *R. hipposideros* specimens composed of eight adult females, six immature males, and six immature females was collected, indicating a record of a late summer roost of a (former) nursery colony. DeBlase (1980: 107) reported on a BMNH specimen collected in the house of the Imperial Bank of Persia in Barforoush (= Babol, Mazandaran) and added: "The Babol [male] specimen had only poorly ossified epiphyses on 5 July [1927], but the forearm length (38.4 mm) is well within the adult range."

Fig. 39. A roosting individual of *Rhinolophus hipposideros* (Borkhausen, 1797) in the 3-N salt cave near Namakdan, Qeshm island (Hormozgan). Photo by M. Filippi.

This also suggests a record of a nursery colony from which the specimen has been taken. Similarly, the group of four USNM specimens of *R. hipposideros* (including one adult female and two juveniles) taken from a colony of 25 individuals in Tamishan (Mazandaran) on 20–21 June 1963 (DeBlase 1980), clearly indicates existence of maternity group, although the roost was not specified, unfortunately. A pregnant female was found alone in an (abandoned?) stone hut in the mountain pass south-west of Nosrat Abad (Baluchestan) on 7 May 2000. The hut probably represented an alternative day-roost out of the main roost of the colony from which the female originated; the roost was dark, but not completely, as it was situated in the second room after the entrance and the hut had no windows.

An observation of *R. hipposideros* colony was reported by Etemad (1967, 1984) from Asporis [= Esburez] near Sari (Mazandaran), one individual was collected from a group roosting in an unused kiln (whose interior was not dark); however, Etemad did not specify the number of bats or the date nor season of this record. An aggregation of some 60 individuals was found by Akmali (2004) in the Tange Rad cave at Aseman Abad (Ilam) in October 2002; this record represents the largest accumulation of *R. hipposideros* known from Iran. However, this record from the transient period most probably represents a pre-hibernation aggregation rather than a group remaining from a nursery colony, since the visit in the cave a month earlier did not reveal any large number of *R. hipposideros* but only several individuals (Faizolâhi 2004).

Other roosts of *R. hipposideros* known from Iran contained only single individuals; most of these roost are natural caves, only two reports are available from artificial shelters. One individual of *R. hipposideros* was observed to hang in an attic of some 5 m high mosque in Seqalaksar (Gilan) on 23 October 2009; the attic was most probably a transient roost in the pre-hibernation period. Two males were found torpid in a qanat at Emamzadeh near Kashan (Esfahan) on 1 May 1997, another male on 6 April 2000. The qanat looked disused and its ceiling was broken and partially fallen on more sites in the visited part, terminating (or beginning?) into a broad river valley, temporarily dry during both visits; the qanat was penetrable only for a few tens of metres, but its original total length was certainly some hundreds of metres.

Lay (1967: 138) found an individual of *R. hipposideros* that "hung nearly torpid entirely alone in a limestone cave" situated northwest of Maku (Azarbaijan) on 29 September 1962; Lay (1967: 90) described the cave as follows: "a small inconspicuous opening led into a low-ceilinged chamber that continued about 25 m. and ended. Stalactites, stalagmites, columns, and ridges of calcium carbonate along the floor indicated former presence of water, but during our visit this cave was totally dry." DeBlase (1980: 107–108) reported on a finding of "one male and one female of this form hanging together [...] in a small crawlway deep in Canae Gabru Cave [= Tadovan cave (Fars)]. At the time of our visit [10 November 1968] a strong, cold draft passed through this tunnel and the two bats were in deep torpor." (see under *Rhinopoma microphyllum* for description of the cave). This author also found five females of *R. hipposideros* in the Shahpur cave (Fars) on 9 October 1968 and added the following notes (DeBlase 1980: 107–109): "The five [bats] were scattered through the cave but each hung in full torpor from the tip of a long slender stalactite. [...] The absence of this species from Shahpur Cave on 29 December 1962 indicates that this cave, or at least such exposed and conspicuous areas of this cave, is not used as a hibernaculum."

During a spring visit of the 3-N salt cave on the Qeshm island (Hormozgan; see also under *Rousettus aegyptiacus*), one roosting individual of *R. hipposideros* was observed (Fig. 39). Single individuals of *R. hipposideros* were met in summer months also in the Sarab cave at Omid Abad and in a small cave in the Sabzkuh Protected Area near Ma'dan (both Chahar Mahal va Bakhtiari). In autumn (October), solitary individuals of *R. hipposideros* were found also in a small cave in a steep side of the valley below Chuplu (Azarbaijan; see under *Rhinolophus ferrumequinum*) and in the Moghan cave (Khorasan). Hemmati (2001) collected a male *R. hipposideros* in the tunnel-

-like Benjo cave at Ravansar (Kermanshah) on 9 May 2000; Sheikh-Jabbâri (2008) collected a female in the Kânkahul cave at Razi on 2 June 2006 and a male in the Qushâ Dahaneh cave at Tabnaq (both Ardabil) on 31 October 2006. Other authors (Etemad 1967, 1984, Akmali et al. 2011a) mentioned findings of individuals or small groups of *R. hipposideros* in various caves (see above); however, they did not specify the date or season of the record nor even details concerning the record (number, sex and/or age of the recorded bats).

Most of the roosts were found to be inhabited solely by *R. hipposideros*, only approximately one third of them was shared with some other bats, predominantly in caves. The only above ground roost shared by *R. hipposideros* with other bat species is the house of the Imperial Bank of Persia in Babol, from which DeBlase (1980) reported also the collection of *Myotis emarginatus* and *Pipistrellus pipistrellus*. DeBlase (1980) reported *Rhinolophus ferrumequinum*, *Myotis capaccinii*, *Pipistrellus pipistrellus*, and *Miniopterus pallidus* sharing the Shahpur cave together with *R. hipposideros* during his visit in October 1968, while in the Tadovan cave (Fig. 43) the species was acompanied by *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus euryale*, and *R. blasii* in November 1968. Three bat species besides *R. hipposideros* were documented from the Sarab cave at Omid Abad, *Rhinolophus ferrumequinum*, *Myotis blythii* and *Miniopterus pallidus*. *Rhinolophus ferrumequinum* and *R. hipposideros* were found simultaneously in a small cave below Chuplu. *Myotis blythii* was collected along with *R. hipposideros* in the Moghan cave. *Rhinolophus blasii* was documented from two roosts of *R. hipposideros*, the qanat at Emamzadeh and the Tange Rad cave. Etemad (1967, 1984) and Akmali et al. (2011a) also mentioned co-occurring species in roosts of *R. hipposideros* (*Rhinolophus ferrumequinum*, *Myotis blythii*, *M. emarginatus*, and *Miniopterus pallidus* in the Azad-Khan cave; *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus euryale*, *R. mehelyi*, *R. blasii*, *Myotis blythii*, and *Miniopterus pallidus* in the Tadovan cave; *Rhinolophus mehelyi* and *Myotis blythii* in the Biboneh cave; *Rhinolophus ferrumequinum* and *Myotis blythii* in the Katale Khor cave at Altinkosh; and *Miniopterus pallidus* in the Golgik cave), however, simultaneous occurrence at the sites is not quite clear from their reports. Thus, *R. hipposideros* was found to share its roost most frequently with *Myotis blythii* (six times), *Rhinolophus ferrumequinum* and *Miniopterus pallidus* (five times) and *Rhinolophus blasii* (three times).

Foraging individuals of *R. hipposideros* were recorded in only few sites in Iran. Perhaps the most curious record was reported by DeBlase (1980: 100), who mentioned a male collected when it "Flew into open window of moving jeep" on the road 14.5 km northeast of Kermanshah on 20 August 1968. At the Roseh cave near Sarkhun (Chahar Mahal va Bakhtiari), a subadult female of *R. hipposideros* was netted on 20 September 2010; however, this record indicates rather roosting than foraging activity of the species. At two sites, echolocation calls of foraging individuals of *R. hipposideros* were detected and recorded; at the Zolaikha crevice in the Gandoman wetland (Chahar Mahal va Bakhtiari) in summer, while in autumn in the river valley at Lenje Abad (Lorestan; Fig. 40); during the same netting session as the latter record, on 1 October 2011, also one individual of *Pipistrellus pipistrellus* was netted and calls of *Rhinolophus ferrumequinum*, *Asellia tridens*, *Pipistrellus kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis* were detected and recorded.

Rather scarce data are available on the reproduction of *R. hipposideros* in Iran. One pregnant female was collected in the stone hut near Nosrat Abad on 7 May; it contained one foetus of the crown-rump length 9.2 mm. The MNHN specimen collected in Borazjan (Bushehr) in July also represents a pregnant female. Roosts containing adult females and volant juveniles were reported from various parts of the country from early June to early September. This evidence indicates the occurrence of parturitions in the Iranian populations of *R. hipposideros* in the second half of May, i.e. in a more or less similar period as in the Levant (Benda et al. 2006, 2010) and roughly

Fig. 40. The Dez river valley at Lenje Abad near Dorud (Lorestan), a foraging habitat of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Asellia tridens*, *Vespertilio murinus*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis*. Photo by A. Reiter.

a month earlier than in eastern Transcaucasia and northern Turkey (Rahmatulina 2005, Aşan Baydemir & Albayrak 2006).

Material examined. 1 ♂ (NMP 94427 [A]), Assalem (Gilan Prov.), 3 October 2002, leg. P. Hulva; – 1 ♀ (MHNG 1905.3 [A]), Bouchir, Brazjan [Bushehr Prov.], June 1968, leg. A. Arata; – 2 ♂♂ (NMP 48096, 48097 [S+A]), Emamzadeh (Esfahan Prov.), 1 May 1997, leg. P. Benda; – 1 ♂ (NMP 48439 [S+A]), Emamzadeh (Esfahan Prov.), 6 April 2000, leg. P. Benda & A. Reiter; – 1 ♀ (BMNH 94.11.16.1 [S], holotype of *Rhinolophus midas* Andersen, 1905), Jask, Persian Gulf [Hormozgan Prov.], date and collector unlisted; – 1 ♂ (NMP 39588 [A]), Karaj River valley (Alborz Prov.), 1934, leg. Kargl; – 1 ind. (NMP 93858 [S+Sk]), Moghan cave (Khorasan-e Razawi Prov.), October 1999, leg. K. Faizolahi; – 1 ♀ (NMP 48117 [S+A]), Nosrat Abad (Sistan va Baluchestan Prov.), 7 May 1997, leg. P. Benda; – 1 ♂ (NMW 21008 [S+A]), Schiras [Fars Prov.], 1894, leg. B. Wagschal.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rhinolophus hipposideros* are shown in Table 8. For the material examined see above.

According to the most frequent opinions (see the detailed review by Benda et al. 2006: 63, Table 7), the populations of *R. hipposideros* occurring in Iran (and the Middle East as well) belong either to one subspecies, *R. h. midas* Andersen, 1905 (type locality: Jask, Persian Gulf [Hormozgan, Iran]; Andersen 1905b: 139), or to two subspecies, additionally also to *R. h. hipposideros* (Borkhausen, 1797). When the two-subspecies concept is considered, the nominotypical form is reported from the northern, more elevated and humid areas of Iran, while *R. h. midas* from central and southern, more arid areas of the country. The comparison of skull and forearm dimensions of Iranian samples with the Levantine, European and Maghrebian samples (Benda et al. 2006, 2011c) showed the bats from Iran to be similar in size to the European samples (while larger than the Maghrebian and Levantine bats) and to possess relatively long and broad rostra among other samples.

Although all the above conclusions on the *R. hipposideros* taxonomy are based mostly on skull and teeth morphology, forearm length and pelage colouration (see namely Andersen 1905b, Felten et al. 1977, and DeBlase 1980), they more or less conform to the results of a mtDNA analysis of West-Palaearctic samples (Guillén Servent et al. 2003, Kůs 2008), concerning the separation of the species range into several taxa. In the comparison of the cytochrome *b* gene sequences, Kůs (2008) revealed three main lineages within the species, (1) European (incl. Crete), (2) Levantine (incl. Cyprus), and (3) Iranian (Esfahani). The Iranian lineage was divergent for 4.1–4.3% of uncorrected *p* distance from the European and 2.7–3.1% from the Levantine lineages, respectively (the Levantine and European lineages were distant for 2.6–3.1%). The analysis by Guillén Servent et al. (2003), based on a very limited sample, rather conforms to these results.

These relatively deep divergences between the lineages support taxonomic separation of the respective populations of *R. hipposideros*. The nominotypical subspecies thus seems to be restricted to the European continent and adjacent islands, *R. h. midas* occurs in Iran, and a yet undescribed subspecies occurs in the Levant (no name from the species synonymy is available from the respective area). However, considering the species distribution range, only limited samples were used by Kůs (2008) and the taxonomic conclusions are thus rather tentative; the taxonomic positions of the Maghrebian, Ethiopian, south-Arabian, Caucasian, West Turkestani, and/or Afghanistani-Kashmiri populations still remain unresolved. On the other hand, the separate position of the (central) Iranian populations of *R. hipposideros* seems to be clear, considering the available data.

Concerning the Iranian populations, another subspecies name from the *R. hipposideros* species rank should be noted (see also Benda et al. 2006). Felten et al. (1977: 14) mentioned it as follows: "So wird denn auch DeBlase ([…] 1975) die Berechtigung seiner aufgrund von Färbungsmerkmalen aufgestellten Unterart *R. h. billanjani* aus dem Iran (DeBlase 1971 [= unpubl. PhD. Thesis])

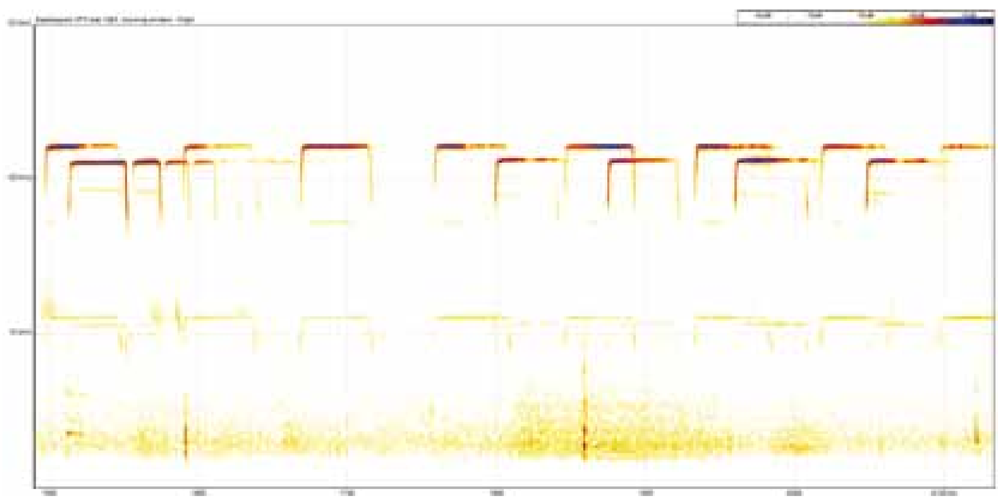

Fig. 41. Spectrogram of echolocation calls of *Rhinolophus hipposideros* (Borkhausen, 1797); an individual foraging near riparian vegetation at Lenje Abad (Lorestan) together with a medium-sized horseshoe bat (*Rhinolophus* sp).

überprüfen.", while Corbet (1984: 8) quoted the name differently: "*Rhinolophus hipposideros billanyani* DeBlase, 1972. Shahpur Cave (29°48'N, 51°37'E), Fars Prov., Iran. Subsequently considered 'invalid' (presumably a synonym of *R. h. midas*) by the same author (DeBlase 1980)." Although the name *billanjani* or *billanyani* was accepted into the synonymy of *R. hipposideros* also by some following authors (Strelkov 1981a, Borisenko & Pavlinov 1995, Benda & Horáček 1998, Simmons 2005), this name represents a nomen nudum since the description has not been formally published, although it was introduced by Felten et al. (1977). DeBlase (1980: 99) described this situation as follows: "In an earlier version of this monograph, an unpublished Ph.D. dissertation, […] 1972, I described a new subspecies of *R. hipposideros*. After re-examination of the holotype of *R. h. midas*, I now consider that described form invalid."

Echolocation. Foraging calls of *Rhinolophus hipposideros* were detected at two sites in Iran, the Gandoman wetland (Chahar Mahal va Bakhtiari) and Lenje Abad (Lorestan). However, the calls were recorded only from the latter locality (Fig. 41); basic echolocation parameters are given in Table 3. The obtained FMAX values (109–111 kHz) conform to characteristics given for the populations from Europe (Jones & Rayner 1989, Russo & Jones 2002, Obrist et al. 2004, Papadatou et al. 2008, Dietz et al. 2007, Schuchmann & Siemers 2010). However, considering the maximum frequency values, the species probably shows a certain geographic variation throughout its range; rather lower values were reported from extreme arid regions of the western Middle East, starting at 105 kHz in Israel and Sinai (Shalmon et al. 1993, Mendelssohn & Yom-Tov 1999, Dietz 2005, Benda et al. 2008); similarly in Jordan, Benda et al. (2010) preliminarily assigned horseshoe bat calls with the maximum frequency range of 101–103 kHz to be produced by *R. hipposideros*.

Feeding ecology. *Rhinolophus hipposideros* is a small bat that hunts close to the vegetation and also within bush and smaller trees (Dietz et al. 2007). It was also observed foraging very close to the ground, but continuously on the wings (Benda et al. 2008). Nevertheless, wing morphology of *R. hipposideros* suggests rather foliage gleaning than aerial hawking (Norberg & Rayner 1987).

Diptera and Lepidoptera prevail in the diet of *R. hipposideros* in most of the analyses of its diet composition from Europe (McAney & Fairley 1989, Beck et al. 1989, Beck 1995). Tipulidae, Lepidoptera, Heteroptera, Neuroptera (Chrysopidae) are reported to comprise the diet of *R. hipposideros* in Azerbaijan (Rahmatulina 2005). Lepidoptera seem to prevail in the diet also in Israel and Turkey (Feldman et al. 2000, Whitaker & Karataş 2009). *R. hipposideros* was observed to feed on ants (Formicoidea), homopterans and mosquitos (Diptera: Culicidae) in Sinai (Benda et al. 2008). A small sample set from Jordan (seven faecal pellets from two animals) indicates that also other prey groups can play an important role in the diet composition of *R. hipposideros* in arid habitats at the edge of the distribution range; Homoptera (Auchenorrhyncha) were found to prevail in this sample (Benda et al. 2010). Results of analyses of the diet samples collected in Cyprus and Lebanon also showed Lepidoptera to be the most important food item (own unpubl. results).

From Iran, we analysed one digestive tract from a *R. hipposideros* specimen collected near Nosrat Abad (Baluchestan). The tract contained only smaller moths (Lepidoptera) with the wingspan of ca. 25 mm and smaller. This dominance of Lepidoptera in the diet well corresponds with results of the available diet analyses from the Middle East (see above).

Rhinolophus euryale Blasius, 1853

Records. **Original data**: E s f a h â n: Alavice [= Alavijeh] [1], 15 September 1998: coll. 1 ma, 1 fs (HMNH 2000.63.4., 2000.63.5.; leg. M. Szatyor); – Deh Zireh [2], 35 km SE of Kashan, 27 April 1996: remnant of 1 ind. (left mandible) found in *Bubo bubo* pellets. – F â r s: Bishapur [3], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April

2000: remnants of 5 inds. (5 right and 5 left mandibles, 4 skull fragments) found in *Bubo bubo* pellets; – Dashtak [4], 32 km SSW of Yasuj, 3 May 1996: coll. 1 ind. ad (JOC unnumbered); – Tâdovân [5], 44 km NW of Jahrom, Tâdovân cave, 21 November 2009: obs. & exam. several inds. – G o l e s t a n: Shir Âbâd cave [6], 20 km NE Ali Âbâd, water cave, April 1998: coll. 1 ma (HMNH 2000.6.2.), 2008: coll. 1 fa, 1 fs (HMNH 2008.37.1., 2008.37.2.; leg. H. Zohoori). – K o r d e s t â n: Sanandaj [7], 11 September 1998: coll. 1 fa (HMNH 2000.63.6.; leg. M. Szatyor). – **Published data**: Â z a r b â i j a n - e G h a r b i: Maku [8], cave in the mountain south of Zangmar River at eastern edge of town, 27 September, 2 and 6 October 1962: obs. ca. 200 inds. [a colony mixed of *R. euryale* and *R. mehelyi*], coll. 7 m, 10 f, FMNH (Lay 1967, DeBlase 1980). – C h a h â r M a h â l v a B a k h t i â r i: Shah Abbas Caves [9], Kuh Rang, cave, 1965: 1 m, BMNH (Lay 1967, DeBlase 1972, 1980). – F â r s: Canae Gabru cave [= Tâdovân cave] near Tadovan [= Tâdovân] [5], 10 November 1968: coll. 5 m, 4 f, FMNH (DeBlase 1972, 1980), Tâdovân, Tâdovân cave (Akmali et al. 2011a). – G o l e s t a n: Mohamed Reza Shah National Park [10], scrub forest, 14 August 1970: net. 1 f, BMNH (DeBlase 1980). – H a m a d â n: Khorazan cave [= Tafrijân, Khorzeneh cave] [11] near Hamedan, Summer 1965: 1 f (Etemad 1967, 1984, DeBlase 1980). – K e r m â n s h â h: Kerend cave [12], 5 km W Kerend-e Gharb (Akmali et al. 2011a). – K h o r a s â n - e R a z a w i: 71 km. SE Meshad [13], 30 July 1969: 1 m, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – Mozduran [14], 4 October 1974: 6 m, 1 f, SMF (Felten et al. 1977, DeBlase 1980, Kock 1983, Benda et al. 2006). – K h u z e s t â n: Behbahan [15], 1 m (Etemad 1967, DeBlase 1980). – K o r d e s t â n: 30 km NE of Bijar [16], shrine, 20 September 1969: coll. 1 m, 1 f, UMM (DeBlase 1972, 1980). – L o r e s t a n: Eshkaf Dareze Cave, W edge of Khurramabad [17], 6 September 1968: coll. 4 inds. juv. (mummies), FMNH (DeBlase 1972, 1980).

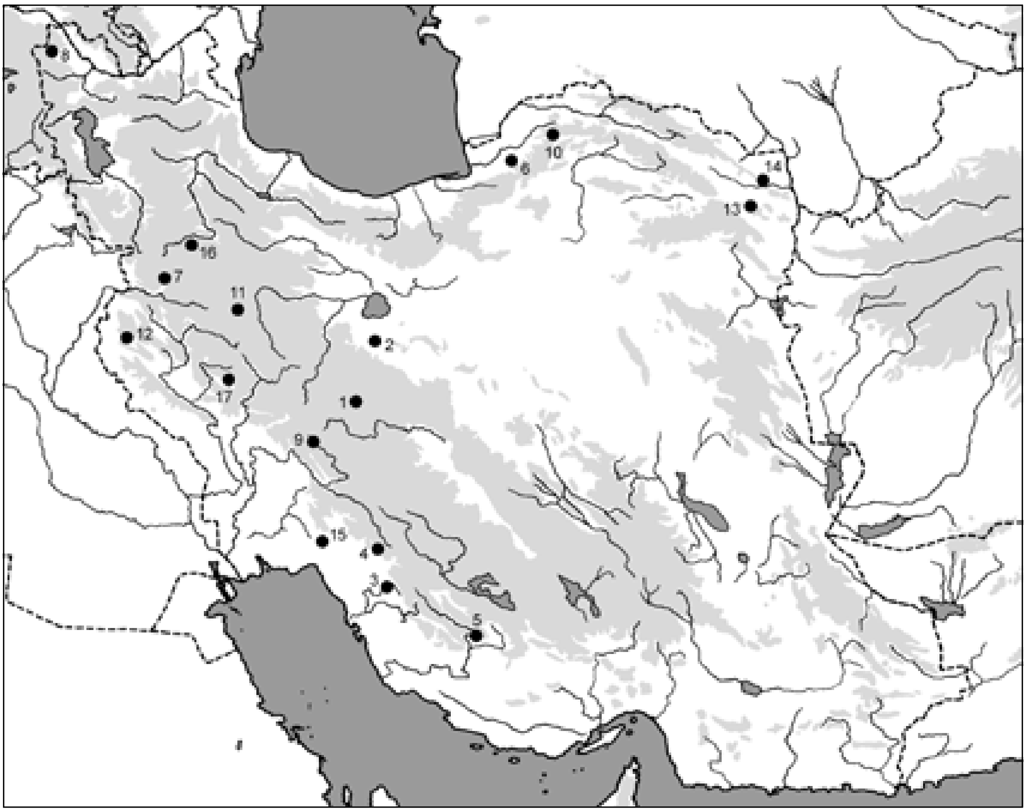

Fig. 42. Records of *Rhinolophus euryale* Blasius, 1853 in Iran.

Distribution. *Rhinolophus euryale* belongs to widespread but uncommon bats in Iran, 17 record sites are available from the country (Fig. 42). Concerning its whole distribution range, *R. euryale* is a typical Mediterranean species and such a distribution pattern is apparent also from the distribution of particular records in Iran. This bat was found to occur widely throughout the Zagros Mts., 12 localities regularly cover this mountain range and the areas closely adjacent to it. Much less records are known from northern, more continental or humid regions of Iran, although its occurrence could be expected there, rather than in the arid southern regions. This pattern is identical to that presented by DeBlase (1980), new records only more concentrate the localities summarised by this author (Table 1), showing three separate regions of known records, West Azarbaijan, Zagros Mts., and north-eastern Iran (see Fig. 42).

As already stressed by DeBlase (1980), the Meshed area in north-eastern Khorasan represents the eastern margin of the whole distribution range of the species; two records are available from this region (Fig. 42) and the Mozduran cave (Felten et al. 1977) is the easternmost known occurrence point. Moreover, the records of *R. euryale* from the Zagros Mts. in central Fars represent the southernmost occurrence spot within the whole species range (Horáček et al. 2000, Gaisler 2001b). In the west, the Iranian distribution continues to Transcaucasia and Turkey, where this bat is also an uncommon faunal element (Benda & Horáček 1998, Rahmatulina 2005).

Field notes. *Rhinolophus euryale* was recorded in Iran almost exclusively in its roosts, only one finding of a foraging bat is available; two records of osteological remains from owl pellets were also documented. Natural caves were mostly registered as the roosts of *R. euryale*, only one artificial shelter was reported – a 'religious shrine' near Bijar (Kordestan) (DeBlase 1972, 1980); however, it is not clear whether this roost is situated under or above ground.

At least one evidence of a maternity roost of *R. euryale* was reported; DeBlase (1980: 113) described this finding as follows: "On 6 September 1968 I found four mummified *R. euryale* in a cave [= Eshkaf Dareze cave] in the mountain at the west edge of Khurramabad [Lorestan]. A great quantity of guano was present and the *Rhinolophus* mummies […] were found in the guano. […] The […] mummies are all of immature individuals incapable of flight. This cave did not penetrate very deeply into the mountain and, except for one small room that contained guano, light from the entrance was visible from all parts of the cave. The presence of mummified prevolant *R. euryale* and large guano deposits indicate that this cave is used by *R. euryale* as a nursery site."

Another record of a supposed nursery roost was described by Lay (1967: 135): "Specimens obtained in late September [and early October, 1962] from the group of about 200 [a colony mixed of *R. euryale* and *R. mehelyi* (cf. DeBlase 1972)], in the cave near Maku [Azarbaijan] had accumulated much fat, the entire colony, however, remained active. […] A few *Miniopterus schreibersi* [= *M. pallidus*] roosted among the Maku colony". At another place, Lay (1967: 89) gave detailed characteristics of the roost: "[it] occurred in the mountain south of the Zangmar River at the eastern edge of Maku. The mouth of this cavity gaped 12–15 m. wide and 3 to 4 m. high. […] This outer chamber narrowed horizontally and vertically toward the rear, so that it became necessary to crawl. Two continuations at the rear, estimated to be 46 m. from the outside entrance and just large enough for a man to crawl through, opened down into a large, cone-shaped, vertical chamber approximately 23 to 25 m. wide. Water dropped from the ceiling accumulating in a rounded depression to percolate through the limestone floor. Fine droplets coated wall and ceiling surfaces and a mixture of red clay and guano had accumulated on the floor. This room maintained a noticeably cooler atmosphere than either the ante-chamber or outside environment. The ceiling became cone-shaped 30 to 50 m. above the floor and spiraled out of sight. *Rhinolophus euryale* [and *R. mehelyi*] and *Miniopterus schreibersi* [= *M. pallidus*] […] hung, until disturbed, on the walls in this part of the cave." DeBlase (1980: 112), who also visited this cave, added the following note: “On 25 July 1968 I revisited this cave and located the room described by Lay. The chamber was quite wet and a few inches of guano carpeted the floor but no bats were present. […] This cave appears to be used as a hibernaculum or a migratory roost used prior to hibernation, but it is not inhabited by *Rhinolophus* of either sex during the summer.” Here it could be noted, that

Fig. 43. The entrance to the famous Tadovan cave (Fars); the cave serves as a roost of ten bat species – colonies of *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus blasii*, *Myotis blythii*, and *Miniopterus pallidus*, and individuals of *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale*, *R. mehelyi*, and *Myotis capaccinii* were found in the cave, while in the valley at the cave, foraging of *Eptesicus anatolicus* and *Tadarida teniotis* was documented. Photo by A. Reiter.

Fig. 44. The Qarah Agaj river valley at Tadovan (Fars), an area of occurrence of at least twelve bat species; the entrance to the Tadovan cave is hidden behind the river meander, situated in a wall on the left side of the valley (i.e. on the right side of the picture; see also Fig. 43). Photo by A. Reiter.

the large colony recorded by Lay (1967) might have lived in the cave year-round (as the guano deposit indicates) including the nursing period, but it disappeared from this roost during six years between the two visits. The roost was situated close to a large town and thus heavy disturbance of the colony is quite likely, unless the colony diseppeared even in reaction to the repeated visits by Lay, who disturbed the roost three times and collected tens of bats from the colony.

Other roost records documented only single individuals or small groups of *R. euryale*. The largest such group was reported by DeBlase (1980: 112) from the Canae Gabru [= Tadovan] cave (Fars; Fig. 43): "Five male and four female *R. euryale* were found on 10 November 1968 in deep torpor hanging from a small dime." This record perhaps represents a hibernation aggregation, similarly as during the visit of this cave on 21 November 2009, when some bats were observed in deep torpor. Several specimens were also collected by Felten et al. (1977) from the Mozduran [cave] (Khorasan) on 4 October 1974. One male specimen of *R. euryale*, collected in the Shir Abad water cave (Golestan) in April 1998, was found in the HMNH collection (plus two specimens without any data on the season of collection). DeBlase (1980) specified the Hamedan record made by Etemad (1967, 1984), as a female that was collected in the Khorazan [= Khorzeneh] cave in the summer 1965. Lay (1967) and Akmali et al. (2011a) added three other findings from caves (see above), however, they did not give details concerning the period of the year.

R. euryale was found to share several roosts with other bat species (see also the above record from the cave at Maku). Four to five additional species were documented in the Tadovan cave, where *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus hipposideros*, *R. blasii*, and *Myotis capaccinii* were recorded in 1968 (DeBlase 1980), and *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus ferrumequinum*, and *Miniopterus pallidus* in 2009. *Rhinolophus ferrumequinum*, *R. blasii*, *Myotis blythii*, and *Miniopterus pallidus* were reported to occur in the Mozduran cave along with *R. euryale* on 4 October 1974 (Felten et al. 1977, Kock 1983). Three bat species were found to share the roost with *R. euryale* in the Shah Abbas caves (DeBlase 1980), *Rhinolophus mehelyi*, *R. blasii* and *Plecotus macrobullaris*. *M. pallidus* was found together with *R. euryale* at Dashtak and

Sanandaj. DeBlase (1980) discovered mummies of *R. euryale* and *M. blythii* in one guano deposit in the Eshkaf Dareze cave. Akmali et al. (2011a) also mentioned numerous co-occurring species in roosts of *R. euryale* (*Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus hipposideros*, *R. mehelyi*, *R. blasii*, *Myotis blythii*, and *Miniopterus pallidus* in the Tadovan cave and *Myotis blythii*, *M. emarginatus*, and *Pipistrellus pipistrellus* in the Kerend cave), however, their simultaneous occurrence at the sites is not quite clear from the report. In the HMNH collection, the series of *R. euryale* and *M. blythii* collected during various visits of the Shir Abad cave are present.

The only record concerning the foraging activity of *R. euryale* in Iran was made in the Mohamed Reza Shah National Park (today the Golestan NP), where a female was netted in a scrub forest on 14 August 1970 (DeBlase 1980).

DeBlase (1980: 113) summarised the ecological observations of *R. euryale* in Iran: "In summary, three caves probably used as hibernacula by *R. euryale* contained this species on 27 September 1962, 4 October 1974, and 10 November 1968. One of these caves did not house the species on 25 July. A cave apparently used as a nursery site contained no *R. euryale* on 6 September. At the northernmost site (39° 17'N) for this species in Iran, the bats had arrived at the hibernaculum by 27 September but had not yet become torpid […]. At the southernmost locality yet recorded (at about 29° 8'N) *R. euryale* was in deep torpor on 10 November." Only one new detail can be added to this summary, the record of hibernating bats in the Tadovan cave (= the southernmost site mentioned) on 21 November. These are the only data on phenology of *R. euryale* in Iran and no information on reproduction of this species is available from the country.

Remains of six individuals of *R. euryale* in total have been discovered in the pellets of *Bubo bubo* (Table 40) from two sites in Iran, at Deh Zireh (Esfahan) and Bishapur (Fars). They represented 1.14 and 5.74% per sample volume of all prey items (and 3.13 and 7.04% of mammal items, respectively) in the respective samples and 0.08% of all prey items (0.10% of mammal items) in the whole analysed eagle owl diet from Iran. In the Middle East, *R. euryale* has been found in owl diet only in Turkey (Obuch 1994).

Material examined. 1 ♂, 1 ♀ (HMNH 2000.63.4., 2000.63.5. [S+A]), Alavice [Esfahan Prov.], 15 September 1998, leg. M. Szatyor; – 5 inds. (JOC unnumbered [Sf]), Bishapur (Fars Prov.), 21 April 2000, leg. J. Obuch; – 1 ind. (JOC unnumbered [S+Sk]), Dashtak (Fars Prov.), 3 May 1996, leg. J. Obuch; – 1 ind. (JOC unnumbered [Sf]), Deh Zireh (Esfahan Prov.), 27 April 1996, leg. J. Obuch; – 7 ♂♂ (SMF 46680–46685, 46687 [S+B]), Mozduran [Khorasan-e Razawi Prov.], 4 October 1974, leg. H. Felten; – 1 ♂ (HMNH 2000.6.2. [S+A]), Shir Abad cave [Golestan Prov.], April 1998, leg. S. Ashrafi, M. Peymani & H. Zohoori; – 2 ♀♀ (HMNH 2008.37.1., 2008.37.2. [S+A]), Shir Abad cave [Golestan Prov.], 2008, leg. H. Zohoori; – 1 ♀ (HMNH 2000.63.6. [S+A]), Sanandaj [Kordestan Prov.], 11 September 1998, leg. M. Szatyor.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rhinolophus euryale* are shown in Table 8. For the material examined see above.

DeBlase (1980) resigned from assigning the Iranian populations of *R. euryale* to any described form, because of the lack of sufficient comparative material. However, in the broad-scale comparisons of skull and wing dimensions by Felten et al. (1977) and Benda et al. (2006), the Iranian samples belonged to the larger form of the species (LCc 15.7–16.8 mm), distributed also in Europe and the Maghreb, and differed in size from the smaller Levantine samples (LCc 15.2–16.2 mm). These results suggest that Iran is inhabited by the widely distributed west-Palaearctic form, which could be co-identified with the nominotypical subspecies, *R. e. euryale* (type locality: Mailand, Gardasee, Triest [= Milan, Garda lake, and Trieste, Italy]; Blasius 1853: 35). However, the question of possible division of the particular populations of *R. euryale* to separate taxa should be solved with the help of a DNA analysis.

Echolocation. *Rhinolophus euryale* emits constant-frequency calls in the range 100–109 kHz. A considerable variation in this value was observed within the European range of this bat, with frequencies 100–104 kHz in Italy, ca. 104 kHz in Spain, 102–106 kHz in Greece, and 104–106 kHz in Bulgaria (Russo et al. 2001, Russo & Jones 2002, Salsamendi et al. 2005, Siemers et al. 2005, Papadatou et al. 2008), suggesting that these values slightly increase in the Mediterranean range from the west to the east. We did not record any call of *R. euryale* in Iran and no data on echolocation of this bat are available from the Asian part of its distribution range.

Feeding ecology. *Rhinolophus euryale* is a medium-sized horseshoe bat searching for its prey mostly in dense vegetation (Gaisler 2001b, Siemers & Ivanova 2004). The species seems to be a moth-eating specialist as its diet is dominated by Lepidoptera in all studies carried out in Europe (Koselj 2002, Sabourin et al. 2002, Goiti et al. 2004, Salsamendi et al. 2012) as well as in the Middle East (Benda et al. 2006, 2010, Whitaker & Karataş 2009). Other important prey items found were Diptera (especially Tipulidae), Coleoptera (mostly Scarabaeidae) and Neuroptera. The diet of *R. euryale* in Iran has not yet been studied.

Rhinolophus mehelyi Matschie, 1901

Records. **Published data**: Â z a r b â i j a n - e G h a r b i: Maku [1], a cave just east of town, 27 September and 2 October 1962: obs. ca. 200 inds. [a colony mixed of *R. euryale* and *R. mehelyi*], coll. 4 inds., FMNH (DeBlase 1972). – C h a h â r M a h â l v a B a k h t i â r i: Shah Abbas Caves [2], Kuh Rang, cave, 1965: coll. 2 m, 1 f, BMNH (DeBlase 1972). – F â r s: Shahpur Cave [3], 29 December 1962: obs. 300–400 inds., coll. 14 inds., FMNH (Lay 1967 [as *R. euryale*], Etemad 1969 [as *R. euryale*], DeBlase 1972) (originally as from 'Khorassan, north eastern part of Iran' by Etemad 1963 [as *R. euryale*]); – Tâdovân [4], 50 km NW Jahrom, Tâdovân cave (Akmali et al. 2011a). – I l â m: Âsemân Âbâd [5], 30 km N Ilâm, Tange Rad cave, 14 October 2003: obs. a colony of several hundreds of inds. (Akmali 2004). – K e r m â n s h â h: Biboneh cave [6], 60 km NE Eslâm Âbâd (Akmali et al. 2011a); – Dakal [7], near Sar Pol-e Zahâb, October 2003: obs. a colony of several hundreds of inds. (Akmali 2004); – Kilasefid [8], 30 km NE Qasr-e Shirin, Kilasefid cave, 1 September & 19 October 1999, 9 July 2000: obs. a nursery colony, coll. 2 m, 18 f, RUBC, 21 January 2000: obs. ca. 70 inds. (Hemmati 2001), Killasefid cave, 2001: maternity colony (Sharifi & Hemmati 2001), Kilasefid cave (Sharifi & Hemmati 2004); – Mâhidasht Cave [9], 30 km SW Kermânshâh, 7 June 2000: obs. a colony of 200–300 inds., coll. 4 fa+juvs., RUBC (Hemmati 2001), Mâhidasht Cave, October 2003: obs. a colony of ca. 200 inds. (Akmali 2004), Mahidasht cave (Sharifi & Hemmati 2004), Mahidasht Cave, August 2001: colony of 60 inds. (Sharifi 2004a), Mahidasht Cave, colony (Sharifi 2004b); – Sharif Âbâd cave [10], 5 km S Eslâm Âbâd (Akmali et al. 2011a). – K o r d e s t â n: Âftâbi cave [11], 24 July 2000: obs. a colony, coll. 6 m, 3 f, RUBC (Hemmati 2001); – Gara Tarik [12], about 4 km. N Qareh, 13 August 1968: exam. 55 m, 73 f, coll. 24 inds., FMNH, 14 August 1968: obs. ca. 12,000 inds., coll. 16 inds., FMNH (DeBlase 1972, 1980); – Karaftu [13], 45 km NW Divândarreh, Karaftu cave, 19 February 1998, 16 April 1999: coll. 3 m, RUBC (Hemmati 2001), Karafto cave (Sharifi & Hemmati 2004); – Zivieh [14], 40 km E Saqqez, Zivieh cave, 23 July 2000: coll. 1 m, RUBC (Hemmati 2001).

Distribution. *Rhinolophus mehelyi* is an uncommon bat species in Iran, altogether 14 record sites are available from the western and south-western parts of the country (Fig. 45). DeBlase (1980) reported only four localities of occurrence from Iran (Table 1), however, the picture of distribution given by this author is very similar to that presented here. The Iranian range of *R. mehelyi* creates a narrow belt of sites localised along the western and southern slopes of the Zagros Mts. from north-western Azarbaijan to central Fars (Fig. 45). Although *R. mehelyi* is a Mediterranean bat species, its range in Iran has a rather limited extent, its records are apparently missing in the central, northern and north-eastern parts of the country, where other similar faunal types are present and/or even very abundant (see the pattern of distribution e.g of *Rhinolophus euryale*, Fig. 42).

The Iranian record sites of *R. mehelyi* represent eastern and southern margins of the species distribution range, the Tadovan cave (Akmali et al. 2011a) is the easternmost and also southernmost point of its known occurrence (Benda et al. 2006). In the west, the Iranian range continues to Transcaucasia, Turkey and Iraq, where it connects the distribution range in the Levant, southern Europe, and north-eastern and north-western Africa (Harrison & Bates 1991, Horáček et al. 2000). The occurrence of *R. mehelyi* in Afghanistan, mentioned by several authors (Harrison & Bates

1991, Corbet & Hill 1992, Koopman 1993, Horáček et al. 2000, Gaisler 2001c, Simmons 2005, Srinivasulu & Srinivasulu 2012), is apparently erroneous (cf. Bates & Harrison 1997, Csorba et al. 2003).

Field notes. *Rhinolophus mehelyi* has been recorded in Iran only in its roosts; these were exclusively natural caves. No foraging bats nor osteological remains from owl pellets were found.

Maternity colonies of *R. mehelyi* were localised at least in three caves. Hemmati (2001) reported on an observation of a nursery colony of 200–300 individuals in the Mahidasht cave (Kermanshah); from this colony four adult females with non-volant pups on their nipples were examined on 7 June 2000. In August 2001, a colony of some 60 bats was observed by Sharifi (2004a) and about 200 individuals in October 2003 by Akmali (2004), but no bat was found in the cave on 22 November 2003 (Akmali 2004). This large cave served as a roost of five bat species (*R. mehelyi*, *Myotis blythii*, *M. capaccinii*, *Miniopterus pallidus*, and *Pipistrellus pipistrellus*) with an estimated total population of about 3000 bats; however, it was destroyed due to mining activities (Akmali et al. 2011a). Another maternity colony of *R. mehelyi* was documented in the Kilasefid cave near Qasr-e Shirin (Kermanshah) on 9 July 2000 (Hemmati 2001). The colony

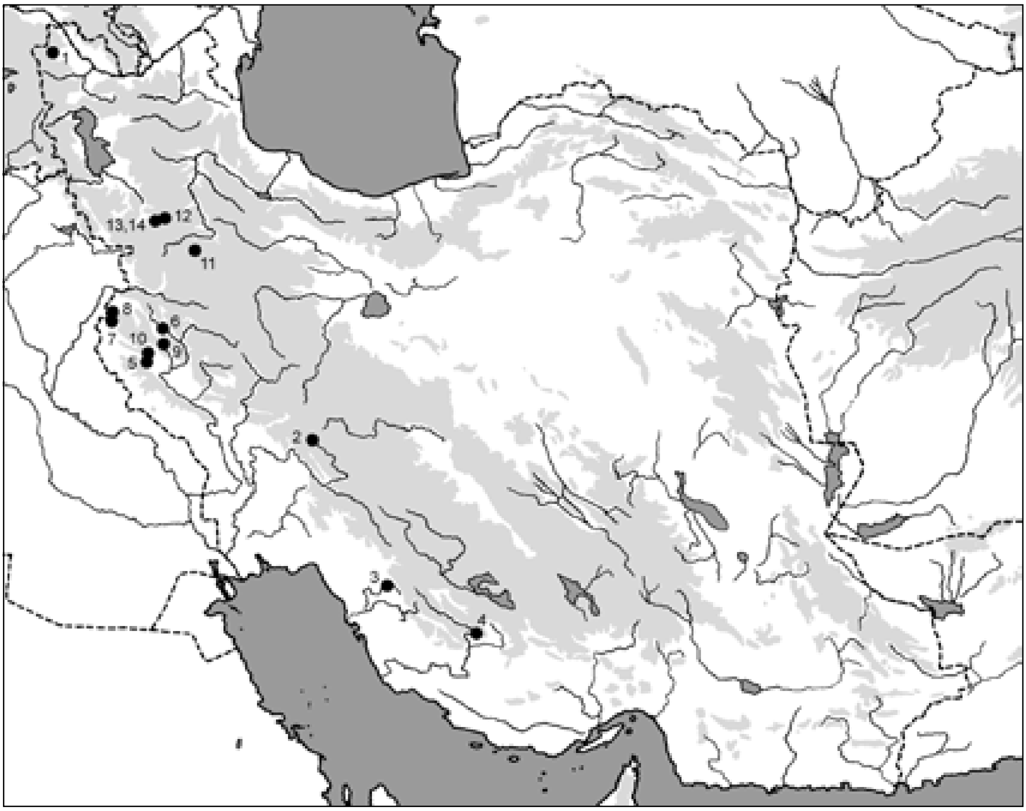

Fig. 45. Records of *Rhinolophus mehelyi* Matschie, 1901 in Iran.

was observed in the cave also on 1 September and 19 October 1999, 21 January 2000, 14 April, 19 May, 8 June, and 9 July 2001; during the visit on 21 January 2000, some 70 individuals were found to hibernate there (Hemmati 2001). On 24 July 2000, a nursery colony of *R. mehelyi* was observed in the Aftabi cave (Kordestan; Hemmati 2001).

Besides the record from the Kilasefid cave, the wintering of *R. mehelyi* in Iran was observed only in the Shahpur cave (Fars) by Lay (1967: 135) on 29 December 1962: "The assemblage of 300 to 400 of these bats in Shahpur cave were fat but active in late December. Perhaps they do not hibernate in the warmer environs of the […] locality. [… In the cave,] two species occurred in the ratio of approximately one *M. schreibersi* [= *M. pallidus*] to three *R. euryale* [= *R. mehelyi*, based on examination of 14 specimens by DeBlase (1972)] in completely integrated clusters." Lay (1967: 60) described the roosting situation as follows: "An almost vertical, slippery precipice was the only access to a circular room roughly 45 m. vertically below the floor of the main room. This high-ceilinged (ca. 23 m.), chamber, 30 m. in diameter, housed a colony of some 500 *Rhinolophus euryale* [= *R. mehelyi*] and *Miniopterus schreibersi* [= *M. pallidus*]."

In several caves, roosts of *R. mehelyi* in the transient period of the year (i.e., after the disintegration of nursery colonies and before the beginning of hibernation, approximately from August till October) were documented. Lay (1967: 135) found a colony in a cave just east of the town of Maku (Azarbaijan) on 27 September and 2 October 1962 (see also under *R. euryale*): "this species roosted in dense clusters in moist caves. Specimens obtained in late September from the group of about 200 [a colony mixed of *R. euryale* and *R. mehelyi* (cf. DeBlase 1972)], in the cave near Maku had accumulated much fat, the entire colony, however, remained active." (for the description of the cave and other circumstances see under *R. euryale*). DeBlase (1980: 115) summarised this finding as follows: "The presence of *R. mehelyi* in this cave on 27 September and 2 October [1962] and their absence on 25 and 28 July [1968] indicates that the cave is used as a hibernaculum or as a roosting area just prior to hibernation but does not serve as a nursery site." However, here we can add similar comments as in *R. euryale*, see above.

Akmali (2004) reported a colony of several hundred individuals of *R. mehelyi* observed in the Tange Rad cave at Aseman Abad (Ilam) on 14 October 2003; another colony of a similar size was observed by the same author at Dakal (Kermanshah) also in October 2003. DeBlase (1980: 116) reported on a finding of an extremely large colony of *R. mehelyi* of the estimated size ca. 12,000 bats in the Gara Tarik cave at Qareh (Kordestan) on 13 and 14 August 1968: "In the large chambers of this cave we found an estimated total population of 30,000 bats in a ratio of two *R. mehelyi* to two *M. blythi* to one *M. schreibersi* [= *M. pallidus*]. Much of the ceiling of the dark area of the cave was covered with large clusters of bats that included all three species apparently randomly mixed. As we approached these massive clusters, the *Rhinolophus* bats flew out and retreated to higher cracks and domes. […] The 40 bats preserved included 14 adult females, two adult males, 12 immature females, and 12 immature males. […] The low percentage of adult males (5 per cent) in the sample of *R. mehelyi* from Gara Tarik indicates that this cave is a nursery inhabited primarily by females and young of the year." DeBlase (1980: 324–325) described the roost site as follows: "The entrance to Gara Tarik […] faces approximately north and is about 1.5 m. wide and about 6 m. high. The limestone solution cave branches repeatedly […] and most passages were 1.5 to 2 m. high. There was no water visible in the areas we explored and no evidence of water in the recent past. Once we passed the twilight zone, we found the cave full of bats […]. Mixed clusters […] carpeted the numerous low domes which were from 1 to 4 m. in diameter and one--third to 1 m. high. […] Very high domes and cracks in the cave ceiling were filled with scattered *R. mehelyi*. These were all active and were probably individuals who had flown from the large clusters at our first approach." The temperature recorded at two points in the cave was 59 °F [= 15.0 °C] and 64 °F [= 17.8 °C] and humidity 94% and 89%, respectively (DeBlase 1980: 326).

Besides these records of numerous bats in colonies, also some findings of single individuals are available; Hemmati (2001) collected one male in deep torpor from the Zivieh cave on 23 July 2000 and three males from the Karaftu cave (Figs. 31–33) (both in Kordestan) on 19 February 1998 and 16 April 1999, respectively. The latter two collections may represent findings from a hibernation roost. DeBlase (1972) and Akmali et al. (2011a) reported *R. mehelyi* from several other caves (see above), however, without any specification of the date or season of the year.

Almost in all cases (with only one exception), *R. mehelyi* has been found to share its roost with other bat species (see above for the bat communities recorded in the Mahidasht and Gara Tarik caves). In the cave at Maku (also called the Zangamar river cave), *R. mehelyi* was found together with *Rhinolophus euryale* and *Miniopterus pallidus* in 1962 (DeBlase 1980). Hemmati (2001) met *R. mehelyi* in the Karaftu cave in February 1998 together with *Miniopterus pallidus*, while in April 1999 with *Myotis blythii*. The latter species was collected along with *R. mehelyi* also from the Zivieh and Aftabi caves (Hemmati 2001), as well as from the Tange Rad cave (Akmali 2004). In the Shahpur cave, *R. mehelyi* was recorded to roost along with *Myotis capaccinii*, *Pipistrellus kuhlii* and *Miniopterus pallidus* in December 1962 (Lay 1967, DeBlase 1980). Akmali et al. (2011a) also mentioned co-occurring species in roosts of *R. mehelyi* (*Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus hipposideros*, *R. mehelyi*, *R. blasii*, *Myotis blythii*, and *Miniopterus pallidus* in the Tadovan cave, *Rhinolophus hipposideros* and *Myotis blythii* in the Biboneh cave, and *M. blythii* in the Sharif Abad cave), however, their simultaneous occurrence at the sites is not quite clear from his report. Various authors reported observations of *R. mehelyi*, *M. blythii*, *P. kuhlii* and *M. pallidus* during different visits of the Kilasefid cave near Qasr-e Shirin and simultaneous occurrence of these species cannot be excluded there.

Reproduction of *R. mehelyi* was reported from several sites in Iran. Nursery colonies including juveniles were observed in the Mahidash cave on 7 June, in the Kilasefid cave on 9 July and in the Gara Tarik cave on 14 August; an observation of a colony (without a mention of its reproduction status) was reported from the Aftabi cave from 24 July.

In the Mahidasht and Kilasefid caves, roosting of colonies was observed year-long, from the latter cave even including the hibernation period. As already mentioned above, an assemblage of *R. mehelyi* was observed to roost in the Shahpur cave on 29 December, however, the bats were not in hibernation torpor. Colonies of this bat were found during the autumn period in the cave at Maku (September and October), in the Tang Rad cave (October) and at Dakal (October). These records suggest permanent use of roosts by *R. mehelyi* aggregations throughout all seasons, including the reproduction period and in some cases also including the hibernation period.

Variation. We did not examine any museum material of *Rhinolophus mehelyi* from Iran, and neither Felten et al. (1977) nor DeBlase (1980) reported any taxonomic notes on the Iranian populations of this species. Moreover, the external and skull dimensions published by DeBlase (1980) seem to be incomparable (i.e. perhaps taken by a different method) with those presented by Felten et al. (1977) and Benda et al. (2006, 2011c) from other parts of the species distribution range, thus the dimensional comparison of Iranian samples cannot be carried out for the time being. Benda et al. (2006) described bimodality in size characters in the Mediterranean populations of *R. mehelyi*; larger bats occur in the Maghreb and Europe, while smaller bats live in Cyrenaica (Libya) and the Levant. To which of these groups the Iranian populations belong or whether they represent a group of its own, remains a task for further studies.

Echolocation. According to the data obtained from the European populations (Heller & von Helversen 1989, Russo et al. 2001, Salsamendi et al. 2005, Siemers et al. 2005, Papadatou et al. 2008), *Rhinolophus mehelyi* produces calls with a long constant-frequency part with the maximum energy frequencies between 104–112 kHz. Data on echolocation of this bat in the Asian part of its distribution range are available only from Israel, Mendelssohn & Yom-Tov (1999) mentioned similar values as known from Europe. Benda et al. (2008) reported a single echolocation sequence from Sinai, with ca. 105 kHz of the maximum energy, which were preliminarily attributed to *R. mehelyi*. Echolocation of *R. mehelyi* in Iran has not yet been studied.

FEEDING ECOLOGY. *Rhinolophus mehelyi* is a medium-sized horseshoe bat using the feeding strategies of hawking and flycatching prey close to vegetation (Gaisler 2001c); the gleaning mode of foraging is also expected in this bat (Siemers & Ivanova 2004). In Spain, Lepidoptera were the major food item consumed by *R. mehelyi*; the moths were complemented with Neuroptera, Tipulidae, Chrysomelidae, Brachycera, and Chironomidae (Salsamendi et al. 2008).

From Iran, the diet composition of *R. mehelyi* was studied from several sites. Sharifi & Hemmati (2001) analysed the diet and its variation in the maternity colony in the Kilasefid cave (Kermanshah) within the spring and summer seasons of 2001; they found Lepidoptera to represent a dominant part of the food (56.7–88.2% of volume), followed by scarabaeid beetles (8.2–26.2%) and muscid dipterans (0–11.0%), other nine diet items were found less important. Sharifi & Hemmati (2004) compared the diet of three maternity colonies in the Kilasefid and Mahidasht caves (Kermanshah), and the Karaftu cave (Kordestan). These analyses also showed mostly Lepidoptera to be present in the diet of *R. mehelyi* (34.9–69.6% of volume), other important food items were Coleoptera (11.3–33.5%), Homoptera (0–13.9%), and Diptera (0–13.1%).

Rhinolophus blasii Peters, 1866

RECORDS. **Original data**: E s f a h â n: Emamzadeh [1], 15 km W of Kashan, qanat, 1 May 1997: net. 11 ma, 1 fG, 1 fs (NMP 48098–48110, JOC unnumbered; cf. Benda et al. 2006). – F â r s: Tâdovân [2], 44 km NW of Jahrom, Tâdovân cave, 7 October 2011: obs. a colony of ca. 10 inds. – F â r s: Takht-e Jamshid (Persepolis) [3], ruins of ancient palace, 23 April 2000: remnants of 1 ind. (1 right and 1 left mandibles, skull fragment) found in *Asio otus* pellets. – I l â m: Âsemân Âbâd [4], 30 km N of Ilâm, Tange Rad cave, September 2002: net. 1 ind. (cf. Faizolâhi 2004). – K h o r a s â n - e R a z a w i: Mahvid [5], 26 km NE of Ferdows, cave, July 2012: obs. & photo 1 ind. (leg. H. Ostovari); – Mozdurân [6], 2 km N of Mazdâvand, Mozdurân cave, 14 October 2009: obs. ca. 20 inds., net. 1 m; – Hendel Âbâd [7], 40 km NE of Mash'had, Hendel Âbâd cave, 28 September 2009: obs. ca. 10 inds., net. 1 m. – K o h g i l u y e v a B o y e r A h m a d: valley 3 km N of Meymand [8], 24 km N of Pataveh, grove, 4 October 2011: net. 1 fa (NMP 93864; Fig. 47). – Z a n j â n: Golgik [9], 25 km W of Zanjân, Golgik cave, 11 May 2009: coll. 1 ma (HMNH 2009.46.2.; don. F. Hemmati). – **Published data**: Â z a r b â i j a n - e G h a r b i: Maku [10], man-made tunnel in a cliff, 26 July 1968: 1 ind., FMNH (DeBlase 1980). – Â z a r b â i j a n - e S h a r q i: Tabriz [11], March 1975: 1 f, SMF (Felten et al. 1977, DeBlase 1980, Kock 1983, Benda et al. 2006). – C h a h â r M a h â l v a B a k h t i â r i: Shah Abbas Caves [12], Kuh Rang, cave, 1965: 3 f, BMNH (Lay 1967, DeBlase 1980). – F â r s: Canae Gabru Cave [= Tâdovân cave], near Tadovan [2], 10 November 1968: coll. 5 m, FMNH (DeBlase 1980), Tâdovân, Tâdovân cave (Akmali et al. 2011a); – Takht-e Jamshid (Persepolis) [3], 11 km NE Marvdasht, 1 ind. (Etemâd 1984). – G o l e s t a n: Shirabad Cave (5 km SE of Shirabad, 60 km east of Gorgan, 310 m) [13], June 1999 (Morshed & Patton 2002). – I l â m: Âsemân Âbâd [4], Tange Rad cave (Akmali et al. 2011a). – K e r m â n: 1.6 km. east of Kerman [14], cave, 8 December 1962: obs. 7 inds., coll. 3 m, 3 f, FMNH (Lay 1967, DeBlase 1980); – Zahrud-e Bala [15], 70 km S of Kerman, Kuh-e Hazar Mts., 2700 m, 21 May 1975: 1 fa, MHNG (de Roguin 1988). – K h o r a s â n - e J a n u b i: 3 km. SW Isfehden [= Esfedan] [16], 6 November 1962: 1 f, USNM (DeBlase 1980); – 5 km. NE Isfehden [= Esfedan] [17], 8 November 1962: 1 m, USNM (DeBlase 1980). – K h o r a s â n - e R a z a w i: Chelmir [18], 13 July 1969: 2 f, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – 8 km. NW Meher [19], 48 km. W Sebzavar, 5 August 1969: 1 m, 1 f, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – Mozduran [6], 4 October 1974: 1 f, SMF (Felten et al. 1977, DeBlase 1980, Kock 1983, Benda et al. 2006), Mozdurân cave, 2 km N Mazdâvand, 4 m (Etemâd 1984); – 137 km. SE Sebzavar [20], 10 September 1970: 7 f, IPHR (Farhang-Azad 1971 ex DeBlase 1980). – K h o r a s â n - e S h o m â l i: Ganjan Kuh Cave [21], 12 November 1962: majority from a colony consisting of ca. 500 inds., coll. 5 m, 7 f, FMNH (Lay 1967, DeBlase 1980); – Robat-i-Qarabil [23], cave, 9 November 1962: coll. 3 m, 9 f, FMNH (DeBlase 1980, cf. Lay 1967); – Shahrabad Kaur [22], qanat, 9 November 1962: coll. 13 m, 14 f, FMNH (Lay 1967, DeBlase 1980). – M a r k a z i: Baba-djaber [Bâbâ Jâber] cave in Mahalat [= 18 km S Mahallât] [24], November 1963: coll. 2 m (Etemad 1964, 1984, DeBlase 1980). – S e m n â n: Afghan Cave [25], 110 km. SE Tehran, 23 April 1969: coll. 1 m, 1 fa, IPHR (DeBlase 1980). – S i s t â n v a B a l u c h e s t â n: Kusheh [26], western slope of the Kuh-e Taftan Mt., 2250–2600 m, 13 June 1975: 3 fa, 16 June 1975: 2 ma, 2 fa, MHNG (de Roguin 1988); – Baluchestan [undef.]: Mekran Coast [*27*], 1 ind., BMNH (DeBlase 1980). – Y a z d: 15 km. S, 6 km. E Yazd [28], 14 December 1970: 4 f, IPHR (Farhang-Azad 1971 ex DeBlase 1980). – Z a n j â n: Golgik [9], 25 km W Zanjân, Golgik cave, 26 May 2008: 1 m, 1 f (Hemmati 2009), Golgik, Golgik cave (Akmali et al. 2011a).

Distribution. Although *Rhinolophus blasii* is not a quite common bat in Iran, it belongs to the most widespread bat species in the country – at least 27 record sites are available from all parts of Iran with the exception of the central deserts (Fig. 46). There is no apparent trend in distribution of the records, the species occurs throughout the country. Although it probably prefers rather elevated localities with a less arid climate, some records are available also from desert regions. Distribution of the records has, however, an almost identical pattern with that presented by DeBlase (1980), who reviewed two thirds of the up-to-date known records only (Table 1). *R. blasii* is the most frequent and most widespread among the three medium-sized *Rhinolophus* species in Iran, similarly as in some other rather arid countries of the Middle East (e.g. Jordan, see Benda et al. 2010).

Compared to other bats of the Middle East, *R. blasii* is a species with very broad distribution covering the south-western Palaearctic and eastern and southern Africa (Horáček et al. 2000, Simmons 2005). In the Palaearctic it occurs from the Balkans and Maghreb to Afghanistan and

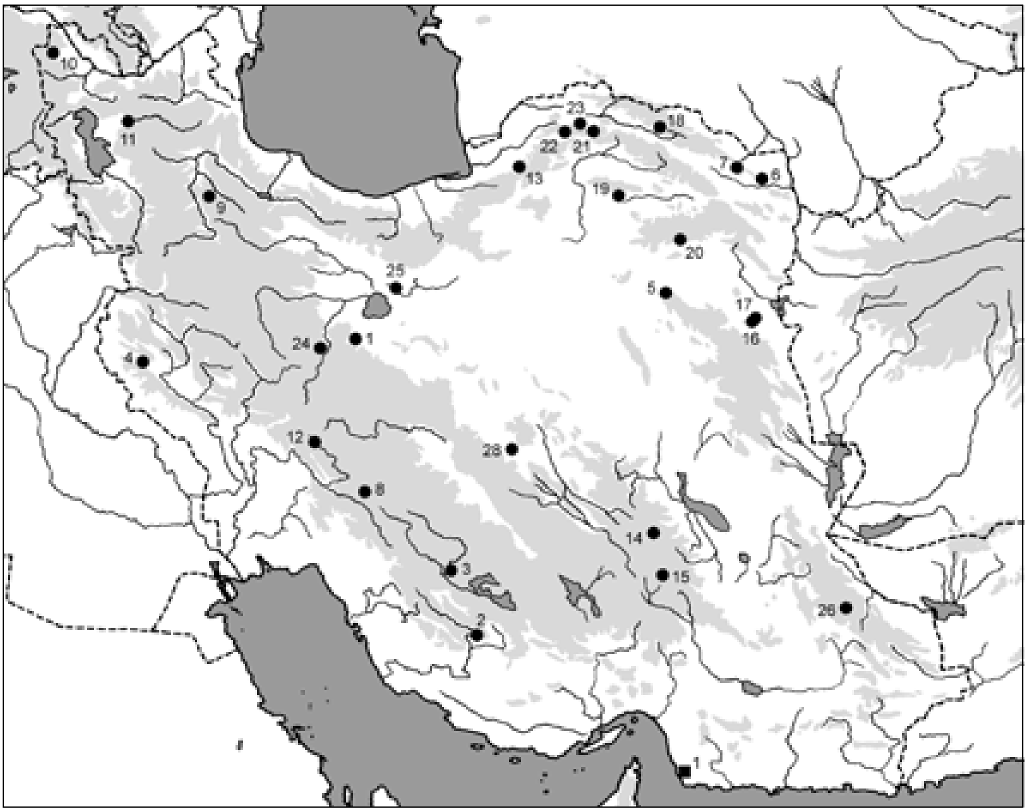

Fig. 46. Records of *Rhinolophus blasii* Peters, 1866 (circles) and *Hipposideros fulvus* Gray, 1843 (square) in Iran.

Pakistan and from Transcaucasia and Turkmenistan to Yemen and Oman (Bates & Harrison 1997, Kryštufek & Đulić 2001, Benda et al. 2006). The Iranian area of occurrence of *R. blasii* thus lies in the centre of the Asian range of the species, which continues in all directions (with the excepion of Iraq in the south-west), including Oman in the south over the Strait of Hormuz (Harrison & Bates 1991).

Field notes. In Iran, *Rhinolophus blasii* was frequently recorded in or at its roosts, more than a half of the records were made in or at shelters of colonies or individuals; only two findings represent evidence of netted bats.

According to the available data, no maternity colony of *R. blasii* was recorded in Iran. The only record indicating a reproduction group was made at Emamzadeh near Kashan (Esfahan); a part of this group was netted at an opening to a qanat on 1 May 1997 (for description of the site see under *Rhinolophus hipposideros*); it was composed mainly of adult males, but contained also one pregnant female. Although several other records were made in the summer season, i.e. in the period of the existence of nursery colonies, only individual bats were found and/or reported from the roosts. Two individuals were collected from the Afghan cave (Semnan) on 23 April 1969 (DeBlase 1980); one and two bats were collected from the Golgik cave (Zanjan) on 26 May 2008 (Hemmati 2009) and 11 May 2009, respectively; and one individual was observed in a cave at Mahvid near Ferdows (Khorasan) in July 2012. One bat was collected from a man-made tunnel in a cliff at Maku (Azarbaijan) on 26 July 1968 by DeBlase (1980: 121); this author wrote that the individual "was found dead and partly decomposed. The tunnel in which it was found was explored but neither additional specimens nor any further evidence of bat occupation was found." Thus, the latter record may represent an individual which died in the course of roosting, e.g. during hibernation or in the early spring period of the respective year.

Aggregations of *R. blasii* were observed in their roosts only in autumn and winter. A small group of some ten bats was found in the Hendel Abad cave (Khorasan) on 28 September 2009. Another group of ten roosting but active individuals was localised in the Tadovan cave (Fars; Fig. 43) on 7 October 2011; in the same cave (under the name Canae Gabru Cave), DeBlase (1980: 120) observed a small group on 10 November 1968: "specimens were found in deep torpor hanging from the dome of a small room. The temperature of the room was 75° F [= 23.9 °C] and relative humidity was 91 per cent. Five *R. blasii* shared the room with nine *R. euryale* and one *Myotis capaccinii*. The *Rhinolophus* hung singly and in small clumps of two to three." From the Mozduran cave (Khorasan), one individual was collected on 4 October 1974 (Felten et al. 1977) and a group of ca. 20 bats observed on 14 October 2009. Etemad (1964, 1984) reported a November record of two bats in the Baba Jaber cave at Mahalat (Markazi). Lay (1967: 136) reported that "several colonies of 100 to 500 individuals were found to be hibernating near Shahrabad Kaur [Khorasan] in early November [= 9 November 1962]. One qanat aggregation there contained only *R. blasii*, but another [= Robat-i-Qarabil] housed both *blasii* and *R. ferrum-equinum*." Along with the above mentioned qanat at Emamzadeh, the latter records represent the only findings in artificial underground spaces. A large colony was reported to occur in the Ganjan Kuh cave (Khorasan) on 12 November 1962, Lay (1967: 136) described the record as follows (for description of the cave see under *R. ferrumequinum*): "Ganja Kuh cave […] housed in excess of 500 bats of which *R. blasii* constituted the majority. A number of *Miniopterus schreibersi* [= *M. pallidus*] were scattered through the compact cluster hanging from the ceiling, roughly one to every ten *R. blasii*." A small group of *R. blasii* was found in a cave at Kerman (Kerman) on 8 December 1962; according to Lay (1967: 137), the bats "were hibernating in a fault crack […] and individuals hung spatially separated." Lay (1967: 86–87) described the site and record as follows: "About 60 m. up the side of a rock extrusion 1.5 km. east of this city

[= Kerman], a small cave opened southward. The opening divided into two shallow chambers. The southeast chamber led down into a fissure that varied in width between 0.6 and 2 m. I was unable to determine the absolute depth of this fissure but it appeared to descend more than 50 m. below the 20 m. depth to which I penetrated. Slit deposited on the ledges of the fissure faces suggested earlier presence of water. The atmosphere within this parture was warm and dry in contrast to the cool dryness of the paired upper chambers. Apparently the temperature of these chambers fluctuated with the outside temperatures, whereas the mountain rock within this fissure, lacking a direct exterior opening, maintained a nearly constant temperature by absorbing radiant energy at a greater rate during the day than it radiated at night. Seven *Rhinolophus blasii* were hibernating at a depth of approximately 15–20 m. in this crevice."

From most of localities, *R. blasii* was reported as the only bat recorded; however, it was also observed to be a part of diversified bat communities in some roosts. During two visits of the Tadovan cave, *R. blasii* was found to share (see also above) this roost with *Rhinopoma microphyllum*, *R. muscatellum* and *Myotis capaccinii*; from the 1968 visit, DeBlase (1980) reported also *Rhinolophus hipposideros* and *R. euryale*, and during the 2011 visit, also *Rhinolophus ferrumequinum*, *Myotis blythii* and *Miniopterus pallidus* were recorded. From the Golgik cave, *R. blasii* was collected together with *Myotis blythii*, *Plecotus macrobullaris* and *Miniopterus pallidus* (cf. Hemmati 2009). Two visits of the Mozduran cave confirmed co-occurrence of *R. blasii* with *M. pallidus*; Felten et al. (1977) and Kock (1983) reported there also findings of *R. ferrumequinum*, *R. euryale*, and *M. blythii* made in October 1974. Several roosts were found to be shared by *R. blasii* with one bat species; with *R. ferrumequinum* it was reported from the Ganjan Kuh cave (see also above) and the Robat-i-Qarabil qanat by Lay (1967) and from the Baba Jaber cave by

Fig. 47. *Rhinolophus blasii* Peters, 1866 from Meymand (Kohgiluye va Boyer Ahmad). Photo by A. Reiter.

Fig. 48. Valley near Meymand (Kohgiluye va Boyer Ahmad), a foraging area of *Rhinolophus blasii*, *Pipistrellus pipistrellus*, *P. kuhlii*, and *Miniopterus pallidus*. Photo by A. Reiter.

Etemad (1967, 1984), while with *R. hipposideros* it was observed in the Tange Rad cave and also in the qanat at Emamzadeh near Kashan.

Foraging *R. blasii* were recorded in Iran at few sites. One individual was netted in an oak grove in the river valley near Meymand (Kohgiluye va Boyer Ahmad; Fig. 48) on 4 October 2011, into a net exposed above a small spring between trees. At this site calls of *Pipistrellus pipistrellus* and *P. kuhlii* were also detected. Farhang-Azad (1970a ex DeBlase 1980) reported on nettings of nine bat species at Chelmir (Khorasan) in July 1969, including two females of *R. blasii* (plus *Myotis blythii*, *Eptesicus serotinus*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Nyctalus leisleri*, *Otonycteris leucophaea*, *Miniopterus pallidus*, and *Tadarida teniotis*); however, no information on the netting site and other details concerning the record are available. De Roguin (1988) reported collection (no method is given) of seven individuals of *R. blasii* at Kusheh (Baluchestan) on 13 and 16 June 1975, by two ornithologists (cf. Desfayez & Praz 1978); this fact and also the composition of the recorded bat community (incl. *Eptesicus bottae*, *Hypsugo savii*, and *Tadarida teniotis*) suggest netting as the method of collection and thus, most probably a record of foraging individuals. The site was briefly described by de Roguin (1988: 597) as follows: "en bas, zone de production agricole des nomades baloutches (céréales, abricotiers), très empierrée; en haut, entrée d'une gorge sans rivière, au-dessus des derniers campements nomades." The same is perhaps valid for another record by de Roguin (1988), from Zahrud-e Bala in the Kuh-e Hazar Mts., south of Kerman (Kerman). An adult female of *R. blasii* was there collected (= most probably netted) on 21 May 1975, de Roguin (1988: 596) characterised the locality as follows: "murs et tas de pierres de la zone cultivée du village, comportant abricotiers, céréales, luzerne, etc. La zone cultivée est irriguée par des bisses (canaux) au-dessus desquels se retrouve la zone aride à *Artemisia* sp."

At several sites, individuals of *R. blasii* were netted at entrances to underground roosts (qanat at Emamzadeh, Tange Rad cave, Mozduran cave), but these reports indicate use of the roost and/or possible swarming at its entrance rather than foraging activity of the recorded bats.

Concerning the biology of *R. blasii* in Iran, DeBlase (1980: 121) concluded: "Little is known of the annual and reproductive cycles of this species in Iran. […] In northern Iran hibernation appears to have begun by 9 November." The reviewed data can only slightly modify this conclusion. On 1 May, a pregnant female was collected that contained one foetus of the crown-rump length 9.3 mm; it suggests that the parturitions in central Iran occur in mid-May. In October foraging bats and active individuals in roosts were recorded, while in November and December the roosting bats were torpid, most probably indicating the ongoing hibernation.

Remains of *R. blasii* were documented in pellet material from one owl species, *Asio otus*, collected at the Persepolis ruins (Fars; Table 40). The remains represented the only bat found and 1.18% of all prey items (and 2.08% of mammal items) in the respective sample and 0.93% of all prey items (and 1.85% of mammal items) in the whole analysed long-eared owl diet from Iran. Besides Iran, in the Middle East *R. blasii* was found among owl prey only in Palestine (Dor 1947).

Material examined. 10 ♂♂, 2 ♀♀ (NMP 48098–48110 [S+A]), Emamzadeh (Esfahan Prov.), 1 May 1997, leg. P. Benda; – 1 ♂ (HMNH 2009.46.2. [S+A]), Golgik cave [Zanjan Prov.], 11 May 2009, collector unlisted, don. F. Hemmati; – 2 ♂♂, 2 ♀♀ (MHNG 1703.88–1703.91 [S+A]), Kusheh, Kuh-e Taftan Mt. [Sistan va Baluchestan Prov.], 16 June 1975, leg. M. Desfayes & J.-C. Praz; – 1 ♀ (NMP 93864 [S+A]), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (SMF 46686 [S+B]), Mozduran [Khorasan-e Razawi Prov.], 4 October 1974, leg. H. Felten, K. Walch & Wirth; – 1 ind. (JOC unnumbered [Sf]), Persepolis (Fars Prov.), 23 April 2000, leg. J. Obuch; – 1 ♀ (SMF 47842 [S+B]), Tabriz [Azarbaijan-e Sharqi Prov.], March 1975, leg. Assadi; – 3 ♂♂ (MHNG 1703.85–1703.87 [S+A]), Varaj [= Kusheh], Kuh-e Taftan Mt. [Sistan va Baluchestan Prov.], 13 June 1975, leg. M. Desfayes & J.-C. Praz; – 1 ♀ (MHNG 1703.84 [S+B]), Zahrud-e Bala, Kuh-e Hazar [Kerman Prov.], 21 May 1975, leg. M. Desfayes & J.-C. Praz.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rhinolophus blasii* are shown in Table 10. For the material examined see above.

R. blasii is a polytypic species, up to four subspecies are currently recognised within its distribution range (Kock & Howel 1988, Koopman 1994, Csorba et al. 2003, Simmons 2005, Benda et al. 2006). The Palaearctic populations of the species, comprising those of the Maghreb, south--eastern Europe, Middle East, Afghanistan, and Pakistan, were primarily considered to belong to one form, the nominotypical subspecies (Andersen 1905a, Ellerman & Morrison-Scott 1951, Aellen 1959a, Corbet 1978, Strelkov et al. 1978, DeBlase 1980, Strelkov 1981a, etc.).

Felten et al. (1977) divided the Palaearctic populations of *R. blasii* into two forms, *R. b. blasii* Peters, 1866 occurring in the Mediterranean region eastwards to western Turkey (type locality: Milan and Triest; Benda et al. 2006: 82), and a newly described *R. b. meyeroehmi* Felten, 1977 from Afghanistan and Iran (type locality: Pashtunkot (Grotte Zarmast), Prov. Fariab, Afghanistan; Felten et al. 1977: 25). This opinion was accepted by most of later authors (Corbet 1984, Corbet & Hill 1992, Koopman 1994, Horáček et al. 2000, Kryštufek & Đulić 2001, Kock et al. 2002, Csorba et al. 2003, etc.). However, Kock & Howel (1988) indicated the Iranian populations to belong to the nominotypical subspecies, but without any explanation why they refused the results by Felten et al. (1977), although they accepted the subspecies *R. b. meyeroehmi* in Afghanistan. *R. b. blasii* was reported from Iran also by de Roguin (1988). This statement was commented by Kryštufek & Đulić (2001) who pointed out the uncertain status of the Iranian populations which could belong to *R. b. blasii* or *R. b. meyeroehmi*. On the other hand, Csorba et al. (2003) reported *R. b. meyeroehmi* to occur in Iran, Turkmenistan, Afghanistan, and Pakistan.

Felten (in Felten et al. 1977) defined the form *meyeroehmi* to be larger in skull and forearm size than the nominotypical subspecies and mainly, to differ by much longer phalangi of its fourth wing finger. Benda et al. (2006) compared a large set of Palaearctic samples of *R. blasii* including the specimens from Iran and Afghanistan and found them to agree in the forearm length and in skull

Table 10. Basic biometric data on the examined Iranian samples of *Rhinolophus blasii* Peters, 1866, *Asellia tridens* (Geoffroy, 1813), and *Triaenops persicus* Dobson, 1871. For abbreviations see p. 171

	Rhinolophus blasii					*Asellia tridens*					*Triaenops persicus*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	15	**57.3**	51	65	3.105	21	**64.3**	62	69	1.875	–	–	–	–	–
LCd	15	**29.5**	23	34	2.722	21	**24.5**	21	28	1.834	–	–	–	–	–
LAt	25	**47.36**	45.0	50.6	1.261	35	**52.75**	49.7	55.8	1.492	2	**51.05**	50.7	51.4	0.495
LA	15	**19.44**	18.4	21.0	0.730	21	**19.67**	18.2	21.1	0.712	–	–	–	–	–
LCr	18	**19.47**	18.97	20.07	0.318	34	**18.88**	17.73	19.62	0.521	1	18.65	–	–	–
LOc	23	**18.93**	18.56	19.60	0.264	35	**18.78**	17.58	19.43	0.520	3	**18.79**	18.37	19.27	0.453
LCc	24	**16.66**	16.32	17.19	0.257	33	**16.71**	15.58	17.58	0.493	3	**16.45**	16.05	16.98	0.480
LaZ	24	**8.98**	8.67	9.63	0.228	36	**10.48**	9.72	11.07	0.338	3	**8.85**	8.65	9.02	0.186
LaI	26	**2.32**	2.14	2.51	0.090	36	**2.31**	1.89	2.65	0.141	3	**2.64**	2.54	2.78	0.123
LaInf	24	**4.68**	4.48	4.86	0.092	36	**5.89**	5.49	6.34	0.205	1	6.27	–	–	–
LaN	25	**8.13**	7.69	8.62	0.230	36	**7.38**	6.73	7.87	0.257	3	**7.45**	7.24	7.61	0.189
LaM	23	**9.02**	8.81	9.38	0.168	36	**8.87**	8.42	9.33	0.229	3	**8.66**	8.53	8.75	0.117
ANc	24	**6.03**	5.77	6.27	0.136	35	**5.52**	5.07	6.04	0.229	3	**6.50**	6.41	6.64	0.125
LBT	23	**3.22**	2.92	3.47	0.131	35	**3.03**	2.77	3.23	0.099	3	**2.92**	2.87	2.97	0.050
CC	25	**4.34**	4.06	4.54	0.134	35	**5.30**	4.92	5.68	0.177	3	**5.00**	4.89	5.06	0.095
M^3M^3	25	**6.62**	6.48	6.88	0.107	36	**7.47**	7.06	7.76	0.193	3	**6.83**	6.75	6.91	0.080
CM^3	25	**6.71**	6.47	6.93	0.092	35	**6.87**	6.37	7.19	0.218	3	**6.86**	6.51	7.27	0.384
LMd	25	**12.02**	11.73	12.43	0.210	35	**12.71**	11.74	13.20	0.356	3	**11.74**	11.39	12.16	0.390
ACo	27	**2.55**	2.32	2.86	0.127	36	**4.13**	3.67	4.44	0.192	3	**2.61**	2.42	2.75	0.172
CM_3	25	**7.06**	6.82	7.24	0.116	35	**7.57**	7.12	7.95	0.218	3	**7.45**	7.28	7.73	0.244

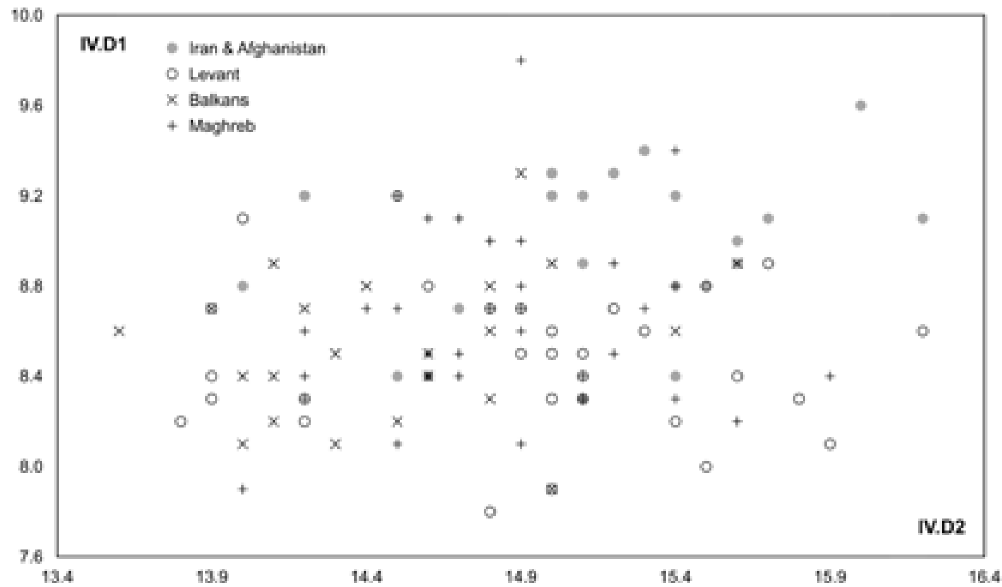

Fig. 49. Bivariate plot of the examined Iranian and comparative samples of *Rhinolophus blasii* Peters, 1866: length of medial phalanx of the fourth wing finger (IV.D2) against the length of proximal phalanx of the fourth wing finger (IV.D1).

Table 11. Comparison of three wing dimensions of five sample sets of *Rhinolophus blasii* Peters, 1866. For abbreviations see p. 171

	n	**M**	min	max	SD	n	**M**	min	max	SD	
			Iran					Levant			Afghanistan
LAt	25	**47.36**	45.0	50.6	1.261	47	**47.00**	43.6	49.1	1.216	47.4
IV.D1	25	**8.91**	8.3	9.4	0.332	32	**8.46**	7.8	9.2	0.326	9.6
IV.D2	25	**15.15**	14.0	16.2	0.523	31	**14.92**	13.8	16.2	0.640	16.0
			Balkans					Maghreb			
LAt	22	**46.70**	43.9	48.3	1.006	36	**46.77**	43.4	49.0	1.280	
IV.D1	23	**8.53**	7.9	9.3	0.325	36	**8.61**	7.9	9.8	0.399	
IV.D2	23	**14.50**	13.6	15.6	0.491	36	**14.83**	14.0	15.9	0.435	

dimensions with the compared samples from the Mediterranean (see Benda et al. 2006: 83, Table 12), see also the new data on the Iranian set (Table 10). These results indicated that body size does not affect significantly the geographic variation in the Palaearctic populations of *R. blasii*. However, Benda et al. (2006) did not compare the length of the wing finger phalangi in the whole set of examined samples; from Iran, only the data from Emamzadeh (Esfahan) were available to them; anyway, the latter dimensions were consistent with the data from other Mediterranean countries (see Benda et al. 2006: 84, Table 13).

For a new comparison of phalanx lengths, all available data from the examined Iranian samples were gathered (see Material examined). The values of the lengths of the fourth wing finger phalangi in Iranian samples (including one Afghanistani bat) agree with those of other Mediterranean samples of *R. blasii* (Fig. 49, see also Appendix II for origin of the comparative material); although slightly larger in mean values, the phalanx lengths of Iranian samples are well in the

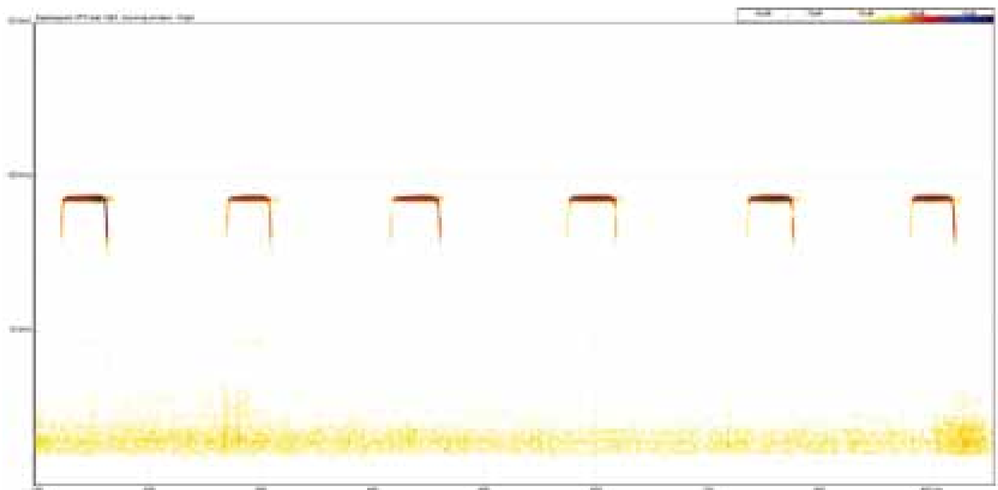

Fig. 50. Spectrogram of echolocation calls of *Rhinolophus blasii* Peters, 1866; an individual foraging in the valley near Meymand (Kohgiluye va Boyer Ahmad).

length ranges of the Levantine and Maghrebian specimens and only slightly exceed the lengths of the examined Balkan samples.

These results clearly indicate that the nominotypical subspecies as defined by Felten et al. (1977) lives in the whole Palaearctic range of *R. blasii* west of Afghanistan, i.e. including the whole territory of Iran, while the form *R. b. meyeroehmi* probably occurs solely in Afghanistan (and perhaps also in Pakistan, as suggested by Bates & Harrison 1997). However, a question still remains, whether all the specimens examined by Felten et al. (1977) as representatives of the ssp. *meyeroehmi* (two specimens from Iran, 14 from Afghanistan) were measured in a different way, as suggested by differences between the data from Iranian and Aghanistani specimens presented here and those presented by Felten et al. (1977) – comp. Fig. 49 and Table 11 here and Felten et al. (1977: 27, Abb. 7, Tab. 12) – or whether the Afghanistani populations really differ in all morphological traits from other populations of *R. blasii*. Although the taxonomic affiliation of the Iranian populations seems to be clear, a profound re-examination of the SMF type series of this taxon is necessary for any relevant conclusion concerning the status of the subspecies *meyeroehmi*. Anyway, its partial examination by Benda et al. (2006) did not confirm the differences in body and skull size, previously reported from this population by Felten et al. (1977).

Echolocation. *Rhinolophus blasii* produces calls with a long constant-frequency part and with the maximum energy at 92–98 kHz. From Iran, we obtained two call sequencies of this species at one site, Meymand (Kohgiluye va Boyer Ahmad). Calls were recorded from a single bat in a resting position in hands. The measured echolocation characteristics are given in Table 3 and spectrogram of the call in Fig. 50. The obtained maximum frequency values (93.0–93.3 kHz) fully comform to the data on *R. blasii* reported from Europe and the Middle East (Heller & von Helversen 1989, Shalmon et al. 1993, Mendelssohn & Yom-Tov 1999, Siemers et al. 2005, Papadatou et al. 2008, Benda et al. 2010, Schuchmann & Siemers 2010). In the southern part of the African range of distribution of *R. blasii* (Swaziland), a significantly lower maximum frequency was recorded, ca. 86 kHz (Monadjem 2005, Monadjem et al. 2010).

Feeding ecology. *Rhinolophus blasii* is a medium-sized bat with an extremely agile flight, hunting its prey close to the foliage (Dietz et al. 2007). Furthermore, the ability to pick up the prey from the ground was proved in flight experiments (Siemers & Ivanova 2004). Results of previous studies from Zambia (Whitaker & Black 1976), Jordan (Benda et al. 2010), and Cyprus and Crete (own unpubl. results) indicate that the species is a moth-eating specialist.

The diet composition of two individuals of *R. blasii* from two sites in Iran was analysed. One digestive tract from a specimen collected at Emamzadeh (Esfahan) contained only medium-sized Lepidoptera (wingspan ca. 30 mm). Seven faecal pellets from one individual collected at Meymand (Kohgiluye va Boyer Ahmad) contained Lepidoptera (29% of volume) and Orthoptera (71%). The high proportion of orthopterans in the diet of the latter individual does not correspond much with the previous studies, however, the sample set is too limited to allow for some reasonable conclusions.

Records of ectoparasites. **Original data**: S t r e b l i d a e: *Brachytarsina flavipennis*: 1 ma (CMŠ [P]) from 1 fa (NMP 93864), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011. – I x o d i d a e: *Ixodes vespertilionis*: 1 larva, 1 nymph (CMŠ [P]) from 1 fa (NMP 93864), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011.

Comments on ectoparasites. *Brachytarsina flavipennis* Macquart, 1851 is a permanent parasite of the bats of the genus *Rhinolophus*. Thus, its finding on *R. blasii* in Iran is not surprising, it was previously collected in the country from *Rhinolophus ferrumequinum* (Kock 1983, see above).

The hard tick *Ixodes vespertilionis* also parasitises primarily bats of the genus *Rhinolophus*. Findings of this tick from Iran were previously published from *Myotis blythii* (Vatandoost et al. 2010), however, the host spectrum may be even wider.

Rhinolophus sp., medium-sized

RECORDS. **Original data**: K h o r a s â n - e R a z a w i: Mozdurân, 2 km N of Mazdâvand, Mozdurân cave, August 1999: obs. 1 ind. (cf. Faizolâhi 1999); – Bazangân, 75 km SW of Sarakhs, Bazangân cave, September 2009: obs. 20–30 inds. – L o r e s t a n: river valley 3 km S of Lenje Abad, 9 km SW of Dorud, 1 October 2011: det. & rec. calls of at least 1 ind. (104–107 kHz); – valley 5 km W of Arjank, 52 km SE of Dorud, at a stream, 2 October 2011: det. & rec. calls of 1 ind. (106 kHz). – Z a n j â n: Kataleh Khur cave, 2 km SW of Garmab, 1 October 2011: obs. & det. 1 flying ind. inside the cave.

COMMENTS. As already mentioned above, three species of the medium-sized horseshoe bats occur in Iran, *Rhinolophus euryale*, *R. mehelyi* and *R. blasii*. These species are similar in size, but differ in echolocation parameters and fine morphological traits (DeBlase 1972, 1980, Harrison & Bates 1991, see above). According to the values of echolocation calls available (Table 3), our records belong to one of the pair of sibling species, *Rhinolophus euryale* or *R. mehelyi*, emitting calls overlapping at ca. 104–109 kHz (see above). On the other hand, the observation records from two caves in Khorasan may represent one of the two species occurring in north-eastern Iran, *R. euryale* or *R. blasii*. The bat which was observed and whose call was detected (but not recorded) in the Kataleh Khur cave near Garmab, could belong to any of the three species.

Hipposideros fulvus Gray, 1838

RECORDS. **Original data**: H o r m o z g â n: rock cliff 6 km E of Tujak [1], 53 km SSE of Sirik, 15 April 2000: remnants of 1 ind. (pair of mandibles, 2 skull fragments) found in *Athene brama* pellets.

DISTRIBUTION. *Hipposideros fulvus* is a very rare bat species in Iran, only one record is available from the southern part of the country, the Hormozgan province (Fig. 46), where remains of one individual were found in the osteological material from owl pellets. *H. fulvus* is an Oriental biogeographical element within the Iranian fauna, it occurs over the Indian subcontinent from Afghanistan and Baluchestan to Bihar (India) and Ceylon (Bates & Harrison 1997). The evidence of *H. fulvus* in Hormozgan represents the first record of this species in Iran and the western Palae-

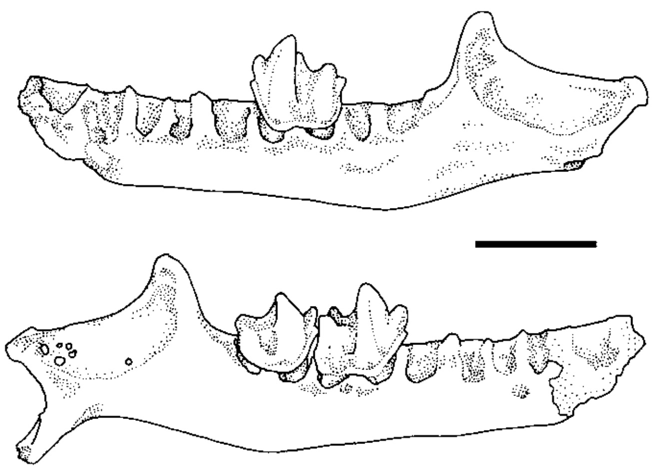

Fig. 51. Mandibles of *Hipposideros fulvus* Gray, 1843 discovered in owl pellets at Tujak (Hormozgan). Scale bar – 2 mm.

arctic as well, and also proves a prolongation of the species distribution range by some 650 km to the west from the Pakistani Baluchestan. Two records are available from the latter region, which are situated very close to the eastern border of Iran (cf. DeBlase 1980: 258); Wroughton (1920) reported a male from Panjgur, some 70 km east of the Iranian border, and Roberts (1977) added a record from Hoshab, 95 km east of the Iranian border (no new records from this region were published, see Mahmood-ul-Hassan et al. 2009). The Iranian locality of *H. fulvus* lies in one of the most arid parts of Iran, covering the southern and south-eastern parts of the country; other records of this bat can be expected in these areas interconnecting the known localities in Iran and Pakistan.

Field notes. The only specimen of *Hipposideros fulvus* known from Iran was discovered in the pellets of *Athene brama* collected at Tujak (Hormozgan). Its remains made up 0.15% of all prey items (and 5.56% of mammal items) in the respective sample and 0.07% of all prey items (0.82% of mammal items) in the whole analysed diet of the spotted owlet from Iran (Table 40). In the osteological material documented from *A. brama* pellets collected at Tujak on 15 April 2000, a mandible of *Rhinopoma muscatellum* was also found. At the locality, an adult female of *Otonycteris hemprichii* was caught into a net above a pool of remaining water in a dry wadi and calls of foraging *Pipistrellus kuhlii* were detected at the pool. The surrounding landscape is a stony desert with very steep rocks with numerous cracks and fissures; a small colony of *Rhinopoma muscatellum* was discovered in one small fissure close to the wadi.

Material examined. 1 ind. (JOC unnumbered [Sf]), Tujak (Hormozgan Prov.), 15 April 2000, leg. J. Obuch.

Morphology. The only known Iranian specimen of *Hipposideros fulvus* is represented by two complete mandibles without teeth, but one (M_2) and two molars (M_2, M_3), respectively (Fig. 51), and two fragments of maxillae bearing three (M^1–M^3) and four molariform teeth (P^4–M^3), respectively. Only two standard dimensions could be taken from these remains, mandible lengths (LMd) and heights of coronoid processes (ACo): right mandible LMd = 10.66 mm, ACo = 2.88 mm; left mandible LMd = 10.63 mm, ACo = 2.92 mm. The mandible lengths are slightly smaller than the length range given by Bates & Harrison (1997: 87) for Indian specimens (11.1–12.0 mm). This difference possibly reflects the wear of bones caused by processes in the owl's digestive tract or perhaps individual variation (e.g. the geographical differences – Iranian habitats are more arid than the Indian ones).

Asellia tridens (Geoffroy, 1813)

Records. **Original data**: B u s h e h r: Bouchir [= Bushehr], Brazjan [= Borazjan] [1], June 1968: coll. 2 fL (MHNG 1905.4A, 1905.4B; leg. A. Arata); – Qal'eh Sefid [2], Mârâl caves near the abandoned Mârâl quarry, 5 km N of Dâlaki, 18 November 2009: obs. several inds.; – Shanbeh [3], 47 km SE Khormuj, palace ruin, 14 October 2011: obs. a colony of 8 inds., coll. 1 fa (NMP 93900). – F â r s: Jahrom [4], Sang Eshkan, artificial caves, 8 October 2011: obs. a colony of ca. 20 inds., net. 1 ms, 1 fs (NMP 93894, 93895; Fig. 53). – H o r m o z g â n: river valley 12 km NNE of Chah Mosallam [5], 42 km NE of Bandar Lengeh, 12 October 2011: det. & rec. calls of several foraging inds.; – Hormoz island, Daneshyu salt cave [6], 4 km SW of Hormoz, 25 January 1999: coll. carcasses of 3 inds. (NMP 48202–48204; leg. J. Bruthans); – Qeshm island [7], winter 2002: coll. 1 ma, 1 ind. ad (HMNH 2007.3.3., 2007.3.4.; leg. H. Zohoori); – Zangârd [8], 25 km E of Bastak, palm oasis, 9 October 2011: obs. 1 foraging ind. – I l â m: Dehlorân cave [9], 5 km NE of Dehlorân, 17 October 2011: obs. a colony of ca. 1000 inds., coll. 2 ma (NMP 93909, 93910). – K h u z e s t â n: Choqâzanbil [10], 33 km SE of Shush, ancient tomb, 5 May 1996: obs. a colony of ca. 500 inds., coll. 6 inds. ad, 2 inds. sad (JOC unnumbered), 15 October 1998: obs. a colony of ca. 3000 inds., coll. 5 ma, 10 fa (NMP 48173–48187; cf. Benda et al. 2006, 2011d), 18 October 2002: remnants of 2 inds. found in *Tyto alba* pellets (cf. Obuch & Khaleghizadeh 2011), 16 October 2011: obs. a colony of ca. 250 inds., exam. 2 ms, 6 fa, coll. 1 fa (NMP 93901), det. & rec. several inds. – L o r e s t a n: river valley 3 km S of Lenje Abad [11], 9 km SW of Dorud, 1 October 2011: det. & rec. calls of at least 1 ind. – S i s t â n v a B a l u c h e s t â n: oasis 4 km S of Espakeh [12], 68 km SW of Irânshahr, date palm grove, 10 April 2000: remnant of 1 ind. (right mandible) found in *Athene brama* pellets. – **Published data**: B u s h e h r: Bushire [= Bushehr] [13], Persian Gulf, 29 August 1879: 1 fa, IMC (Anderson 1881, Trouessart 1897) =? Sulzabad, Bushire [= Bushehr], 1 m, BMNH (DeBlase 1980). – F â r s: 10 km. SE Kazerun [14], 19 November 1963: 1 f, USNM (DeBlase 1980); – Fereshteh Jân [15], 50 km SE Jahrom, qanat, May 2002: several inds. (Akmali 2004); – Jahrom [16], abandoned buildings, 31 December 1962: many mummies found, coll. 3 f, 4 inds., FMNH (Lay 1967, DeBlase 1980); – Jahrom, Sang Eshkan [4], man-made cave (Akmali et al. 2011a); – Kazerun [17], February 1967: 1 ind. (Etemad 1967, 1984), 30 October 1966: 1 ind. (Vercammen-Grandjean et al. 1970), 1968: 1 mj, IPHR (DeBlase 1980); – Khesht [18], 30 km W Kâzerun, cave (Akmali et al. 2011a); – Lâr [19], centre, cellar, September 2001 (Akmali 2004); – Rabatak [20], abandoned house, 4 January 1963: 50–100 mummies found, coll. 8 fa, FMNH (Lay 1967, DeBlase 1980). – H o r m o z g â n: Isin [21], southern foot of Kukhaye Genu Mts., 26 May 1973 (Hůrka 1984a, b); – Nâz Island [22], 22 km SW Qeshm, ventilator of a lodge, 2 August 2001: net. 2 inds. (Zohoori 2002a); – Qeshm Island, Kharbas cave [23], 11 km S Qeshm, Spring 2000: net. 4 inds., RUBC (Zohoori 2002a); – Qeshm Island, Chirâ pool [24], above a pool, 2 August 2001: net. 1 ind. (Zohoori 2002a); – Qeshm Island, Turgan [25], lodge, 1 May 2002: net. (Zohoori 2002a); – Roudan [26], 80 kms. east of Bandar Abbas, well, 10 March 1966: obs. several hundred inds., coll. 1 f, BMNH (Etemad 1967, 1969, 1984, DeBlase 1980, Benda et al. 2011d), Rudan (Minab), ghanat, March 1966: 12 inds. (Farhang-Azad 1969b). – I l â m: Bisheh Derâz [27], 30 km NW Dehlorân, Bisheh Derâz cave, several inds. (Farâsat 2003); – Mehran [28], house, 5 September 1968: 1 ms, FMNH (DeBlase 1980); – Sarin Ab-Garma Cave [9], Dehloran, large cave, 5 September 1968: obs. colony of ca. 5000 inds., coll. 5 m, 2 f, FMNH (DeBlase 1980), 20 June 1973: 3 mj, 7 fa (DeBlase 1980), Dehloran, 3 m, 1 f, FMNH (Owen & Qumsiyeh 1987), Dehlorân, Khoffâsh cave (Natural Monument), April 2000: obs. a colony of ca. 2000 inds., net. 20 m, 10 f, RUBC (Hemmati 2001), Dehloran, Khofash cave, large aggregation (Sharifi et al. 2002). – K e r m â n: 40 km E Bam [29], 1 f (Etemad 1984); – Kah'nuj

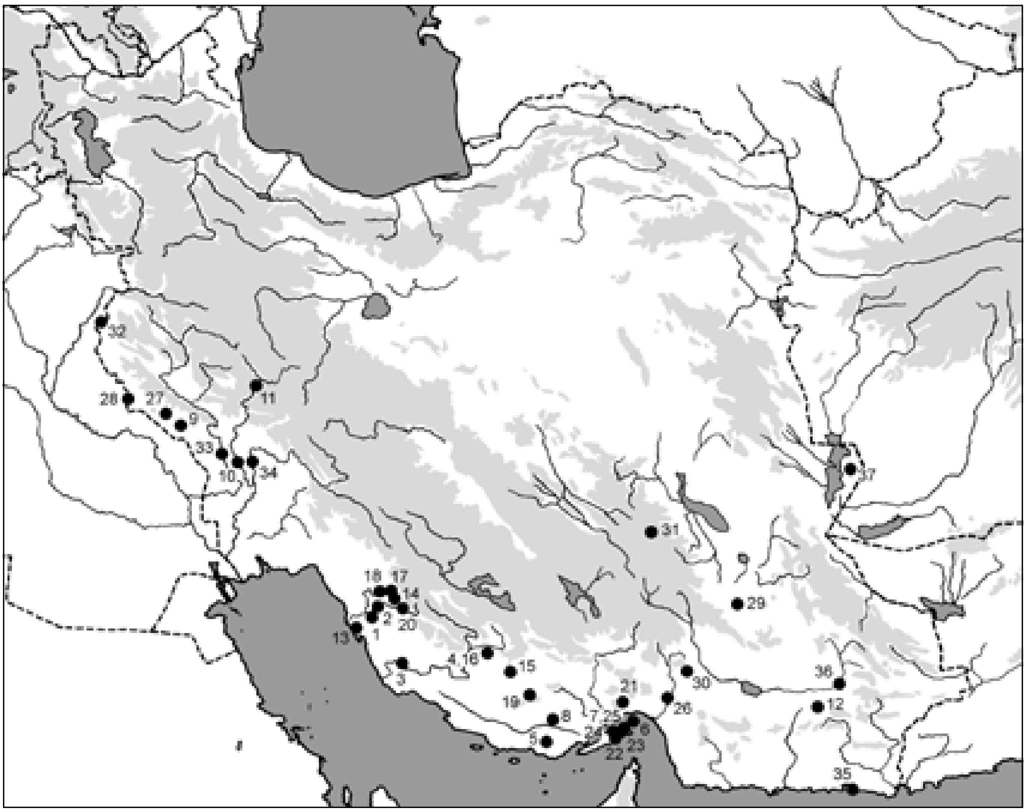

Fig. 52. Records of *Asellia tridens* (Geoffroy, 1803) in Iran.

Fig. 53. Portrait of *Asellia tridens* (Geoffroy, 1803) from Jahrom (Fars). Photo by A. Reiter.

[30], qanat, 1 m, 1 f (Etemad 1984), Kahnuge, S of Kerman, 3 March 1971: 1 m, BMNH (Benda et al. 2011d); – Kerman [31], 3 inds., NMW (Lay 1967). – K e r m â n s h â h: Qasr-e Shirin [32], channel, October 2002: obs. flying inds. (Akmali 2004). – K h u z e s t â n: Chagazniel [= Choqâzanbil] [10], Dezful, old buildings, Spring 1964: obs. extremely large groups, coll. 1 f (Etemad 1967, 1969, DeBlase 1980), Choqâzanbil ziggurat, 42 km SW Dezful, ancient ruins, Spring 1964: obs. a large colony, coll. 1 m, 1 f, 1 ind. (Etemâd 1984), Chehar-Zanbil, Dezful, SW Iran, 19 May 1964: 1 m, BMNH (Benda et al. 2011d); – Shush [33], 1 ind. (Lay 1967), Shuh or Susa [= Shush], 2 f, ROM (Owen & Qumsiyeh 1987); – 3 km. to Shushtar [34], 9–13 September 1970: 38 inds. (Farhang-Azad 1971 ex DeBlase 1980), Shushtar, tunnel under a bridge, 9 July 2002: net. 1 ind. (Akmali 2004). – S i s t â n v a B a l u c h e s t â n: Chah Bahar [35], 1966–1967: 2 m, IPHR (DeBlase 1980); – Iranshahr [36], Baluchistan (Etemad 1984), 12 March 1975: 1 ind., BMNH (Benda et al. 2011d); – Seistan [37], 1 ind., BMNH (Lay 1967, Benda et al. 2011d). – [Iran?] Mekran Coast [*38*], August 1877: 1 m, BMNH (Lay 1967, Siddiqi 1969, DeBlase 1980). – Iran (undef.): Persia (Trouessart 1904).

Distribution. *Asellia tridens* ranks among very common bats in the southern part of Iran; concerning the whole country, it also belongs to very frequent bat species – at least 37 record sites are known from the country (Fig. 52). The records come mainly from lower areas along the southwestern and southern margins of the south-Iranian mountain ranges, from the eastern edges of Mesopotamia in the Kermanshah province up to southern Baluchestan, via arid parts of the Khuzestan, Bushehr, Fars and Hormozgan provinces, including some islands in the Strait of Hormuz. However, several records are also available from the inland regions of eastern Iran, from the Kerman province (Kerman and near Bam [29, 31], both adjacent to the Dasht-e Lut desert) and from the Seistan basin (Fig. 52). Although DeBlase (1980) summarised less than a half of the number of records currently known (Table 1), his picture of distribution of *A. tridens* was almost identical with that presented here.

Generally, the range of distribution of *A. tridens* in Iran resembles well the pattern of distribution of *Rhinopoma muscatellum* (see Fig. 17). The Iranian range of distribution of *A. tridens* is a part of the belt of occurrence stretching from southern Pakistan and southern Afghanistan via southern Iran, Iraq to Syria and to southern Levant, creating the northern margin of the species distribution range in Asia (Kock 1969, Horáček et al. 2000, Benda et al. 2011d); it also continues from Iran in the south to the Gulf States and Oman over the Strait of Hormuz (Harrison & Bates 1991).

The presence of *A. tridens* was confirmed more times in one Iranian site, Choqazanbil at Shush (Khuzestan), suggesting continual occurrence there over a long period (1964, 1996, 1998, 2011).

Field notes. *Asellia tridens* was most frequently found in its roosts in Iran, both natural and artificial, only few records of foraging bats are available. The largest colony, composed of several thousand individuals, was documented in the Dehloran cave near Dehloran (Ilam; Fig. 206); DeBlase (1980) observed in this cave (under the name Sarin Ab-Garma Cave) some 5,000 individuals of *A. tridens* in September 1968, Hemmati (2001) about 2,000 bats in April 2000 and one thousand (at least) was observed there in October 2011. DeBlase (1980: 127–128) described the circumstances of his observation as follows: “I visited a large cave known as Sarin ab-Garma just north of the town of Dehloran. We arrived at this cave just after the beginning of twilight and large numbers of bats were flying. A sample of 23 bats, collected with a hand net at a constriction in the passageway, included 14 *Miniopterus schreibersi* [= *M. pallidus*], seven *A. tridens*, and two

Fig. 54. Area of the Elamite Royal Palace in the Choqazanbil monument (Khuzestan); access to the entrance of a roost of *Asellia tridens* colony (see Fig. 55). Photo by A. Reiter.

Fig. 55. A group of *Asellia tridens* (Geoffroy, 1803) roosting in an ancient tomb of the Elamite Royal Palace, Choqazanbil (Khuzestan). Photo by A. Reiter.

Rhinopoma microphyllum. While this sample was being taken, I examined the deeper regions of the cave and observed about 5,000 *A. tridens* […]. The main passage of this cave was estimated at over 100 ft. [= 30.5 m] in height. The walls converged gradually and met at the apex, so that no true ceiling was present. Starting about 2.5 m. up, the walls were covered with spots of crystallized urine and feces. Each spot measured about 15 cm. in diameter and was spaced about 15 cm. from the spots surrounding it. A single *Asellia* hung on each spot. The temperature 2 m. from the floor was 85°F [= 29.4 °C] and the relative humidity was 80 per cent. […] On 20 June 1973 Lay visited this cave and collected 10 *A. tridens*. This sample includes seven females and three immature males, one of which was found clinging to its mother. On this visit most of the crystallized urine spots were occupied by a species of *Rhinopoma* rather than by *Asellia* […].” For the description of the cave by DeBlase (1980) see under *Rhinopoma microphyllum*.

Another large colony of *A. tridens* was documented several times in a tomb situated in the ruins of an ancient settlement at the ziggurat of Choqazanbil near Shush (Khuzestan; see Fig. 68); in this badly accessible tomb in a deep pit in the excavation area of Elamite Royal Palace, with ca. 1.5 m high door opening and with the base ca. 15×5 m and three metres of height in the vault (Figs. 54, 55), the colony of 250–3000 bats was observed several times. The variable bat numbers in the colony could be explained by varying intensity of human pressure in particular periods of the year (the strong smell of the colony could be considered as inappropriate within the monument by the locals; the roost is visited by people at least to collect the guano, since no large piles of droppings were found on the bottom) as well as by seasonal movements (migration) known in *A. tridens* and described even from Mesopotamia already by Al Robaae (1966). The latter explanation suggests an existence of alternative roost/s of the colony used in certain seasons of a year by larger or lesser numbers of bats of the Choqazanbil population. This assumption is also supported by the record made by Etemad (1967) of the “extremely large groups” of *A. tridens* in old buildings of Chagazniel (= Choqazanbil) in the spring 1964 (cf. DeBlase 1980).

Etemad (1967, 1984) reported a large colony containing several hundred bats, observed in a well at Rudan (Hormozgan) in March 1966 (cf. DeBlase 1980). A smaller colony of *A. tridens*, composed of some 20 bats, was found in an underground system of artificial corridors of Sang Eshkan at Jahrom mixed with colonies of several other bat species on 8 October 2011 (for the description see under *Rousettus aegyptiacus*; Figs. 60, 61); from this site *A. tridens* was reported already by Akmali et al. (2011a), however, they did not specify period of the record nor the number of recorded bats.

A small colony of eight *A. tridens* was discovered in a dark ground-floor room of a large abandoned and partly ruined palace in Shanbeh (Bushehr) on 14 October 2011 (Fig. 56). Groups of several bats were observed in various parts of a year in the Maral caves at Qal'eh Sefid (Bushehr), in the Bisheh Deraz cave near Dehloran (Ilam), and in a qanat at Fereshteh Jan near Jahrom (Fars) (Farâsat 2003, Akmali 2004). Solitary individuals of *A. tridens* were reported to roost in a house in Mehran (Ilam) on 5 September 1968 and in a qanat in Kah'nuj (Kerman) on 3 March 1971 (DeBlase 1980, Etemad 1984). Akmali (2004) and Akmali et al. (2011a) reported findings of *A. tridens* in roosts in the Fars province, however, without any details on the recorded number of bats; viz. a man-made underground space of Sang Eshkan at Jahrom, a cave at Khesht near Kâzerun and a cellar in the centre of Lar.

In several roosts, the occurrence of *A. tridens* was documented by findings of carcasses; some of them could also give an evidence of a former presence of colonies. Besides the record from the Daneshyu salt cave on the Hormos island, two such findings were reported by Lay (1967: 139); these records were the only of *A. tridens* reported by this author: "We did not find this species alive. The guano and mummies abundant in late December [31 December 1962] provide an indication that these bats occupy seldom used or abandoned buildings. At Jahrom they were said to be a nuisance in many houses and the people try to eliminate the colonies by burning the bats. Jahrom residents stated that the bats return every summer, which suggests that these mammals either migrate and/or hibernate. […] Nearly 100 mummies lay in an abandoned mud house at Rabatak, some 50 of which were brought to camp, many in nearly perfect condition […]." (p. 61):

Fig. 56. Palace ruin in Shanbeh (Bushehr), a roost of a small colony of *Asellia tridens*. Photo by A. Reiter.

“The mummified remains of 50 to 100 *Asellia tridens* lay in a pile on the floor of an abandoned mud house located south of the [Famur] lake [at Rabatak].”

From most of the sites, *A. tridens* was reported as the only bat species; however, it shared some roosts with other bat species. In the Sang Eshkan roost, *A. tridens* was documented together with *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. muscatellum*, *Triaenops persicus* and *Taphozous perforatus*. In the Maral caves at Qal’eh Sefid, the additional species were *Myotis emarginatus*, *Rhinopoma microphyllum* and *R. muscatellum*. The latter two species of *Rhinopoma* were found along with *A. tridens* also in the Bisheh Deraz cave at Dehbarez; in the large Dehbarez cave located nearby, a rich bat community was found, composed of these three species complemented by *Rhinopoma hardwickii* and *Miniopterus pallidus*. In the cave at Khesht near Kazerun and in the Kharbas cave on the Qeshm island, *A. tridens* shared the roost with *Rhinopoma muscatellum*.

The foraging individuals of *A. tridens* were recorded in several sites by netting and bat detectors. On the Qeshm island, an individual was netted above the Chira water pool, four bats at the entrance of the Kharbas cave and another individual at a lodge in Turgan (Zohoori 2002a); two bats were netted at the ventilator of a lodge on the Naz island (Zohoori 2002a). Akmali (2004) reported on netting of an individual at a tunnel under bridge near Shushtar.

Echolocation calls of foraging individuals of *A. tridens* were detected in few sites only; in the river valley near Chah Mosallam (Hormozgan; along with the calls of *Otonycteris hemprichii* and *Tadarida teniotis*) on 12 October 2011 (Fig. 213), in the river valley near Lenje Abad (Lorestan; along with calls of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis*, and netting of one individual of *P. pipistrellus*; Fig. 40) on 1 October 2011, and in a palm oasis at Zangard (Hormozgan; along with calls of *Rhyneptesicus nasutus* and *Pipistrellus kuhlii*, and netting of individuals of *Rousettus aegyptiacus*; Fig. 7) on 9 October 2011. Akmali (2004) observed flying individuals of *A. tridens* at a channel in Qasr-e Shirin (Kermanshah).

No accurate data on reproduction of *A. tridens* are available from Iran; two females in lactation were collected in Borazjan (Bushehr) in June. In the adjacent Mesopotamia, pregnancy and parturitions are estimated to occur in April–June and in mid-June, respectively (see Al Robaae 1966 and Benda et al. 2006). Similar periods of reproduction can be expected also in the Iranian populations.

Remains of *A. tridens* were documented in pellet material from two owl species collected at two sites in Iran (Table 40). In *Tyto alba* pellets collected at Choqazanbil (Khuzestan), where also a large colony of this bat was repeatedly recorded (see above), the remains of *A. tridens* made up 0.62% of all prey items (and 0.64% of mammal items) in the respective sample and 0.09% of all prey items (0.12% of mammal items) in the whole analysed barn owl diet from Iran (Obuch & Khaleghizadeh 2011). A mandible of *A. tridens* was detected in *Athene brama* pellets collected in an oasis near Espakeh (Baluchestan), making up 0.43% of all prey items (and 2.08% of mammal items) in the respective sample, but 0.07% of all prey items (0.82% of mammal items) in the whole analysed diet of the spotted owlet from Iran. Besides Iran, *A. tridens* was found to represent owl prey in Iraq, Syria, Jordan, Egypt, and Morocco (Nader 1969, Goodman 1980, Benda et al. 2004d, 2006, 2010).

Material examined. 2 ♀♀ (MHNG 1905.4A, 1905.4B [A]), Bouchir, Brazjan [Bushehr Prov.], June 1968, leg. A. Arata; – 1 ♂ (BMNH 77.824 [S+B]), Chehar-Zanbil, Dezful, SW Iran [Khuzestan Prov.], 19 May 1964, leg. R. Szbokar; – 8 inds. (JOC unnumbered [S+Sk]), Choqazanbil (Khuzestan Prov.), 5 May 1996, leg. J. Obuch; – 5 ♂♂, 10 ♀♀ (NMP 48173–48177, 48180–48187 [S+A], NMP 48178, 48179 [A]), Choqazanbil (Khuzestan Prov.), 15 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 93901 [S+A]), Choqazanbil (Khuzestan Prov.), 16 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 3 inds. (NMP 48202–48204 [S+Sk]), Daneshyu salt cave, Hormoz island (Hormozgan Prov.), 25 January 1999, leg. J. Bruthans; – 2 ♂♂ (NMP 93909, 93910 [S+A]), Dehloran cave (Ilam Prov.), 17 October 2011, leg. M. Andreas, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ind. (JOC unnumbered [Sf]), Espakeh (Sistan va Baluchestan Prov.), 10 April 2000, leg. J. Obuch; – 1 ind. (BMNH 77.827 [S+B]), Iranshahr, Baluchistan [Sistan va Baluchestan Prov.], 12 March 1975, collector unlisted, ded. E. Etemad; –1 ♂, 1 ♀ (NMP 93894, 93895 [S+A]), Jahrom (Fars Prov.), 8 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♂ (BMNH 77.826 [S+B]), Kahnuge, S of Kerman [Kerman Prov.], 3 March 1971, collector unlisted, ded. E. Etemad; – 3 inds. (NMW 8894–8896 [S]), Kerman [Kerman Prov.], September 1892, leg. Bornmüller; – 1 ♂, 1 ind. (HMNH 2007.3.4. [S+Sk], HMNH 2007.3.3. [A]), Qeshm island [Hormozgan Prov.], winter 2002, leg. H. Zohoori; – 1 ♀ (BMNH 77.825 [S+B]), Rudan Minab, SW of Iranshahr, South coast of Iran [Hormozgan Prov.], 10 March 1966, leg. E. Etemad; – 1 ind. (BMNH 6.1.2.1 [S]), Seistan [Sistan va Baluchestan Prov.], date and collector unlisted; – 1 ♀ (NMP 93900 [S+A]), Shanbeh (Bushehr Prov.), 14 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Asellia tridens* are shown in Table 10. For the material examined see above.

The opinions concerning taxonomy of *A. tridens* are rather variable throughout history, two to five subspecies were recognised within the species rank (Ellerman & Morrison-Scott 1951, Harrison 1957, 1964, Kock 1969, Gaisler et al. 1972, Corbet 1978, Nader & Kock 1983a, Owen & Qumsiyeh 1987, Koopman 1994, Horáček et al. 2000, etc.). However, the Iranian populations of this bat were traditionally assigned to the larger subspecies *A. t. murraiana* (Anderson, 1881), differing in size from the smaller nominotypical form in the two-subspecies concept (Harrison 1957, 1964, Kock 1969, DeBlase 1980, Owen & Qumsiyeh 1987, Benda et al. 2006).

Benda et al. (2011d) revised the whole content of the genus *Asellia* Gray, 1838 with the help of morphometric and molecular genetic analyses. They identified four species within the genus (including one newly described), three of them living in the southern part of the African-Arabian transition, *A. patrizii* De Beaux, 1931, *A. italosomalica* De Beaux, 1831, and *A. arabica* Benda, Reiter et Vallo, 2011, and one in a wide range of desert regions from West Africa to Pakistan, *A. tridens*. Within *A. tridens*, Benda et al. (2011d) found four lineages, geographically well separated; (1) north- and east-African (incl. the Maghrebian), (2) West African, (3) north-Middle Eastern,

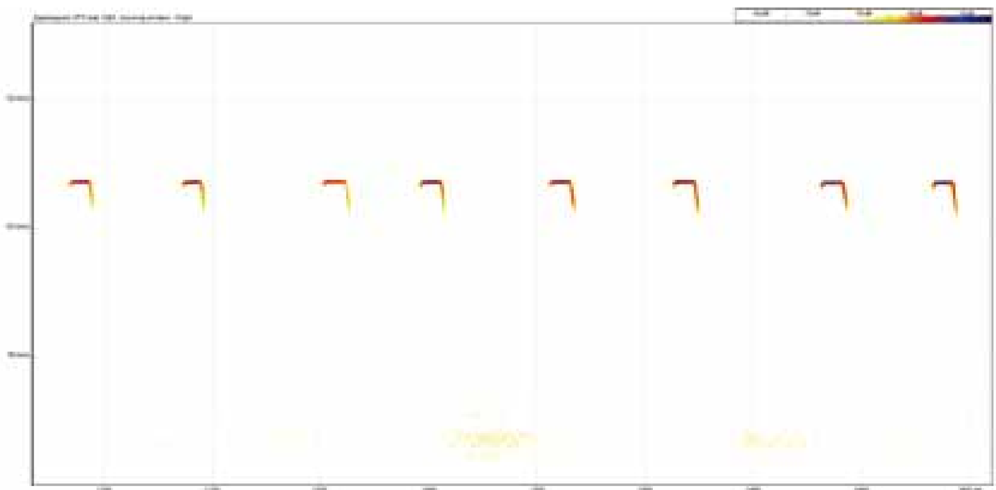

Fig. 57. Spectrogram of echolocation calls of *Asellia tridens* (Geoffroy, 1813); an individual foraging in the river valley near Chah Mosallam (Hormozgan).

and (4) west-Omani (Shisr oasis). No significant metric or morphological differences were found among these four lineages (they contained both larger and smaller morphotypes formerly assigned to two main subspecies, *murraiana* and *tridens*, cf. Owen & Qumsiyeh 1987), they only diverged in genetic distances. The divergences among these geographically limited groups of haplotypes were rather low, 2.1–3.4% of K2p distance, and the largest divergence was found between the African (1, 2) and Middle Eastern (3, 4) pairs of lineages, supporting their taxonomic separation. Therefore, Benda et al. (2011d) suggested to consider these two large geographical groups of populations of *A. tridens* as two subspecies, *A. t. tridens* in Africa (type locality: Theben, Ägypten; Kock 1969: 122) and *A. t. murraiana* in Asia (type locality: Karáchí [= Karachi, Sind, Pakistan] and Bushire, Persian Gulf [= Bushehr, Iran]; Anderson 1881: 113). Thus, the traditional opinion on taxonomic status of the Iranian populations of *A. tridens* has been confirmed by this revision.

Echolocation. *Asellia tridens* produces long constant-frequency calls with the maximum energy between 117–124 kHz (Pye 1972, Dietz et al. 2007). We recorded echolocation calls of this species from four sites in Iran. From three sites, the calls were recorded under natural conditions – from foraging bats and from bats flying in their roosts (Lenje Abad, Chah Mosallam, Choqazanbil) and in one ocase the calls were recorded from handled bats (caught from the colony in Shanbeh). Basic echolocation parameters of *A. tridens* from Iran are given in Table 3. The range of frequencies of maximum energy obtained from field conditions (117–118 kHz, Fig. 57) was lower than the range of calls produced by handled animals (121–122 kHz). Similar slight difference in the frequencies of maximum energy between flying and handled bats were reported also from the Levantine and Sinaitic populations of *A. tridens* – 113–119 kHz and 120–122 kHz, respectively (Benda et al. 2006, 2008). Such observation suggests that the variation in the call frequencies could reflect difference in foraging conditions and in habitat structure. Gustafson & Schnitzler (1979) reported the resting frequency of *A. tridens* between 111–124 kHz, which concurs with our observations. The range of frequency of maximum energy, 108–122 kHz (Jones et al. 1993), recorded in the western part of the distribution range of *A. tridens* (Gambia), was similar to the values observed in the Middle East.

Feeding ecology. *Asellia tridens* is a medium-sized bat with a well manoeuvrable flight (Norberg & Rayner 1987, Amichai et al. in press). The diet composition of this bat was analysed in Israeli and Syrian populations; the main prey item was Coleoptera, but Hymenoptera, Lepidoptera, Heteroptera, Orthoptera, and Diptera also represented important parts of the diet (Whitaker et al. 1994, Mendelssohn & Yom-Tov 1999, Feldman et al. 2000, Whitaker & Yom-Tov 2002, Benda et al. 2006).

From Iran, we collected two sets of fresh faeces from under the roost of *A. tridens* at Choqazanbil (Khuzestan) on two occasions, in mid-October 1998 and in mid-October 2011 (Fig. 58). The composition of the set of faeces collected on the first occasion was dominated by Coleoptera – mostly by Scarabaeidae, but also Cerambycidae and Curculionidae were present. However, the set collected on the second occasion was dominated by Blattodea, despite the fact it was collected in the same period of the year. The most frequent representatives of Heteroptera in the diet samples collected on both occasions were bugs of the family Tingidae.

The majority of Coleoptera in the set of faeces of *A. tridens* collected at Choqazanbil in 1998 corresponds well with the results of the published diet studies (see above) as well as the diet analyses from Oman (own unpubl. results). We observed *A. tridens* to forage on beetles in a hovering flight above cowpats near Choqazanbil several times in the evening on 15 October 1998. The sample set from 2011 showed that the species may focus – at least temporally – on some other prey items, which were not found to be important by previous studies.

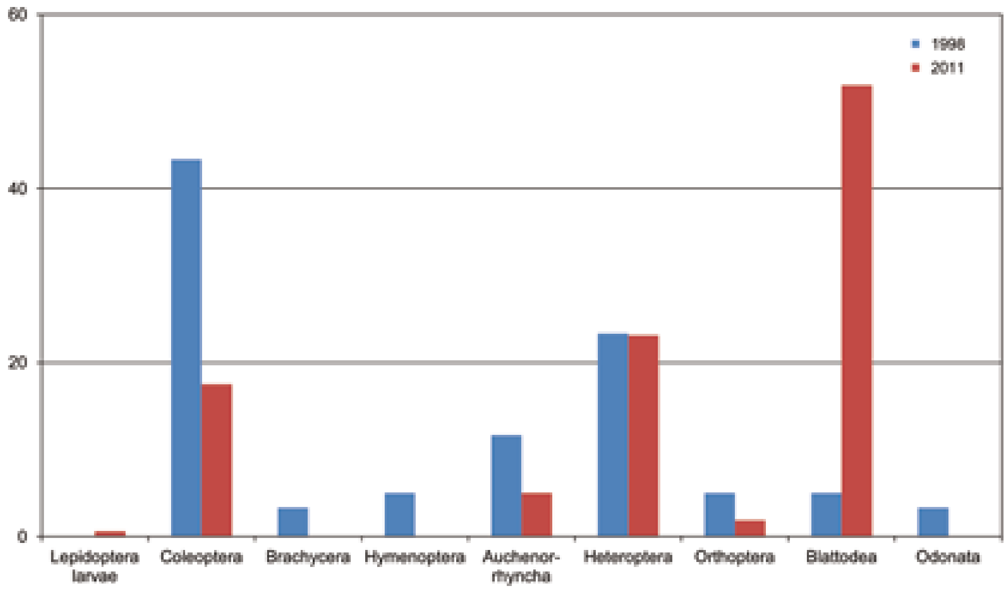

Fig. 58. Percentage volume of particular food items in the diet of *Asellia tridens* (Geoffroy, 1813) in Choqazanbil, Khuzestan, Iran. Thirty faecal pellets collected under a colony roost on 15 October 1998 and thirty pellets collected on 16 October 2011 were analysed.

Records of ectoparasites. **Published data**: I s c h n o p s y l l i d a e: *Chiropteropsylla brockmani*: 2 ma, 4 fa from 12 inds., Rudan (Minab) [Hormozgan Prov.], March 1966 (Farhang-Azad 1969b). – S t r e b l i d a e: *Raymondia huberi*: 1 ma from unknown number of inds., Isin, southern foot of Kuhhaye Genu Mts. [Hormozgan Prov.], 26 May 1973 (Hůrka 1984a). – T r o m b i c u l i d a e: *Neoschoengastia elegans*: 1 ind., Kazerun [Fars Prov.], 30 October 1966 (Vercammen--Grandjean et al. 1970, Kudrâšova 1998).

Comments on ectoparasites. Only one record of the streblid bat fly from *Asellia tridens* is available from Iran, *Raymondia huberi* Frauenfeld, 1855 (Hůrka 1984a). This species is parasitic on *A. tridens* in the Middle East and on *A. tridens*, *Triaenops persicus*, and *Cardioderma cor* in East Africa (Theodor 1968).

Other dipteran parasites of *A. tridens* were recorded in other parts of the Middle East, namely in the Levant, viz. *Nycteribia schmidlii* Schiner, 1853, *Penicillidia dufourii* Westwood, 1834, *Brachytarsina flavipennis* Macquart, 1851, and *Raymondia huberi* Frauenfeld, 1855 (Jobling 1934, Theodor 1954, Theodor & Moscona 1954).

Farhang-Azad (1969b) found the bat flea *Chiropteropsylla brockmani* Rothschild, 1915 on *A. tridens* in Iran. This parasite species was found on this host also in neighbouring Iraq and Afghanistan (Hubbard 1956, Smit 1960, Lewis 1973). From Iraq, Hopkins & Rothschild (1956) reported another flea parasitic on this bat, *Rhinolophopsylla unipectinata* (Taschenberg, 1880). This parasite could be expected also in *A. tridens* populations of Iran.

Only one chigger mite was documented from *A. tridens* in Iran, *Neoschoengastia elegans* (Vercammen-Grandjean, Rohde et Mesghali, 1970). This species remains known only from the type locality in Iran (see above). However, records of several other species of trombiculid mites parasitic on this host are available from neighbouring Afghanistan (Vercammen-Grandjean

1963), viz. *Myotrombicula aselliae* Vercammen-Grandjean, 1963, *Riedlinia platypygia* Vercammen-Grandjean, 1963, *R. afghanensis* Vercammen-Grandjean, 1963. All these species could be potential parasites of *A. tridens* also in Iran.

Two mites of the Myobiidae family were found in different populations of *A. tridens*; *Ugandobia euthrix* Fain, 1972 was documented in Saudi Arabia (Fain 1972) and *Hipposiderobia heteronycha* (Berlese et Trouessart, 1889) in Saudi Arabia and various parts of Africa (Radford 1949, Fain 1972, 1978). Also one species of the argasid soft tick was recorded from *A. tridens* in several African countries, *Argas boueti* Roubaud et Colas-Belcour, 1933 (Roubaud & Colas-Belcour 1933, Hoogstraal 1955). Some of these mites could be expected also in the Iranian populations of the host.

Triaenops persicus Dobson, 1871

Records. **Published data**: B u s h e h r: Ahram [1], 6, 8, 9, and 11 January 1963: 9 m, 6 f, 1 ind., FMNH (Lay 1967, DeBlase 1980); – Bushire [= Bushehr] [2], 1 ind., BMNH (Harrison 1955). – F â r s: Jahrom [3], Sang Eshkan, man-made cave (Akmali et al. 2011a); – near Shiraz [4], 4,750 feet, "just outside the walls of Shiraz", May 1870: shot 6 specimens

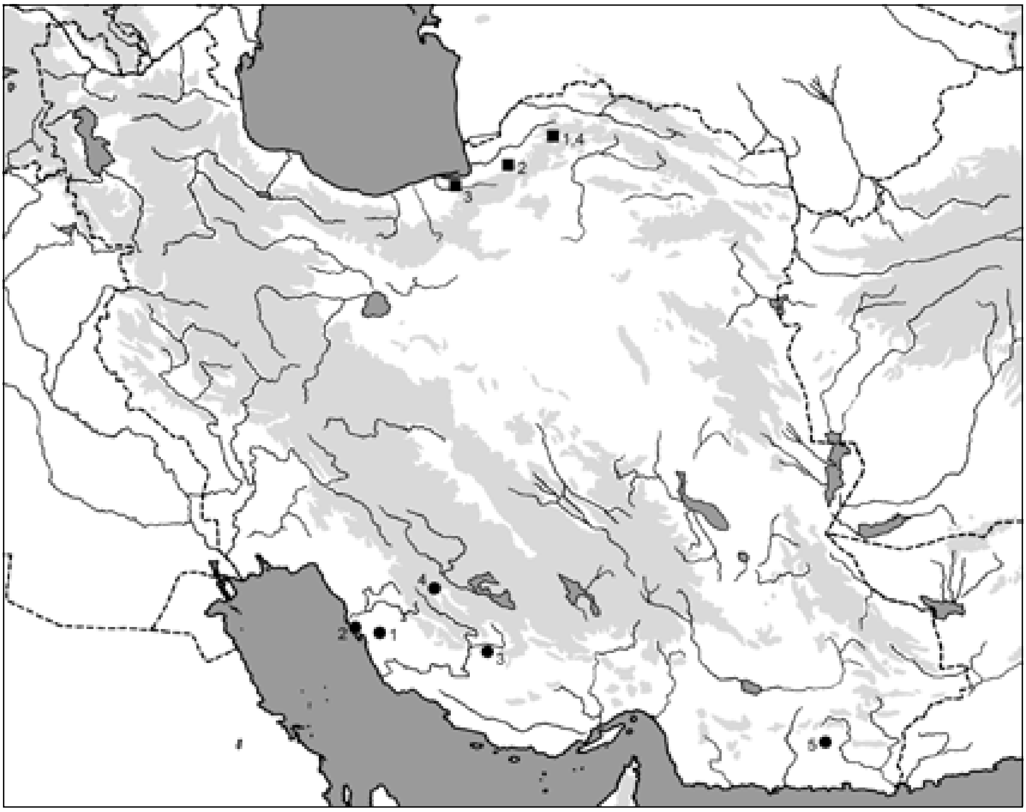

Fig. 59. Records of *Trianeops persicus* Dobson, 1871 (circles) and *Myotis bechsteinii* (Kuhl, 1817) (squares) in Iran.

(Dobson 1871, Blanford 1876), Shiraz, Persia, 1870: 1 m, 3 f, IMC (Dobson 1876), Shiraz, Persia, 1 fa, BMNH (Dobson 1878), Shiraz, 1870: 1 ma, 2 fa, IMC (Anderson 1881), Perse, Shiraz (Trouessart 1879), Persia, Shiraz (Trouessart 1897, 1904), Shiraz, 1 m, 1 f, ZMB (Turni & Kock 2008, Benda & Vallo 2009). – S i s t â n v a B a l u c h e s t â n: Nik Shahr [5], 9 and 10 January 1963: 2 m, 5 f, USNM (DeBlase 1980).

Distribution. *Triaenops persicus* is a rare bat species in Iran, only five records are known from the southern part of the country (Fig. 59). The current review exceeds the number summarised by DeBlase (1980) by one record only, both pictures give very similar patterns. The species is known from two regions in Iran, ca. 700 km distant from each other, four sites are known from a restricted area of the Bushehr and Fars provinces on the south-western edge of the country, while one record is known from Nikshahr in southern Baluchestan (Fig. 59).

T. persicus is an inhabitant of dry savannah habitats, endemic for the Middle East. The occurrence of this bat in the Shiraz area (Fars) represents the northernmost margin of the species (as well as the genus) distribution range (Horáček et al. 2000, Simmons 2005). According to the taxonomic revision by Benda & Vallo (2009), the distribution range of *T. persicus* s.str. is relatively small, comprising a belt of coastal areas stretching from western Yemen, via Oman and UAE, to Iran and southern Pakistan. The other regions formerly considered a part of *T. persicus* range (Africa, Madagascar) were found to be inhabited by another species of the genus (see Morphology and variation).

Field notes. Individuals of *Triaenops persicus* were recorded in Iran in their foraging grounds and once also in a roost. The first record of this species, a collection of the type series composed of six specimens, was mentioned by Blanford (1876: 19) as follows: "the specimens […] were shot the same evening, in May, just outside the walls of Shiráz […] at an elevation of 4750 feet [= 1447.8 m] above the sea." At the same site and occasion, also *Myotis blythii* and *Pipistrellus kuhlii* were collected along with *T. persicus* (Dobson 1871).

Lay (1967: 139–140) reported on netting of 16 individuals at Ahram (Bushehr) in January 1963: "These bats emerged at dusk and were observed flying over the country around Ahram, desert and garden. Much darting and turning characterized their rapid flight, but specimens were noticeably wary of mist nets and when caught seldom remained entangled longer than 30 seconds. These bats may possibly roost in the cavities of the clay foothills […], in cracks in the loose bark of date palms, or in the narrow spaces between the bases of the palm's leaves. None of the females examined January 6–11 was pregnant." Lay (1967: 52–53) described the site of this netting as follows: "Jagged mountains rose almost vertically, delineating the relatively narrow coastal plain from the plateau. Clay surfaced the lower parts of these heights with thick crust overlying a powdery subsurface. Thousands of small holes, some large enough for a man to crawl into, pocket these clay facings. Each evening at dusk many *Triaenops persicus* began their crepuscular and nocturnal flights near these pocked inclines. Some of these holes, though none explored by us, probably served as roosts for these bats. At higher elevations shale and boulder surfaced these mountains. Plant life appeared almost entirely absent in these desiccated places."

The only known roost of *T. persicus* in Iran was recorded by Akmali et al. (2011a) in the man-made cave of Sang Eshkan at the southern margin of Jahrom (Fars); they did not mention the date of observation nor the number and condition of the observed bats, however, they also found *Rousettus aegyptiacus*, *Rhinopoma muscatellum*, and *Asellia tridens* there (for the description of the roost see under *R. aegyptiacus*; Figs. 60, 61).

No data on reproduction of *T. persicus* are available from Iran, and this species has not been recorded in the osteological material from owl pellets collected in the country (Table 40).

Material examined. 1 ♂, 2 ♀♀ (BMNH 76.3.10.3 [S], ZMB 4370/1, 2 [S+A], syntypes of *Triaenops persicus* Dobson, 1871), Shiraz, Persia [Fars Prov.], date unlisted, leg. O. St. John.

Figs. 60, 61. Artificial caves of Sang Eshkan at Jahrom (Fars), a roost of *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. muscatellum*, *Asellia tridens*, *Triaenops persicus*, and *Taphozous perforatus.* Photos by M. Uhrin and M. Andreas.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Triaenops persicus* are shown in Table 10. For the material examined see above.

Because *T. persicus* was described from the territory of Iran (type locality: near Shiraz, Persia [Fars, Iran]; Dobson 1871: 459), there never were doubts about the taxonomic affiliation of the Iranian populations, all authors naturally assigned them to the nominotypical form (Dorst 1848, Harrison 1955, 1964, DeBlase 1980, Hill 1982, Harrison & Bates 1991, Koopman 1994, Horáček et al. 2000, etc.). *T. persicus* has been for a long time considered a polytypic species, represented by two to four subspecies (see the review by Benda & Vallo 2009: 6, Table 1).

Benda & Vallo (2009) revised taxonomy of the genus *Triaenops* Dobson, 1871 with the help of morphometric and molecular genetic approaches. They identified seven species within the genus in its broader sense, from which they separated three Madagascan forms into a newly created genus *Paratriaenops* Benda et Vallo, 2009 – *P. furculus* (Trouessart, 1906), *P. auritus* (Grandidier, 1912), and *P. pauliani* (Goodman et Ranivo, 2008). Within the genus *Triaenops* s.str., they found four species (including one newly described), the African *T. afer* Peters, 1877, Madagascan *T. menamena* Goodman et Ranivo, 2008, and two species living in sympatry in the Middle East, *T. parvus* Benda et Vallo, 2009 from southern Arabia and *T. persicus* from the south-eastern Middle East (W Yemen to S Pakistan), including Iran. According to the morphometric comparison by Benda & Vallo (2009), *T. persicus* is a monotypic species.

Echolocation. Concerning the echolocation characteristics, no data on *Triaenops persicus* s.str. were published. The echolocation calls recorded in Oman showed the maximum energy frequencies between 76.5–82.6 kHz (own unpubl. data). Echolocation of the Iranian populations of *T. persicus* has not yet been studied.

Feeding ecology. No published information on the diet of *Triaenops persicus* s.str. is available. The diet of the individuals collected in Oman consisted mostly of Lepidoptera (own unpubl. results). The diet of *T. persicus* in Iran has not yet been studied.

Taphozous perforatus Geoffroy, 1818

Records. **Original data**: F â r s: Jahrom [1], Sang Eshkan, artificial caves, 8 October 2011: obs. a colony of ca. 40 inds., net. 3 ma, 8 ms, 4 fa, 20 fs, coll. 2 fa (NMP 93892, 93893). – H o r m o z g â n: Hormoz island, Hormoz [2], Portuguese fortress, prison room, 18 April 2000: obs. a colony of ca. 10 inds., coll. 1 fa (NMP 48447); – Pâsorkhi gorge [3], 4 km E of Dehbârez, rocky overhang, 11 October 2011: obs. a small colony (composed of some 5–7 inds., exam. 1 fj). – **Published data**: H o r m o z g â n: Chah Moslem [4], about 57 km. north of Bandar-e-Lengeh, 22 November 1968: shot 1 m, FMNH (DeBlase 1971a); – Minab [5], 29 November 1968: shot 1 m, FMNH (DeBlase 1971a); – Qeshm Island, Irânzamin cave [6], 7 August 2001: obs. several inds. (Zohoori 2002b); – Qeshm Island, Ramchâh cave [7], 7 August 2001: net. [2 fa, HMNH], 29 April 2002: net. 2 inds. (Zohoori 2002b).

Distribution. *Taphozous perforatus* is a rare bat species in Iran, only seven localities are available from a limited area of the southern part of the country (Fig. 62). Although DeBlase (1980) mentioned only two records of this bat from Iran (Table 1), they well demarcated the currently known range on the shore of the Strait of Hormuz, including two islands of the Strait, in the central and western Hormozgan province. The only more distant offshoot from this area (215 km to the northwest) is the record of a small colony in Jahrom (Fars; Fig. 62). The latter site is also exceptional by its relatively high altitude of more than 1100 m a. s. l., all other records were documented from arid lowlands below 300 m a. s. l. The Jahrom record also represents one of the northernmost record sites of *T. perforatus* in the Asian part of the species range, besides the records from the Rift Valley in the Levant (Harrison & Bates 1991, Bates & Harrison 1997). Only a slightly more northwards situated locality of *T. perforatus* has been recently documented by Mahmood-ul-Hassan et al. (2012) in the Indus valley of Punjab, Pakistan.

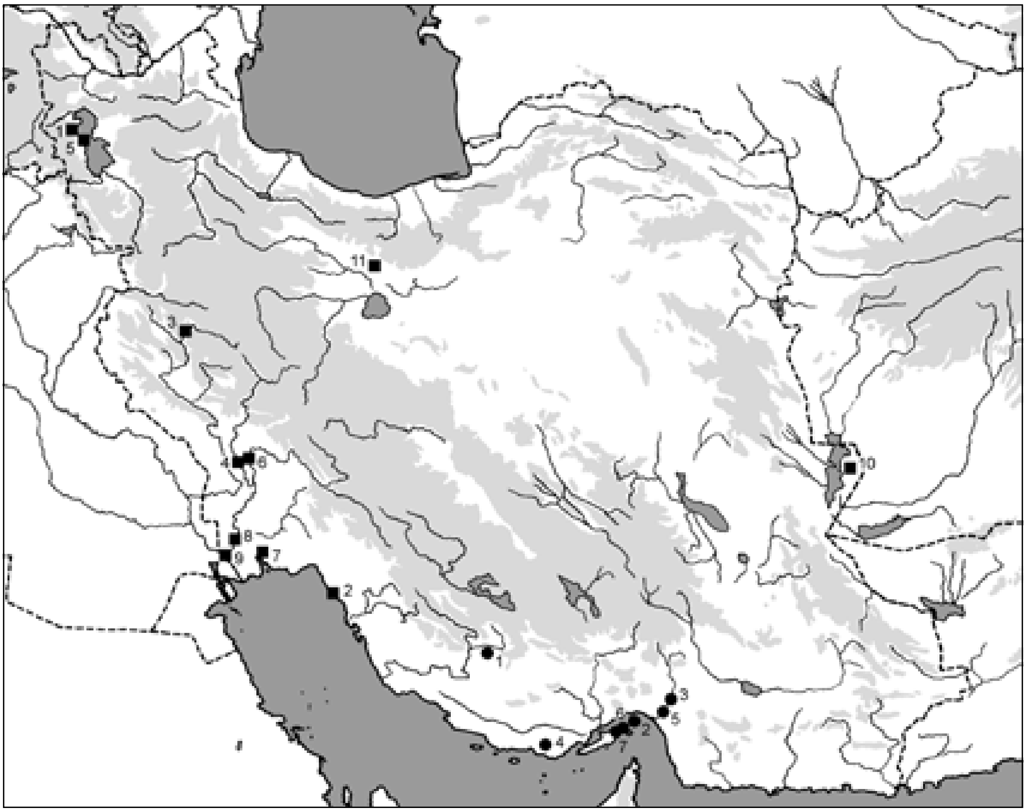

Fig. 62. Records of *Taphozous perforatus* Geoffroy, 1818 (circles) and *T. nudiventris* Cretzschmar, 1830 (squares) in Iran.

T. perforatus is a bat with wide distribution covering steppes and deserts of south-eastern and western Africa over Egypt and the Middle East to central India (Bates & Harrison 1997, Horáček et al. 2000). Thus, its Iranian range has a continuation in the east to the areas adjacent to the Thar desert of western India and the Indus valley of Pakistan (Bates & Harrison 1997, Mahmood-ul-Hassan et al. 2012). However, this range seems to be rather isolated from the Iranian range, the gap between the known Iranian and Pakistani occurrence spots comprises at least 1000 km. Nevertheless, this gap could also be caused by a lack of distribution records in the respective areas of Baluchestan in both countries. The Iranian range of *T. perforatus* continues more closely in the south, over the Strait of Hormuz to south-eastern Arabia (Oman, UAE; Harrison & Bates 1991).

Field notes. *Taphozous perforatus* was recorded in Iran mainly in its roosts. Exceptions include foraging individuals collected by DeBlase (1971a) in the Hormozgan province. DeBlase (1980: 67) described these findings as follows: "The first Iranian specimen was shot on 22 November 1968 as it flew high over the flat agricultural lands near Chah Moslem, and the second was shot on 29 November as it flew over the Minab River at the edge of the town of Minab." Concerning the former record, DeBlase (1980: 335) added: "Numerous bats could be seen and heard flying over the barren fields around [our] camp each evening. Shooting yielded one *Taphozous perforatus*, seven *Pipistrellus kuhlii* and two *Tadarida* [= *Nyctinomus*] *aegyptiaca*."; and he mentioned on the latter one (p. 336): "we shot bats over the Dozdan [sic!] River at the northwest edge of Minab. We collected each one of *Taphozous perforatus*, [*Rhyn*]*Eptesicus nasutus*, and *Tadarida teniotis*."

A relatively large colony of some 40 individuals of *T. perforatus* was discovered on 8 October 2011 in a chamber of the artificial underground system of Sang Eshkan at Jahrom (Figs. 60, 61), where five other bat species were found to occur (see under *Rousettus aegyptiacus*). A smaller colony was observed in the former prison room of the Portuguese fortress in the town of Hormoz on the Hormoz island on 18 April 2000; approximately ten bats hung from the ceiling and wall above the door in the small dark room without windows at the height of ca. 2.5 m, with only traces of day light. Zohoori (2002b) reported on small colonies of *T. perforatus* roosting in two caves on the Qeshm island. In one of these caves, the Iranzamin cave, a group of *Rhinopoma muscatellum* was found to share the roost with *T. perforatus* on 7 August 2001. A rather unusual roost of this species was discovered in the Pasorkhi gorge at Dehbarez (Hormozgan; Fig. 64) on 11 October 2011, where a small colony of less than ten bats occupied shadowed walls of rocky overhang in a small and very narrow canyon, ca. 1–3 m wide and 2–4 m deep. Feeding traces of *Rousettus aegyptiacus* were also found at this site.

No direct data concerning the reproduction of *T. perforatus* was observed in Iranian populations. The adult female collected in the Hormoz island in April did not show any direct signs of reproduction (pregnancy, lactation) and neither did the adult females from Jahrom examined in

Fig. 63. Portrait of *Taphozous perforatus* Geoffroy, 1818 from Jahrom (Fars). Photo by A. Reiter.

Fig. 64. Pasorkhi gorge near Dehbarez (Hormozgan), a roost site of *Rousettus aegyptiacus* and *Taphozous perforatus*. Photo by M. Andreas.

October. The juvenile female from the Pasorkhi gorge examined in October was able to fly probably for only a short period (some weeks) since the cartilaginous parts of the wing metacarpals and phalangi were still apparent, suggesting the age of this individual to be 2–3 months. On the other hand, the data from other parts of the Middle East and from India suggest parturition terms in this species in May (Harrison & Bates 1991, Bates & Harrison 1997).

T. perforatus has not been recorded in the osteological material from owl pellets collected in Iran (Table 40).

Material examined. 1 ♀ (NMP 48447 [S+A]), Hormoz, Hormoz island (Hormozgan Prov.), 18 April 2000, leg. P. Benda & A. Reiter; – 2 ♂♂ (NMP 93892, 93893 [S+A]), Jahrom (Fars Prov.), 8 October 2011, leg. M. Andreas, S. Ashrafi,

P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 2 ♀♀ (HMNH 2007.3.1., 2007.3.2. [S+A]), Qeshm island, Ramchah cave [Hormozgan Prov.], 7 August 2001, leg. H. Zohoori.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Taphozous perforatus* are shown in Table 2. For the material examined see above.

T. perforatus is a polytypic species, from three to six subspecies are recognised throughout its distribution range (Kock 1969, Koopman 1994, Simmons 2005). The particular forms are reported to differ rather slightly in pelage and wing membrane colouration, while in body size only insignificant variation was documented (see Kock 1969 for a review). One or two subspecies are considered to occur in the Asian part of the species range, both described from the African continent (Thomas 1915, Ellerman & Morrison-Scott 1951, Harrison & Bates 1991, Koopman 1994, Bates & Harrison 1997); viz. *T. p. perforatus* Geoffroy, 1818 (type locality: Kom Ombo, zw. Edfu und Assuan [Egypt]; Kock 1969: 74) and *T. p. haedinus* Thomas, 1915 (type locality: Chanler Falls, Euso Nyiro, British East Africa [Chandler's Falls, Kenya]; Thomas 1915: 63).

Taxonomic division of Asian populations was first suggested by Thomas (1915), based on pelage colour differences; he assigned the bats from India to the pale brownish nominotypical form from Egypt, while the bats from south-western Arabia to the dark-brown east-African form *T. p. haedinus*. This separation was accepted by Ellerman & Morrison-Scott (1951) and the presence of *haedinus* in Arabia was mentioned by Harrison (1964) and Kock (1969).

However, Harrison (1968) collected pale-coloured specimens of *T. perforatus* in north-eastern Oman, which he hesitated to assign to *haedinus* of Yemen but rather to *perforatus* of Sudan and India, and a similar uncertain opinion is mentioned also by Harrison & Bates (1991). Corbet (1978: 41) reported only the nominotypical subspecies of *T. perforatus* from the Palaearctic, in which he included also the Arabian populations; he clearly stated that the separation based on slight colour differences "does not seem to justify subspecific naming." On the contrary, Koopman (1994: 42) recognised only *T. p. haedinus* in the Asian range, being distributed in "Tanzania north to Ethiopia and east across southern Asia to India", while *T. p. perforatus* solely in Egypt and northern Sudan.

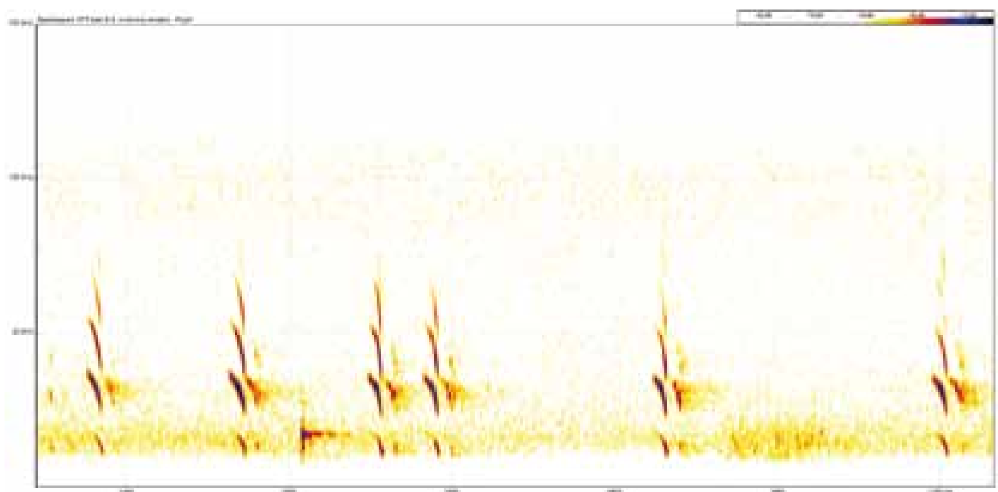

Fig. 65. Spectrogram of echolocation calls of *Taphozous perforatus* Geoffroy, 1818; a hand-released individual caught in the Pasorkhi gorge (Hormozgan).

On the other hand, Sinha (1970, 1976) and Bates & Harrison (1997) identified the specimens from India and Pakistan as belonging to the nominotypical form.

Concerning the populations of *T. perforatus* from Iran, DeBlase (1980: 66) stated that "only the nominate form is known from Iran." This conclusion was based on the comparison of pelage colouration of two available Iranian bats with the darker type specimen of *T. p. haedinus* from Kenya and pale coloured bats from Egypt and Pakistan. The pelage colouration of the newly collected bats from Jahrom is pale greyish-brown (Fig. 63) and conforms in tinge to that of the NMP samples from Egypt and northern Sudan. However, the intensity of pelage tinge in particular populations of *T. perforatus* perhaps depends on environmental conditions, namely relative humidity; bats from the savannah habitats (East Africa, SW Arabia) are darker than those from arid steppes and deserts (Egypt, Sudan, Oman, Iran). Thus, the intraspecific variation in *T. perforatus* should be rather solved with the help of molecular genetic analyses.

Echolocation. *Taphozous perforatus* produces frequency-modulated signals with several harmonics. From the Middle East, the data on echolocation parameters of this species were reported from Sinai, Egypt, Jordan, and Israel (Shalmon et al. 1993, Mendelssohn & Yom-Tov 1999, Dietz 2005, Benda et al. 2008, 2010, Ulanovsky et al. 2004). In this region, the frequency of *T. perforatus* calls with maximum energy covers the range of 27–31 kHz. We made recordings of 16 echolocation calls at two sites in Iran, in the Sang Eshkan caves at Jahrom (Fars) and in the Pasorkhi gorge (Hormozgan; Fig. 65); basic parameters of these signals are given in Table 3. The values obtained from Iran are slightly higher in SF, EF and FMAX than those mentioned by the above authors; this difference is clear in the values obtained from the echolocation sequence of a hand-released bat (Fig. 65). The data obtained from Iran are more similar to those reported from the Indian part of the species range (Punjab, Pakistan), where the maximum energy frequencies were between 30–32 kHz (Mahmood-ul-Hassan et al. 2012).

Feeding ecology. *Taphozous perforatus* is a medium-sized high flying aerial hawker with long and narrow wings (Rydell & Yalden 1997). This bat is known to feed mostly on moths (Lepidoptera), the other food items found included termites (Isoptera), beetles (Coleoptera) and orthopterans (Rydell & Yalden 1997). Results of the diet analyses from the populations of Oman, Yemen and Sudan showed Lepidoptera to be the predominant food item, in some case altered with Coleoptera (own upubl. results).

From Iran, the diet of *T. perforatus* from two sites of the Hormozgan province was analysed (Fig. 66). One digestive tract from a specimen collected in the Hormoz island was dominated by Lepidoptera (wingspan ca. 25–35 mm); Coleoptera were represented by the scarabaeid beetles and neuropterans belonged to the families Myrmeleontidae and Chrysopidae. On the other hand, orthopterans prevailed in the sample set of 30 faecal pellets collected under the roost in the Pasorkhi gorge.

Majority of Lepidoptera in the diet of *T. perforatus* corresponds well with the study by Rydell & Yalden (1997) and most of our analyses of samples collected in Oman, Yemen and Sudan. The sample dominated by orthopterans was recorded for the first time. Nevertheless, it is not very surprising since also other aerial hawkers of the region show important proportions of this item in their diets, see *Taphozous nudiventris* or *Nyctinomus aegyptiacus*.

Records of ectoparasites. **Original data**: S t r e b l i d a e: *Raymondia huberi*: 1 fa (CMŠ [P]) from 1 fa (NMP 93893), Jahrom (Fars Prov.), 8 October 2011; – 1 ma (CMŠ [P]) from 1 fj, Pasorkhi gorge (Hormozgan Prov.), 11 October 2011.

Comments on ectoparasites. Only one parasite species was found on *Taphozous perforatus* in Iran, *Raymondia huberi* Frauenfeld, 1855. This bat fly occur in a broad area from East Africa to the Middle East incl. Afghanistan, where it was found to parasitise *Cardioderma cor* and *Asellia*

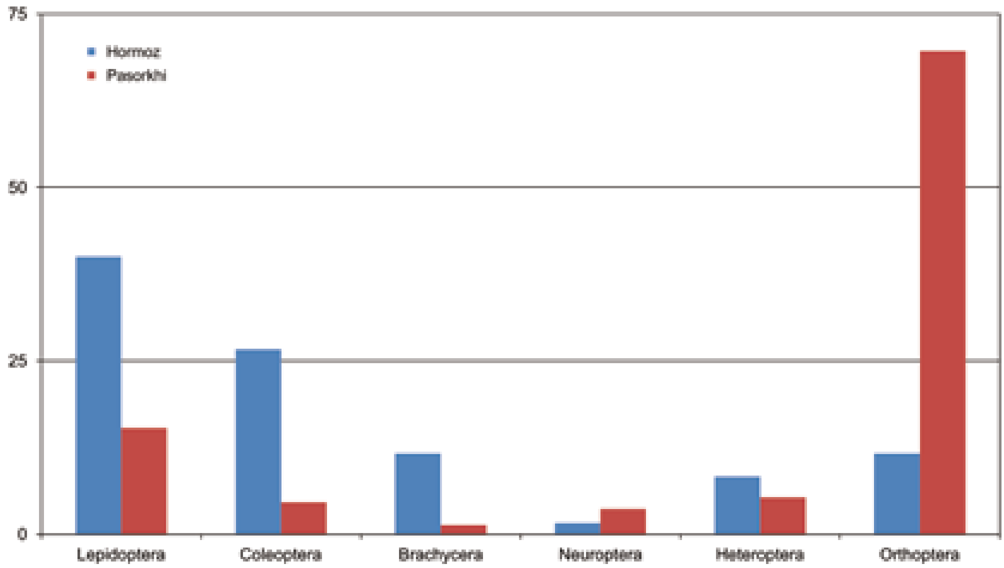

Fig. 66. Percentage volume of particular food items in the diet of *Taphozous perforatus* Geoffroy, 1818 in Iran. Material analysed: Hormoz island (one digestive tract), Pasorkhi gorge (30 faecal pellets collected from under a roost).

tridens (Aellen 1959, Theodor 1968). The Iranian records from *T. perforatus* are thus the first evidence from this host species.

Form North African part of the range of *T. perforatus* several other ectoparasites were recorded in this host, *Argas boueti* Roubaud et Colas-Belcour, 1933, *Chiropteropsylla aegyptia* (Rothschild, 1903), *C. brockmani* Rothschild, 1915 (Hopkins & Rothschild 1956, Haas & Tomich 1973, Anciaux de Faveaux 1987). Records of these species could be expected also in Iran.

Taphozous nudiventris Cretzschmar, 1830

Records. **Original data**: Â z a r b â i j a n - e G h a r b i: rocks on the Oromiyeh lake bank 3 km S of Soltan Abad [1], 28 km N of Oromiyeh, 19 October 1998: remnants of 1 ind. (2 rostrum fragments) found in *Bubo bubo* pellets. – B u s h e h r: Chahak [2], 8 km NW of Bandar Ganaveh, 4 May 1996: remnants of 1 ind. found in *Tyto alba* pellets, 14 October 1998: remnant of 1 ind. (right mandible fragment) found in *Tyto alba* pellets (cf. Obuch & Khaleghizadeh 2011). – K e r m â n s h a h: Bisotun [3], 28 km E of Kermanshah, 7 October 1998: remain of 1 ind. (left mandible fragment) found in *Bubo bubo* pellets. – K h u z e s t â n: Choqâzanbil [4], 30 km SE of Shush, crevice in loess wall of a small valley near ziqqurat, 15 October 1998: obs. a colony of ca. 35 inds. (coll. 2 ma, 1 fs; NMP 48188, 48189, JOC unnumbered; cf. Benda et al. 2006, Ruedi et al. 2012), 17 October 2002: coll. 1 ind. ad (JOC unnumbered), 18 October 2002: remnant of 1 ind. found in *Tyto alba* pellets (cf. Obuch & Khaleghizadeh 2011). – **Published data**: Â z a r b â i j a n - e G h a r b i: Basket Mountain [5], 26 km. northeast of Rezaiyeh [= Oromiyeh], large vertical cracks in rock, 19 and 21 September 1962: 34 inds., resp. 48 m, 2 f, FMNH (Lay 1967, DeBlase 1980), 5 August 1968: 7 m, FMNH (DeBlase 1980). – K h u z e s t â n: 26 km. E Haft Tappeh [6], 17 May 1969: shot 1 ms, MMTT (DeBlase 1980); – Bandar-e-Shahpur [7], large building, 22 October 1968: net. 1 ms, 1 fs, FMNH (DeBlase 1980); – Darkhwein (= Darkhovin) [8], 13–18 September 1970: 3 m, IPHR (DeBlase 1980); – Mohammerah [9], October 1899[?]: 1 m, 1 f (Cabrera Latorre 1901). – S i s t â n v a B a l u c h e s t â n: Zâbol [10], Zâbol University building, attic (Ziâie 2008). – T e h r â n: Varamin [11], 37 kms. south east of Teheran, old tomb, Autumn 1965: 1 m, 1 f, several specimens (Etemad 1967), Alâ'ed'din tower, 26 June 1966 and Autumn 1966: 3 m, 3 f, resp. 2 m, 4 f, HZM, UIM, IPHR (DeBlase 1980, Etemad 1984). – Iran (undef.): [Iran], specimen smaller than those of the Varamin series (Etemad 1984).

DISTRIBUTION. *Taphozous nudiventris* is a rather rare bat species in Iran, at least eleven localities are known from the country (Fig. 62). The records come from two regions of Iran, separated by a thousand kilometres; ten sites are available from the western part of the country (from this region the species' occurrence was reviewed already by Lay 1967 and DeBlase 1980), while one comes from the Seistan basin in eastern Iran.

The west-Iranian distribution continues to the common occurrence of *T. nudiventris* in the Mesopotamian lowland known from a belt stretching from Basra in south-eastern Iraq to the Nizip area in southern Turkey (see Benda et al. 2006 for a review); it is the easternmost extension of this range (along with the records from the islands of Bahrain and Das in the Persian Gulf; Harrison & Bates 1991). The Azarbaijani records from the western bank of the Oromiyeh lake represent the northernmost findings of *T. nudiventris* in its whole distribution range (cf. Lay 1967, Kock 1969).

The Seistan record is the westernmost point of the Indian part of the species range, comprising the whole Indian subcontinent from Afghanistan to Burma (Corbet & Hill 1992, Bates & Harrison 1997). The closest record of *T. nudiventris* from this range is available from Lashkari Bazar, south-central Afghanistan (Meyer-Oehme 1968), almost 300 km east of Seistan at a similar latitude; this distance indicates a new prolongation of this part of the distribution range.

The records of *T. nudiventris* in western Iran come from various regions and altitudes. Most of the records (7) are known from the Mesopotamian lowland of the Khuzestan and Bushehr provinces (Fig. 62); these sites lie at altitudes between the sea level and 100 m a. s. l. Other west-Iranian records (4) come from continental mountain plateaus in the range of 900–1400 m a. s. l. Concerning the region of the western bank of the Oromiyeh lake, the findings of *T. nudivetris* were confirmed repeatedly over an extensive period (colonies in 1962 and 1968; osteological remains from fresh owl pellets in 1998). This suggests regular occurrence in the region, which however represents a part of Iran with very continental climate and thus very harsh winters. Bats unable to hibernate can hardly survive such conditions. This area thus probably serves as a region for breeding and foraging only in the fertile period of a year; for the winter period *T. nudiventris* perhaps migrates to climatically more favourable areas – the closest are the lowlands of Iraqi Mesopotamia (see Field notes).

FIELD NOTES. *Taphozous nudiventris* was recorded in Iran mainly in or at its roosts, significant contributions come also from analyses of owl pellets. The only exception is the foraging immature male "shot near village" in the Khuzestan plain east of Haft Tappeh (Khuzestan) on 17 May 1969, reported by DeBlase (1980: 70); one *Pipistrellus kuhlii* was also shot at this site.

As DeBlase (1980) already concluded, *T. nudiventris* occupies a variety of roosting sites in Iran. Considering the available records, it was found to roost in crevices of rocks, narrow fissures in muddy walls, in roof parts of buildings, and in old tombs. Where the information is available, *T. nudiventris* was the only species found in these spaces, no other bats shared its roosts.

Lay (1967: 135) described the first finding of a *T. nudiventris* roost as follows: "Large numbers of this bat roosted together in the interiormost reaches of the narrow cracks in the granitic rock of Basket Mountain [Azarbaijan]. The periodic calling and squealing of colonies readily led us to their locations and examples were obtained by grappling or prodding with long sticks. […] Vocalizations from one group often elicited similar emissions from neighboring cells. […] Large guano piles beneath several nearby open overhangs suggest their use as roosts during the hot summer. Our specimens caught September 19 and 21 [1962] all showed extensive fat." Lay (1967: 93) characterised the site: "Three gigantic monadnocks rise 300–610 m. above the lacustrine plain, two on the west shore and the other on the east. We explored only the northern mountain on the west bank known as Basket Mountain. Approximately 150 m. up the steep east face was a unit of rock at random angles. Toward the outer edges, split-off rocks have weathered further, forming overhangs or falling slopes as shingles. The scant vegetation consisted of grass and thistle." At this site, DeBlase (1980: 73) collected additional individuals of *T. nudiventris* on 5 August 1968: "I collected seven males from long vertical cracks in the exposed granite of the […] mountain. Inhabited cracks were easily identified by odor and by piles of guano spilling from the base."

Etemad (1967: 275) reported "several specimens [of *T. nudiventris*] taken from an old tomb in Varamin 37 kms. south east of Teheran" in autumn 1965. In addition, Etemad (1969) reported on another finding from Varamin, from the Ala'ed'din [Aladdin] tower, where he collected six

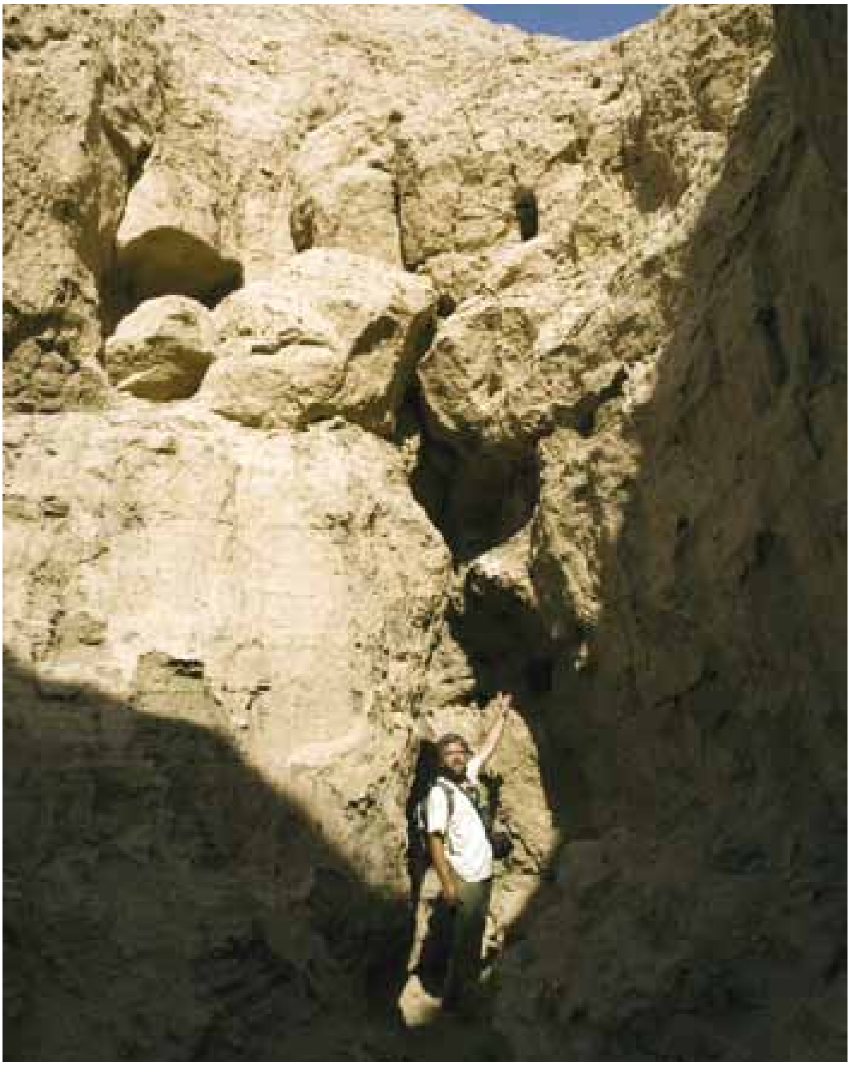

Fig. 67. Choqazanbil (Khuzestan), position of a roost of *Taphozous nudiventris* in a fissure of loess wall near the ziggurat. Photo by A. Reiter.

bats from a space under the roof of the tower, in a height of 17 m, in 1966 (see Etemad 1969: 70, Fig.).

DeBlase (1980: 75) described in details his finding of a roost of *T. nudiventris* in a building on 22 October 1968: "[…] while visiting Bandar-e-Shahpur [Khuzestan], we were told that a large building harbored many bats and were shown holes just under the straw and mud roof from which it was said the bats exited. We placed a mistnet in front of these holes before dusk […]. At 6:30 P. M. a male *T. nudiventris* flew out of a hole and became entangled in the net. At 7:05 P.M. a female of the same species was taken as it exited from a neighboring hole. No other bats were seen […]." Ziâie (2008) reported on a record of this species from attic of the university building at Zabol (Sistan), however, without any additional details on bat number or season of record.

A colony of some 35 individuals of *T. nudiventris* was discovered in an erosion crevice in loess wall of a small valley within a ca. 10–15 m high escarpment (Fig. 67) near the ziqqurat of Choqazanbil (Khuzestan) on 15 October 1998, just near the road from the Choqazanbil monument to the alluvium of the Karkheh river. The colony hung in a narrow crevice ca. 4 m above the valley bottom (Figs. 67, 68); it was recorded there at two occasions in the span of four years (October 1998, October 2002), while in October 2011 the roost was found abandoned (although some fresh faeces were there collected for the diet analysis).

From Iraqi Mesopotamia, i.e. solely from lowland conditions comparable with Iranian Khuzestan, Al Robaae (1966) reported findings of summer roosts of *T. nudiventris* colonies in abandoned and inhabited buildings, including above-ground parts of tombs, ruined caravanserais and under roofs of minarets and corn mills. Harrison (1956b) and Al Robaae (1968) reported on summer roosts discovered in caves in the escarpment of the Euphrates valley in Iraq. Similar types of roosts of *T. nudiventris* are known also from Syrian Mesopotamia, with the exception of inhabited buildings (Benda et al. 2006, Shehab et al. 2007).

The large difference in altitudes of the roost sites in Iran as well as the known inability of *T. nudiventris* to hibernate suggest seasonal migration habits in this species. Since the mountain areas give no chance to survive harsh winters for bats without special adaptations to hibernate, the populations documented during summer period in the mountains of Azarbaijan (ca. 1360 m a. s. l.) and steppes of the Tehran province (ca. 915 m) seem to migrate and spend winter in relative warm lowlands. Moreover, the repeated findings at the Oromiyeh lake in span of almost 40 years (see above) suggest regular summer occurrence there (see also DeBlase 1980). Al Robaae (1968) described migrations of *T. nudiventris* between summer and winter roosts in Iraq; however, these transfers do not have to cover long distances within the Mesopotamian lowlands. The presumed migration routes in Iran should represent hundreds of kilometres between the upland habitats of summer occurrence and lowland sites inhabited in winter (some 200–400 km).

Only indirect evidence of *T. nudiventris* reproduction is available in Iranian populations (cf. DeBlase 1980). DeBlase (1980: 289) interpreted Etemad's (1969) record from the tomb at Varamin on 26 June as a finding of nursery colony. Immature individuals of *T. nudiventris*, both males and females, were collected in May at Haft Tappeh, in October at Choqazanbil and Bandar-e Shahpur, and in autumn at Varamin. Adult females without any signs of pregnancy and lactation were found in August and September in the Basket Mts. From Iraq, Al Robaae (1966, 1968) reported pregnant females with medium developed foeti (15 mm) found in mid-April, parturitions observed in the last decade of May, and the appearance of volant juveniles observed in August; Benda et al. (2006) mentioned records of pregnant females from Syrian Mesopotamia throughout May and in mid-June, volant juveniles in mid-May and early October. All these data concur with the scarce evidence from Iran.

Osteological remains of *T. nudiventris* were recorded in pellets of two owl species coming from four sites of Iran (Table 40). Remains of one individual were discovered in *Bubo bubo* pellets collected in rocks on the western bank of the Oromiyeh lake at Soltan Abad (Azarbaijan) and a fragment of mandible was found in a small sample of 77 prey items from pellets of this owl collected at Bisotun (Kermanshah). These findings represent 0.78 and 1.30% per sample volume of all prey items (1.01 and 2.86% of mammal items, respectively) in the respective samples and 0.025% of all prey items (0.033% of mammal items) in the whole analysed eagle owl diet from Iran. Remains of two individuals of *T. nudiventris* were discovered in two samples of *Tyto alba* pellets collected at two occasions (1996, 1998) in Chahak near Bandar Genaveh (Bushehr) and a remnant of one individual was found in pellets of this owl from Choqazanbil (Khuzestan; Obuch & Khaleghizadeh 2011). They represent 0.31–0.69% per sample volume of all prey items (and 0.32–1.27% of mammal items, respectively) in the respective samples and 0.14% of all prey items (0.18% of mammal items) in the whole analysed barn owl diet from Iran. In the Middle East, remains of *T. nudiventris* were found in the owl diet in Israel, Syria, Iraq, and Iran (Dor 1947, Nader 1969, Ebenau 1996, Shehab et al. 2004, 2007, Benda et al. 2006, Obuch & Benda 2009, Obuch 2011, Obuch & Khaleghizadeh 2011, new data).

Material examined. 1 ind. (JOC unnumbered [Sf]), Bisotun (Kermanshah Prov.), 7 October 1998, leg. J. Obuch; – 1 ind. (JOC unnumbered [Sf]), Chahak (Bushehr Prov.), 14 October 1998, leg. J. Obuch; – 2 ♂♂, 1 ♀ (NMP 48188, 48189 [S+A], JOC unnumbered [S+Sk]), Choqazanbil (Khuzestan Prov.), 15 October 1998, leg. M. Andreas, P. Benda, J. Obuch, A. Reiter & M. Uhrin; – 1 ind. (JOC unnumbered [S+Sk]), Choqazanbil (Khuzestan Prov.), 17 October 2002, leg. J. Obuch; – 1 ind. (JOC unnumbered [Sf]), Soltan Abad (Azarbaijan-e Gharbi Prov.), 19 October 1998, leg. J. Obuch.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Taphozous nudiventris* are shown in Table 2. For the material examined see above.

T. nudiventris is a polytypic species, up to five subspecies are currently recognised within its distribution range (Thomas 1915, Ellerman & Morrison-Scott 1951, Felten 1962, Kock 1969, Corbet 1978, Koopman 1994, Horáček et al. 2000, Simmons 2005, Benda et al. 2006). While

Fig. 68. Khuzestan plain at Choqazanbil, a foraging area of *Asellia tridens*, *Taphozous nudiventris*, *Rhyneptesicus nasutus*, and *Pipistrellus kuhlii*. Photo by A. Reiter.

in Africa, only the nominotypical form is mentioned, three subspecies are reported to occur in south-western Asia (plus the nominotypical one extending from Africa to south-western Arabia and the south-western Levant); viz. *T. n. kachhensis* Dobson, 1872 in the Indian subcontinent incl. Pakistan and Afghanistan, *T. n. magnus* von Wettstein, 1913 in Mesopotamia from southern Turkey to Iran and in two islands in the Persian Gulf, and *T. n. zayidi* Harrison, 1955 presumably in eastern Arabia. However, the status of the latter form is considered uncertain or even invalid by some authors and the respective population belonging to the nominotypical form (Harrison & Bates 1991, Benda et al. 2006).

From Iran, only *T. n. magnus* (type locality: Basra [Iraq]; von Wettstein 1913: 466) has been reported (Etemad 1969, DeBlase 1980, Benda et al. 2006, Karami et al. 2008). Since this form is the largest in body size among all subspecies of *T. nudiventris*, it can be identified very easily (see e.g. the comparison by Benda et al. 2006: 35–41, containing also the Iranian specimens here examined). However, this is true only for the specimens available for examination, which all come from the western part of Iran, geographically more or less adjacent to Mesopotamia (see Distribution), i.e. from the provinces of Azarbaijan, Bushehr, Kermanshah, Khuzestan, and Tehran. On the other hand, taxonomic affiliation of the specimen reported by Ziâie (2008) from Zabol, Seistan basin, remains unclear.

Etemad (1984) mentioned a specimen of *T. nudiventris* from Iran of a closely unspecified geographical origin, in body size smaller and in colouration darker than the specimens he obtained from Varamin, where he found *T. n. magnus* (Etemad 1967, DeBlase 1980). Because of the ash grey tinge of its pelage, Etemad (1984) suggested it may belong to *T. n. zayidi*. Harrison (1955) described his new subspecies *T. n. zayidi* (type locality: Al Ain, Buraimi Oasis, Oman [= Al Ain, Abu Dhabi Emirate, United Arab Emirates]; Harrison 1955: 904) on the basis of its "uniform ash-grey above" colouration of pelage which should differ from the brown pelage in the nominotypical form (he reported body size not to differ significantly between these two forms). However, Benda et al. (2006) demonstrated individual variation of dorsal pelage tinge in *T. nudiventris*, both greyish and brownish morphs being present in the nominotypical populations in Egypt and the Levant and in *T. n. kachhensis* from Afghanistan, and thus, they suggested to consider the greyish colouration to have no taxonomic significance. On the other hand, the smaller size of the Etemad's specimen suggests its origin from the border areas of Pakistan or Afghanistan or from the southern shore of the Hormozgan and Beluchestan provinces, close to Oman and UAE. In Pakistan and Afghanistan, the small-sized subspecies *T. n. kachhensis* is known to occur (type locality: Kachh, N.W. India [= Kutch, Gujarat, India]; Dobson 1875: 554), while from Oman and UAE another small-sized form is known, *T. n. nudiventris* (type locality: Pyramiden von Gize [Giza, Egypt]; Cretzschmar 1830: 71). The occurrence of the former subspecies is quite well possible in Iran; the specimen reported by Ziâie (2008) from Zabol, Seistan basin, most probably belongs to this form. However, this tentative conclusion is based only on biogeographical grounds – its locality is much closer to the Afghanistani and Pakistani sites of *T. n. kachhensis* occurrence (see Bates & Harrison 1997) than to the closest Iranian sites of *T. n. magnus*, and it belongs to the same region of plateaus adjacent to the southern slopes of the Hindu Kush range.

Echolocation. The first basic data on echolocation characteristics of *Taphozous nudiventris* were provided by Benda et al. (2010) from Jordan, although simple values of the FMAX were reported also from Israel (Shalmon et al. 1993, Mendelssohn & Yom-Tov 1999, Dietz 2005). *T. nudiventris* emits frequency-modulated calls comprising several harmonics. The signals are similar to those recorded from *T. perforatus* but the range of frequencies of maximum energy is lower in *T. nudiventris* (21–25 kHz). Similar values were reported from the Levantine populations (Israel, Jordan; see above). Echolocation characteristics of this species have not yet been studied in Iran.

FEEDING ECOLOGY. *Taphozous nudiventris* is a large fast flying aerial hawker that forages in open areas (Neuweiler 1984), its diet was studied in several parts of its distribution range. The most important food items recorded in Syria, Sudan and Oman were Coleoptera (Scarabaeidae) and Orthoptera (Benda et al. 2006, own unpubl. results), while the overwhelming majority of Coleoptera was documented in Turkey (Whitaker & Karataş 2009).

Desai et al. (2012) studied profoundly the diet of *T. nudiventris* in Gujarat, India, and observed noteworthy seasonal changes in the diet composition of this bat. Coleoptera and Orthoptera prevailed in winter, while Isoptera, Lepidoptera, Orthoptera, Neuroptera and Hymenoptera (Vespoidea) in summer; the monsoon season was characterised by increased proportions of termites, beetles, cockroaches (Blattodea) and moths. In the post-monsoon period the proportion of beetles increased and crickets and cockroaches were also favoured. These dynamics indicated flexibility of the species in the utility of food resources.

From Iran, we analysed three sample sets collected at the same site, Choqazanbil (Khuzestan), in 1998, 2002 and 2011, always in mid-October (Fig. 69). The set collected on the first occasion was dominated by Blattodea and Coleoptera (mostly Scarabaeidae). Orthopterans (Ensifera) prevailed in the sample set collected in 2002, and Blattodea, Coleoptera (Carabidae) and Orthoptera were found to be the most important items in the faeces collected in 2011.

These data more or less correspond with the results of previous studies. Different diet compositions documented from the same site and in the same season can be caused by certain shifts in phenology, resulting in shifts in food availability. The variable diet composition most probably suggests an opportunistic exploitation of the temporarily most profitable food supply available at the site.

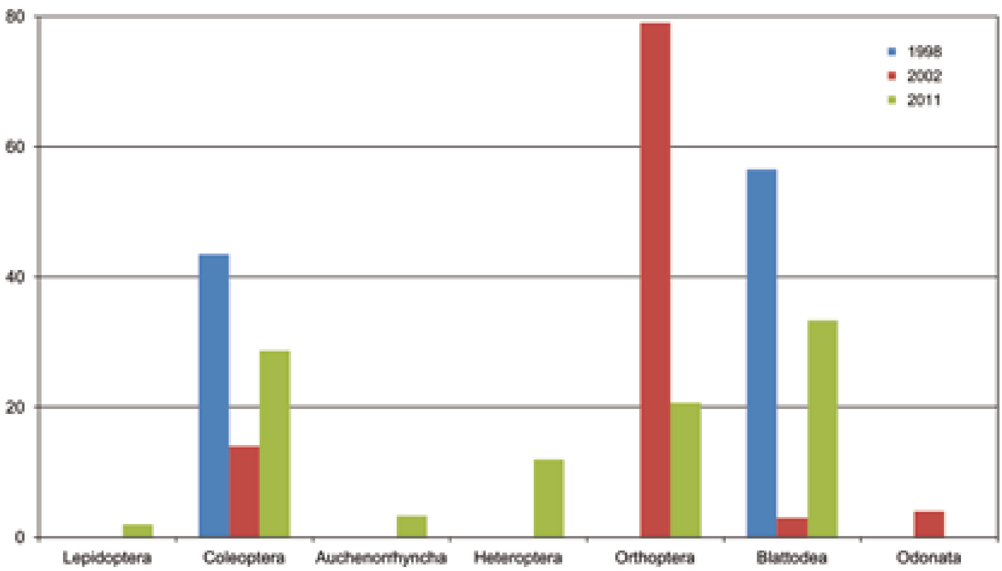

Fig. 69. Percentage volume of particular food items in the diet of *Taphozous nudiventris* Cretzschmar, 1830 in Choqazanbil (Khuzestan). Each sample set analysed was composed of 30 faecal pellets collected from under a colony roost on 15 October 1998, 17 October 2002, and 16 October 2011, respectively.

Myotis blythii (Tomes, 1857)

Records. **Original data**: A r d a b i l: Dâshkasan [1], 17 km SE of Meshginshahr, Dâshkahul cave, 29 September 2011: coll. 1 fs in the cave (NMP 94108). – Â z a r b â i j a n - e G h a r b i: Bastam [2], 6 km W of Qarah Ziya'oddin, 30 September 1998: remains of 2 inds. (2 right and 1 left mandibles, 1 skull) found in *Bubo bubo* pellets; – rocky valley 7 km SE of Chuplu [3], 10 km NW of Takab, 2 October 1998: remnants of 1 ind. (skull fragments) found in *Bubo bubo* pellets; – Takht-e Soleyman [4], 25 km NNE of Takab, 3 October 1998: coll. 6 ma, 1 fs roosting in ruins, net. 2 ma, 1 ms foraging in ruins (NMP 48131–48137, 48142–48144; cf. Benda et al. 2006, 2011c); – Zap. Persiâ, uŝ. Kotur-Čaj, bl. gor. Hoâ [= western Iran, Qotur-Chay valley, near Khoy] [5], 29 August 1914: coll. 6 m, 7 f (ZIN 49783–49795; leg. P. V. Nesterov). – C h a h â r M a h â l v a B a k h t i â r i: Darre Duâli cave [6], 15 km SE of Shahr-e Kord, 7 May 2010: obs. a colony of ca. 80 inds., net. 1 m, 2 f, 4 inds. (cf. Faizolahi et al. 2011); – Hasan Âbâd [7], Eshkaft-e Zolaikhâ (Zolaikhâ crevice), N of Gandomân wetland, 4 km S of Gandomân, Summer 2001: 19 m, 13 f (cf. Ashrafi 2001), 9 May 2010: obs. 1 ind. (cf. Faizolahi et al. 2011); – Katak [8], 25 km WNW of Shahr-e Kord, irrigation tunnel, 13 August 2010: net. 2 m (cf. Faizolâhi et al. 2011); – Omid Âbâd [9], Sarâb cave, 42 km W of Shahr-e Kord, Summer 2001: net. 10 m, 4 f (cf. Ashrafi 2001), 13 August 2010: obs. 15 inds. in deep torpor, exam. 1 ind. (cf. Faizolâhi et al. 2011). – F â r s: 5 km E of Sivand [10], 64 km NE of Shiraz, 30 April 1996: remnants of 9 inds. (9 left and 6 right mandibles, 2 rostrum fragments) in *Bubo bubo* pellets; – small cave 3 km SW of Serizjan [11], 10 km N of Firuz Abad, 21 April 2000: net. 4 fG (NMP 48459–48462; cf. Benda et al. 2006, 2011c), det. calls of ca. 10 inds.; – valley 10 km NW of Hesar [12], 66 km NW of Marv Dasht, above a stream, 5 October 2011: net. 1 ma (NMP 93868; Fig. 71), det. & rec. calls of 1 foraging ind.; – Bishapur [13], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April 2000: obs. a colony of ca. 2000 inds. (mixed with a colony of *Rousettus aegypticaus*), remnants of 2 inds. (1 left and 2 right mandibles, 3 rostrum fragments) in *Strix aluco* pellets (cf. Obuch 2011) and remnants of 6 inds. (5 right and 6 left mandibles, 8 skull fragments) found in *Bubo bubo* pellets; – Dashtak [14], 32 km SSW of Yasuj, 2 May 1996: net. 10 inds., coll. 9 inds. ad (JOC unnumbered; cf. Benda et al. 2006, 2011c), remnants of 1 ind. found in *Bubo bubo* pellets; – valley 11 km SE of Sarvestan [15], 80 km SE of Shiraz, 20 April 2000: remnants of 1 ind. found in *Bubo bubo* pellets; – small cave 5 km E of Shangar [16], 50 km NW of Shiraz, 22 April 2000: net. 1 ind., det. calls of ca. 5 inds., remnant of 1 ind. (right mandible) found in *Bubo bubo* pellets; – Tâdovân [17], 44 km NW of Jahrom, Tâdovân cave, 7 October 2011: obs. a colony of ca. 30 inds., net. 7 ma, 1 fa, 1 ms, coll. 1 ma (NMP 93881). – G o l e s t a n: valley 2 km SSE of Ali Âbâd [18], beech forest, above a stream, 28 May 2006: net. 5 ma, 1 fG, 1 fs (NMP 90848–90854; cf. Benda et al. 2011c); – Sev. Persiâ, Astrabad' [= northern Iran, Gorgan] [19], 8–18 April [21 April – 1 May NS] 1914: coll. 1 m, 2 f, 125 inds. (ZIN 11210–11334, 49809–49811; leg. A. I. Kiričenko, cf. Kuzâkin 1950, Strelkov et al. 1978, Benda et al. 2006, 2011c); – Shir Âbâd cave [20], 20 km NE Ali Âbâd, water cave, October 1997: coll. 5 ma, 1 ms, 1 fa, 1 fs (HMNH 2007.3.16.–2007.3.23.; leg. S. Ashrafi, M. Peymani & H. Zohoori), June 1999: coll. 1 ma (HMNH 2000.6.1.; leg. H. Zohoori, S. Ashrafi & M. Peymani), 2008: coll. 3 ma, 1 fa (HMNH 2008.37.3.–2008.37.6.; leg. H. Zohoori). – I l â m: Âsemân Âbâd [21], Tange Rad cave, 30 km N of Ilâm, May, July & September 2003: obs. a colony, exam. 6 m in torpor (cf. Faizolâhi 2004). – K e r m â n: small cave 5 km NNE of Deh Bakri [22], 40 km W of Bam, 8 April 2000: net. 12 ma, coll. 10 m (NMP 48353–48362; cf. Benda et al. 2006, 2011c), remnants of 3 inds. (1 right and 2 left mandibles, 2 skull fragments) found in *Bubo bubo* pellets. – K e r m â n s h a h: Bisotun [23], 28 km E of Kermanshah, 7 October 1998: remnants of 3 inds. (1 right and 3 left mandibles, 1 rostrum fragment, 1 skull fragment) found in *Tyto alba* pellets (cf. Obuch & Khaleghizadeh 2011). – K h o r a s â n - e R a z a w i: valley 2 km S of Dorbadam [24], 16 km S of Bajgiran, 23 May 2006: net. 1 ind.; – valley 5 km W of Chenarbu [25], 13 km SE of Qalandar Abad, 17 May 2006: net. 1 ma (NMP 90775; cf. Benda et al. 2011c); – valley 5 km S of Mina [26], 20 km SW of Dargaz, 22 May 2006: net. 1 ma, 20 fL, coll. 1 m, 11 f (NMP 90812–90823; cf. Benda et al. 2011c); – valley 3 km SW of Tahir Abad [27], 45 km NE of Mashhad, above a creek, 21 May 2006: net. 1 ma (NMP 90799; cf. Benda et al. 2011c); – valley 7 km E of Bazangan [28], 14 km NNW of Mazdavand, 17 May 2006: net. 2 fL (NMP 90777, 90778; cf. Benda et al. 2011c); – Moghân cave [29], 30 km SW of Mash'had, October 1999: hand-net. 1 m (cf. Faizolâhi 1999). – K h u z e s t â n: valley 2 km S of Sarkan [30], 9 km SW of Izeh, 13 October 1998: remnants of 5 inds. (5 left mandibles, 1 right mandible, 1 rostrum fragment) found in *Bubo bubo* pellets. – K o r d e s t â n: Karaftu cave [31], 22 km WSW of Takab, 18 October 2011: obs. 3 inds. – L o r e s t a n: Gholaman [32], 16 km W of Khoramabad, 7 May 1996: remnants of 1 ind. found in *Bubo bubo* pellets; – Lenje Abad [33], 6 km SW of Dorud, 9 October 1998: remnants of 2 inds. (3 mandible fragments, 1 rostrum fragment) found in *Bubo bubo* pellets. – M â z a n d a r a n: Hotu cave [34], 3 km W of Behshahr, 14 May 1997: skeletal remnants of 2 inds. found in a cave deposit; – Sev. Persiâ, Ašref [= northern Iran, Behshahr] [35], 20 August 1905: coll. 1 f (ZIN 49792; leg. K. A. Satunin; cf. Strelkov et al. 1978). – S e m n â n: Nâmnik [36], Sam cave, 30 km E of Minoodasht, 19 October 2010: obs. of 1 ind. in torpor (photo). – S i s t â n v a B a l u c h e s t â n: Mach Gur [37], 63 km SE of Irânshahr, small cave, 11 April 2000: remnant of 1 ind. (left mandible) found in *Bubo bubo* pellets. – T e h r â n: Elburs, Höhle I b. Koolak (Strasse nach Shemshak) [= Alborz Mts., Kulak, Cave I, at the road to Shemshek] [38], 2450 m, 24 June 1978: remnants of 1 ind. (ZFMK 85.162) found in the cave deposit. – Z a n j â n: valley at Badamestan [39], 32 km ENE of Zanjân, 18 May 1997: remnants of 1 ind. found in *Bubo bubo* pellets; – Golgik [40], 25 km W of Zanjân, Golgik cave, 7 May 2008: coll. 1 ma (HMNH 2009.46.1.; don. F. Hemmati), 28 September

2009: net. 1 ind.; – Shâhneshin [41], 10 km SE of Âbbar, Kharmanesar cave, 27 September 2009: obs. 1 ind. in torpor. – Iran (undef.): Persiâ [= Iran], 1 m (ZIN 6106; leg. Buze). – **Published data**: A r d a b i l: between Âlni and Jahâd Âbâd [42], 10 km NE Meshginshahr, ceiling of water channel under road, 24 September 2006: coll. 1 m (Sheikh-Jabbâri 2008); – between Arbâbkandi and Naqdi [43], 32 km NE Meshginshahr, ceiling of water channel under road, 13 September 2006: coll. 1 m (Sheikh-Jabbâri 2008); – between Diz and Karin [44], 45 km SE Khalkhâl, ceiling of water channel under road, 12 May 2007: coll. 1 m (Sheikh-Jabbâri 2008); – between Nir and Sarâb [45], 15 km E Nir, ceiling of water channel under road, 9 September 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Guter-Su [= Qutur Su] [46], Sulphur Caves, north of Mt. Sabalan, 21 August 1961: 1 ma, BMNH (Harrison 1963); – Khalaf farm [47], 5 km W Meshginshahr, ceiling of water channel under road, 18 July 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Niâz [48], 22 km W Meshginshahr, ceiling of water channel under road, 18 July 2006: coll. 2 m, 1 f (Sheikh-Jabbâri 2008); – Daraq ruin [49], Âdâ kahuli cave, 35 km E Meshginshahr, crevice in the cave wall, 13 May 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Daraq ruin [50], Qaranukh kahul cave, 35 km E Meshginshahr, crevice in the cave wall, 17 May 2006: 1 m[a, HMNH] (Sheikh-Jabbâri 2008); – Daraq ruin [51], Qorbân Darasi valley, 35 km E Meshginshahr, crevice, 17 May 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Samarin [52], Öch otaqli kahul cave, 20 km NW Ardabil, crevice in the cave ceiling, 6 June 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Shâl, 40 km SE Khalkhâl [53], ceiling of water channel under the road, 12 May 2007: coll. 1 m (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: 4 km. west of Maku [54], cave, 29 September 1962: coll. 1 fa (dry), FMNH (Lay 1967, DeBlase 1980); – 16 km. NNW Rezaiyeh [= Oromiyeh] [55], small wet cave, 4 August 1968: 1 ma, FMNH (DeBlase 1980); – 20 km. S Rezaiyeh [= Oromiyeh] [56], 9 inds. (Farhang-Azad 1970a ex DeBlase 1980), 13 inds. (Farhang-Azad 1971 ex DeBlase 1980); – 22 km. south southeast of Rezaiyeh [= Oromiyeh]* [57], 14 September 1962:

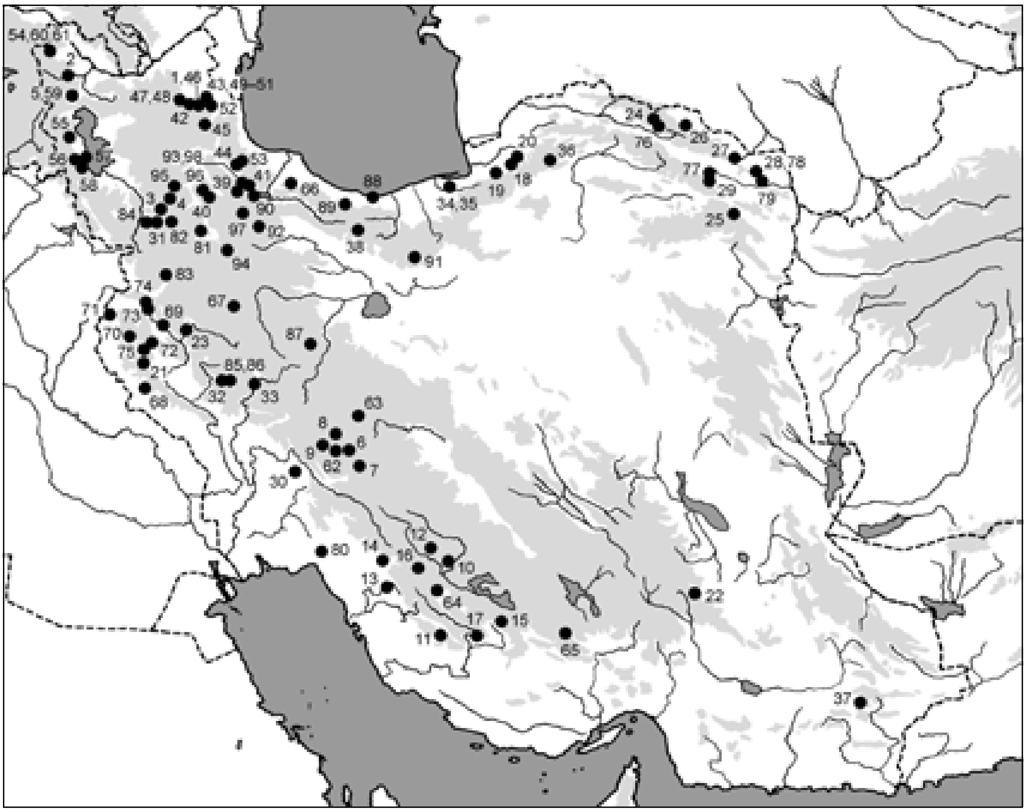

Fig. 70. Records of *Myotis blythii* (Tomes, 1857) in Iran.

1 f, FMNH (Lay 1967, DeBlase 1980); – 33 km. SSE Rezaiyeh [= Oromiyeh] [58], man-made cave, 1 August 1968: 16 m, FMNH (DeBlase 1980); – Dagbageh bei Khoi [59], 1915 [= 1905]: 2 m, NMW (Spitzenberger 1979), near Khoy, 1905: 2 m, NMW (Spitzenberger 1996); – Takhteduzi [60], 7 km NW Mâku, cave, 5 inds. (Ziâie 1996 [as *M. myotis*], cf. Sharifi et al. 2000), Takhteduzi, 7 km NW Mâku, cave (Hemmati 2001); – Zangamar River Cave at Maku [61], 25 July 1968: obs. 1 ind., 28 July 1968: net. 1 fa, FMNH (DeBlase 1980). – C h a h â r M a h â l v a B a k h t i â r i: Jangeh [62], 25 miles from Kuh Rang on Shahkord Road, 1965: 10 m, 2 f, BMNH (Lay 1967, DeBlase 1980, Fain 1982). – E s f a h â n: Derbent [= Darband] [63], 50 mi. W. of Isfahan, 6500', 14 May 1905: shot 2 ma, BMNH (Thomas 1905 [as *M. myotis*], Harrison & Lewis 1961, Benda et al. 2006, 2011c). – F â r s: near Shiraz [64], 4,750 feet, 1870: 1 ind. (Dobson 1871 [as *Vespertilio murinus*], Blanford 1876 [as *V. murinus*], cf. Kuzâkin 1950), Shiraz, Persia, 1871: 1 ind. ad, IMC (Dobson 1876 [as *V. murinus*], Anderson 1881 [as *V. murinus*]), Shiraz, 5,200', 22 June 1919: 2 m, 1 f, BMNH (Cheesman 1921 [as *M. myotis*]), flour mill 2 miles from Shiraz, 14–16 June 1920: 2 m, 3 f, BMNH (Harrison & Lewis 1961, DeBlase 1980, Benda et al. 2006, 2011c), Shiraz, 15 and 16 June 1920: 1 m, 1 f, FMNH (DeBlase 1980); – Rostâgh [65], Sahlak, Mozaffar cave, 65 km SE Dârâb (Akmali et al. 2011a); – Tâdovân [17], Tâdovân cave, 50 km NW Jahrom (Akmali et al. 2011a). – G i l â n: Elburz Mts. [66], near Resht, 400', 15 May 1907: 1 m, 1 f, BMNH (Thomas 1907 [as *M. myosotis*], Harrison & Lewis 1961, DeBlase 1980, cf. Kuzâkin 1950), Mt Elburz (Theodor 1967 [as *M. myotis*]). – G o l e s t a n: Shir Âbâd cave [20], 20 km NE Ali Âbâd, water cave, 1998: net. 26 m, 12 f [coll. 2 ma, MHNG] (Farrokhi 1999). – H a m a d â n: Ghaladidar cave [67], 20–30 inds. (Sharifi et al. 2008). – I l â m: Âsemân Âbâd [21], Tange Rad cave, 30 km N Ilâm, 14 October 2002: obs. 1 m in torpor (Akmali 2004); – small cave about 20 miles southeast of Ilam [68], 28 August 1968: exam. 15 m, 14 f (DeBlase 1971b), Porcupine Cave, 20.6 miles SE Ilam, 28 August 1968: 15 m, 14 f, FMNH (DeBlase 1980). – K e r m â n s h a h: Harasam, Biboneh cave [69], 60 km NE Eslâm Âbâd, 3 September 2002: exam. 1 m, 1 f in torpor (Akmali 2004, Akmali et al. 2011a); – Kerend cave [70], 5 km W Kerend-e Gharb (Akmali et al. 2011a); – Kilasefid cave [71], 30 km NE Qasr-e Shirin, 1 September 1999, 14 April & 19 May 2000: net. 16 m, 11 f, RUBC (Hemmati 2001); – Mâhidasht Cave [72], 30 km SW Kermânshâh, 7 June 2000: 4 m, 2 f, RUBC (Hemmati 2001), Mahidasht cave (Sharifi & Hemmati 2004), Mahidasht Cave, August 2001: colony of 350 inds. (Sharifi 2004a), Mahidasht Cave, mid-May–late August 2001: a colony of 300–350 inds. (Sharifi 2004b), Mahidasht Cave, 10 km southwest Zangolava, 15–20 June 2006: net. 3 fa, ZDNU (Karataş et al. 2008), Mahidasht cave, 2005, 2006 (Sharifi et al. 2008b), Mahi-Dasht cave in Kermanshah, 30 inds. (Vatandoost et al. 2010); – Ravânsar [73], Benjo cave, tunnel (Akmali et al. 2011a); – large cave about 15 miles northwest of Ravansar [74], 23 August 1968: obs. ca. 5,000 inds. (DeBlase 1971b), River Cave (= Korie Cowat) about 15 miles NW Ravansar, 23 August 1968: 16 m, 10 f, FMNH (DeBlase 1980); – Sharif Âbâd cave [75], 5 km S Eslâm Âbâd, 2 September 2002: net. 1 f, 1 ind. (Akmali 2004, Akmali et al. 2011a). – K h o r a s â n - e R a z a w i: Chelmir [76], along a stream, July 1968: net. 2 m, 2 f, IPHR (Farhang-Azad 1969a), July 1969: 1 ind. (Farhang-Azad 1970a ex DeBlase 1980); – 20 km. W Meshad [77], 22 July 1969: 1 m, 1 ind., IPHR (Farhang-Azad 1970a ex DeBlase 1980); – 71 km. E Meshad [78], 29–30 July 1969: 11 inds. (Farhang-Azad 1970a ex DeBlase 1980); – Mozduran [79], 4 October 1975: 1 ind., SMF (DeBlase 1980), Mozdooran, cave, 17 August 1968: 6 mummies (Steiner & Gaisler 1994, Benda & Horáček 1995, Benda et al. 2006, 2011c). – K h u z e s t â n: near Telespid [80], Shulistan, S.W. Persia, 3,200', 13 June 1902: 1 f, BMNH (Thomas 1905 [as *M. myotis*], Cheesman 1921 [as *M. myotis*], Harrison & Lewis 1961, DeBlase 1980). – K o r d e s t â n: 36 km. NE Bijar [81], cave, 20 September 1969: 3 m, UMM (DeBlase 1980); – Cara Tarik cave [82], about 20 miles north of Divandarrah, 14 August 1968: obs. 12,000 inds. (DeBlase 1971b), Cara Tarik, about 20 miles N Divandarreh near village of Qareh, 13–14 August 1968: 77 m, 215 f, FMNH (DeBlase 1980), Gara Tarik, Divândarreh, 24 July 2000: 4 m, 3 f, RUBC (Hemmati 2001); – Karaftu [31], 16 August 1968: obs. about 30 inds. (DeBlase 1971b), Karaftu, about 32 miles N Divandarreh near village of Dashbologh, 16 August 1968: 5 m, 2 f, FMNH (DeBlase 1980), Karaftu cave, 45 km NW Divândarreh, 16 April 1999: 9 m, RUBC (Hemmati 2001), Karafto cave, 2006 (Sharifi et al. 2008b); – Sanandaj [83], dark room of large mosque, 12 August 1968: 12 f, 2 f, 4 inds., FMNH (DeBlase 1980); – Zivieh Castle [84], 40 km E Saqqez, Zivieh cave, 23 July 2000: coll. 4 m, 5 f, RUBC (Hemmati 2001). – L o r e s t a n: Eshkaf Dareze Cave [85], W edge of Khurramabad, 6 September 1968: mummy of 1 ind. juv., FMNH (DeBlase 1980); – 3.2 km. NW Khurramabad [86], cave, 6 and 13 September 1968: 16 m, FMNH (DeBlase 1980). – M a r k a z i: Azad-Khan cave in Mahalat [= Senje Bâshi, 12 km W Mahallât] [87], Fall 1963: 1 f (Etemad 1967, DeBlase 1980), Âzâd Khân cave, 12 km W Mahallât, November 1964: 1 f (Etemâd 1969). – M â z a n d a r a n: 37 km. E Chalus [88], Sisangon Forest Park, 6 August 1970: net. 1 f, BMNH (DeBlase 1980); – Hotu Cave near Behshahr [34], single jaw (Coon 1952 [as *M. myotis*]); – Kelârdasht [89], crevice, 2 m, 3 f (Etemâd 1984). – Q a z v i n: Âltinkosh [90], Katale Khor cave (Âltinkosh cave), 25 km SW Rudbâr, 7 August 2008: coll. 9 m, 9 f (Hemmati 2009), Katale Khor cave (Akmali et al. 2011a). – T e h r â n: Roud-Afshan cave [91], 105 kms. east of Teheran, 3 May 1963: 4 m, 2 inds., HZM (Etemad 1967, DeBlase 1980), Rudafshân cave, 30 km SW Firuzkuh, November 1963: 6 f, 4 inds. (Etemâd 1969,

* Lay (1967: 141) specified this locality as "22 km. south southeast of Rezaiyeh", however, on p. 93 as "approximately 33 km. south-southwest of Rezaiyeh" (see below). DeBlase (1980), who revised the respective FMNH specimen, mentioned it as "22 km. SW Rezaiyeh" (p. 169) and "22 km. SE Rezaiyeh" (p. 172), differently from the versions by Lay (1967). Here, in the review of records as well as in the map of records (Fig. 70) we accepted the data from the original list of records (Lay 1967: 141).

1984). – Z a n j â n: 4 km. W Abhar [92], 9 inds. (Farhang-Azad 1971 ex DeBlase 1980); – Abbar [93], Kızılöz [= Ky--zyluzen] River, 21/22 July 2006: net. 2 fs (Karataş et al. 2008); – Amir Âbâd [94], small cave, 3 May 2009: coll. 4 m, 2 f (Hemmati 2009); – Âq Bolâq [95], 40 km W Mâhneshân, 12 May 2009: coll. 3 m, 4 f (Hemmati 2009); – Golgik cave [40], 25 km W Zanjân, 7 December 2008: coll. 1 m, 1 f (Hemmati 2009); – Mir Âkhor [96], 4 May 2009: coll. 1 m (Hemmati 2009); – Sultaniye [97], Kumbet of Molla Hasan Kâshi, 19/20 July 2006: net. 1 ma, ZDNU (Karataş et al. 2008); – Tekya Qiyasi [98], 35 km NE Zanjân, Tekya Qiyasi cave, 8 December 2008: coll. 1 m (Hemmati 2009).

Distribution. *Myotis blythii* is a very common bat in Iran, at least 98 record sites are known from the country (Fig. 70). Concerning the number of records, *M. blythii* is the second most frequently documented bat species in Iran (Table 1). Its range covers mainly the mountainous areas of the northern, western and south-western parts of the country. Most of the records (71%) originate from the relatively more humid upland areas above 1500 m a. s. l. with Mediterranean vegetation (Fig. 70), the remaining records are geographically more or less closely adjacent to this core distribution area. *M. blythii* is the most widespread true Mediterranean element within the Iranian bat fauna, its range perhaps delimits the widest extent of distribution of such faunal types among Iranian bats.

Fig. 71. Portrait of *Myotis blythii* (Tomes, 1857) from Hesar (Fars). Photo by A. Reiter.

DeBlase (1980) summarised 32 known sites of *M. blythii* occurrence from Iran (Table 1), and the range delimited by these localities roughly corresponds with that presented here, which shows three times higher number of record sites. However, the new records not only extensively concentrate the known occurrence in the previously reported range (namely in western and north-western regions of Iran as well as in the Fars province), but also significantly enlarge the area of occurrence southeast of the Zagros Mts. (Fig. 70). *M. blythii* is here reported for the first time from the Kerman province and from Baluchestan and the species range in the Middle East has extended for more than 900 km to the southeast compared the review by DeBlase (1980). The Baluchestani record of osteological remains from Mach Gur currently represents the southernmost record within the whole species distribution range (Harrison & Bates 1991, Bates & Harrison 1997).

M. blythii is the south-Palaearctic faunal element, distributed from the European Mediterranean (with extension to Central Europe) over the Middle East to Turkestan, Kashmir and north-eastern China (Horáček et al. 2000). The Iranian range continues to the abundant occurrence in Turkey and Transcaucasia in the west and northwest as well as to Afghanistan and West Turkestan in the east and northeast (Harrison & Bates 1991, Bates & Harrison 1997).

FIELD NOTES. In Iran, *Myotis blythii* was recorded most frequently in or at its roosts, only few findings represent bats in their foraging habitats; a relatively large proportion of the records (almost one fifth of the total number) are findings of osteological remains in owl pellets and cave deposits.

Caves are the absolutely prevailing type of *M. blythii* roost in Iran, serving as roosts of maternity colonies, hibernacula as well as roosts used in the transient periods of the year. Despite the high number of cave records, only some of them can be attributed to nursery colonies with a certain probability. One of undoubted findings of a nursery roost was reported by DeBlase (1980) in the Eshkaf Dareze cave at Khoramabad (Lorestan). DeBlase (1980: 174) described the record as well as the roost itself as follows: "On 6 September [1968] I found one mummified *M. blythi* in the guano on the floor of Eshkaf Dareze, a large but shallow cave in the mountainside at the northwest edge of Khurramabad. Mummies of four immature *R. mehelyi* [= *Rhinolophus euryale*, see above and DeBlase 1972] were also found. […] only one live bat, *R. ferrumequinum*(?), was seen […]." (pp. 330–331): "The cave is relatively small […]. The large entrance room opened into a ledge to the left. There were a few cave formations and some dripping water in the central area of this inner room. A thin layer of bat guano covered all surfaces to the left and right of the central area. […] In this left-hand chamber we also found a single, mummified, prevolant *M. blythi* among the guano on the floor. […] The cave was apparently a nursery site […]." Numerous authors (Hemmati 2001, Sharifi 2004a, b, Sharifi & Hemmati 2004, Karataş et al. 2008, Vatandoost et al. 2010) reported a series of records of *M. blythii* from the Mahidasht cave near Kermanshah (Kermanshah) (later on, the cave was destroyed due to mining activities; Akmali et al. 2011a), suggesting year-round occupancy of this roost except for the hibernation period (cf. Sharifi 2004b); among them, Hemmati (2001) collected a series of bats from this cave in June 2000 and Sharifi (2004b) reported an aggregation of 300–350 bats from there, observed in the period from May to August 2001. Since Sharifi (2004b) described the postnatal growth of juveniles of *M. blythii* observed on the free-living population of this cave, the cave certainly represents a nursery roost.

Other presumable records of *M. blythii* nursery colonies are findings of aggregations in the nursing period of the year, from late April to early August (see the review by Topál & Ruedi 2001). Hemmati (2001) collected a series of 27 bats by hand-net during three visits of the Kilasefid cave near Qasr-e Shirin (Kermanshah) including two in April and May 2000; at that time, a nursery colony could have occupied the cave. Such assumption is related also to the records of nine *M. blythii* collected from the Zivieh cave in the Zivieh castle near Saqqez (Koredestan) in July 2000 (Hemmati 2001), a series of 32 bats from the Zolaikha crevice near Hasan Abad (Chahar

Mahal va Bakhtiari) in summer 2001, a colony observed in the Tange Rad cave at Aseman Abad near Ilam (Ilam) in May and July 2003, a colony of some 80 bats observed in the Darre Duali cave near Shahr-e Kord (Chahar Mahal va Bakhtiari) on 7 May 2010, and/or a colony of some 2000 bats composed of *M. blythii* and *Rousettus aegyptiacus* in the large cave above the Sasan spring at Bishapur near Kâzerun (Fars) on 21 April 2000 (for description of the cave see under *R. aegyptiacus*). All these records most probably represent maternity roosts of *M. blythii*, although the direct evidence of pregnant females and/or females with juveniles is not available from the respective sites. DeBlase (1971b) reported a large aggregation of *M. blythii* from the "Cara Tarik" cave 20 miles north of Divandarreh, later named Gara Tarik (DeBlase 1980, Hemmati 2001); DeBlase (1980: 173) described the record as follows: "On 13 and 14 August [1968] a sample of 292 was collected from the estimated 12,000 *M. blythi* inhabiting Gara Tarik. This sample included 215 females and 77 males. If we assume a litter size of one, this ratio of about three to one is what would be expected in a nursery colony containing only females and young. Most of these bats hung with *Miniopterus schreibersi* [= *M. pallidus*] and *R*[*hinolophus*]. *mehelyi* in large clusters that carpeted areas of the cave ceiling. However, numerous *M. blythi* hung singly or in pairs […]. All of the *M. blythi* appeared to be in deep torpor." (for description of the cave see under *Rhinolophus mehelyi*). Although the visit of the cave was made in mid-August, i.e. in the period of a year when the existence of nursery colonies is no longer expected, from the description it seems to be clear that the cave contained a rest of a nursery colony along with pairs reproducing adults; this is the largest aggregation of *M. blythii* known from Iran and perhaps also from the Middle East as well. DeBlase (1971b: 39) described in detail the examination of the aggregation as follows: "numerous bats hung singly and several were observed to hang in pairs. I examined six of the hanging pairs of *M. blythi* […]. Each of these pairs included one male and one female and they always hung with the male's ventrum in contact with the female's dorsum. All of the *M. blythi* observed appeared to be quite torpid and there was no evidence of copulation." DeBlase (1971b) found another similarly extensive cave aggregation of *M. blythii* with a similar arrangement of roosting bats in the River cave (or Korie Cowat cave) near Ravansar (Kermanshah); the record was described by DeBlase (1980: 174) as follows: "On 23 August [1968] we visited a large cave named Korie Cowat […] that has a large, fast stream nearly filling the bottom cave. We observed approximately 5,000 *M. blythi* and 3,000 *M. schreibersi* [= *M. pallidus*]. Most of these bats hung in dense curtains over portions of the stream that were too deep to allow us to approach. Sixteen male and 10 female *M. blythi* were collected from the approximately 1,000 individuals that hung singly or in pairs in accessible areas. All bats appeared to be in deep torpor." It should be noted that DeBlase (1980: 317) mentioned different numbers of the respective species to be found in the Korie Cowat cave: "I estimated the numbers we had observed as 7,000 *M. blythi* and 1,000 *M. schreibersi*." (for the description of the cave see under *Miniopterus pallidus*).

The most numerous group of records of *M. blythii* from Iran includes findings of rather smaller groups or even single individuals in caves. Lay (1967) found one female of this bat in a dry shallow cave 4 km west of Maku (Azarbaijan) on 29 September 1962. Etemad (1967) reported records of *M. blythii* from the Roud-Afshan cave east of Teheran (Tehran) and the Azad-Khan (= Senje Bashi) cave near Mahalat (Markazi); DeBlase (1980) specified these findings as six individuals collected on 3 May 1963 and one female in autumn 1963, respectively. However, Etemâd (1969) mentioned these records as ten bats collected in November 1963 and one female in November 1964, respectively; both findings thus probably represent hibernation records. Another hibernation record was most probably made in the Tekya Qiyasi cave near Zanjan (Zanjan) by Hemmati (2009) who collected one male there on 8 December 2008.

A group of some 50 bats was recorded by DeBlase (1980: 174–175) in a cave near Khoramabad (Lorestan): "On 6 and 13 September [1968] *M. blythi* were collected from a large cave located about 3.2 km. NW Khurramabad […]. The 16 males were collected from approximately 50 that hung singly in a low side tunnel. The cave's main chamber is a large room, most of which was in the twilight zone. On the ceiling, about 100 ft. above the cave floor, were two large clusters of several hundred *M. blythi* each. On the higher portions of the walls and lower portions of the domed ceiling, individual *M. blythi* hung on spaced patches of crystallized urine […]. A sample of about 20 of the lowest of these yielded only males. We were unable to reach the large clusters to determine if females were present in these. All *M. blythi* appeared to be in torpor, but about 12 *R. ferrumequinum* also inhabiting the cave were very active." (for the cave description see under *Rhinolophus ferrumequinum*). DeBlase (1971b) recorded 29 bats in a cave near Ilam which he named Porcupine cave (Ilam); the finding as well as the cave were described by DeBlase (1980: 174) as follows: "On 28 August we found 29 *M. blythi* in a small, damp [Porcupine] cave about 32 km. E Ilam. This population included 15 males and 14 females. The extra male hung above the others, which all hung in bisexual pairs. All bats appeared to be in torpor and no other species were seen." (pp. 305–306): "On 28 August [1968] we visited Porcupine Cave, about 33 km. SE Ilam. […] The cave entrance and entrance passage are triangular, about 3 m. wide at the floor with the apex about 2.5 m. high […]. This triangular passage continues for several meters and then opens into a larger room […] that has limestone cave formations. One *Myotis blythi* was found in this room. Two crawlways open off the rear of this room. The one to the right slopes down a few meters to a small circular chamber where it ends. The one to the left extends for a few meters to a narrow passage that runs at right angles to the crawlway. This passage ends within a few meters the crawlway in either direction. Twenty-eight *M. blythi* hung in this passage. The floor of the cave was covered with quite a bit of old dried guano, and many areas had a thin layer of fresh droppings. The cave was quite warm and humid. The temperature in the passage where most bats were collected was 69°F [= 20.6° C] and the relative humidity was 90 per cent." Smaller groups of *M. blythii* were recorded several times in the Karaftu cave near Takab (Kordestan; Figs. 31–33); the first record was reported by DeBlase (1980: 173) as follows: "On 16 August [1968] we collected five male and two female *M. blythi* from the approximately 30 of the species while they hung singly or in pairs in the large, dark, wet cavern area of Karaftu, an abandoned cliff dwelling and cavern complex. All *M. blythi* observed appeared to be in deep torpor." Nine males were collected in the Karaftu cave by Hemmati (2001) on 16 April 1999, and three individuals were observed in this cave on 18 October 2011; the latter observation represented torpid bats. This unusual combination of a natural cave and an artificial shelter – from which the bats used the natural part – was described by DeBlase (1980: 327–330) as follows: "a chalky yellow cliff […] containing the cave and cliff-dwelling complex called Karaftu. The chalk had been carved into numerous rooms […]. We counted 14 but there were several more. These had numerous doors and windows opening to the exterior […] and most were quite hot and light. There were ornately carved window frames and stairs leading from level to level. […] Near the center of the complex a very tall, relatively narrow passage appeared to be the natural portion of the inhabited area [of the complex]. In places in this passage beam pockets had been carved into the sides of the walls and presumably had supported a now-gone second floor. […] we went left through a tunnel that had water standing in places. We were now in normal limestone solution cave. We emerged into a very large room containing scattered single individuals and pairs of *M. blythi* and scattered single *M. schreibersi* [= *Miniopterus pallidus*]. A few bats were flying but most were in torpor. [… The way] led down into another very large room at a much lower level. The approach was very steep and slippery so we did not descend, but several bats were observed flying and a few scattered torpid bats were seen on the ceiling of this lower room. [… In other room] there were a few pools of water and many old formations, including flowstone curtains, pillars, stalactites, stalagmites, and rimstone pools. […] The temperature in the large room was 58°F [= 14.4 °C] and the relative humidity was 83 per cent. Strong air currents were detected in many parts of the cave […]. Apparently this cave had been a major summer roost, and probably a nursery colony, for bats in the past."

DeBlase (1980: 170) collected one adult male of *M. blythii* "in small solution hole in ceiling of a small wet cave" 16 km north-north-west of Oromiyeh (Azarbaijan) on 4 August 1968 (for details see also under *Rhinolophus ferrumequinum*); this author also reported collection of three male *M. blythii* from a cave north-east of Bijar (Kordestan). At least on two occasions individuals from the Mozduran cave near Mash'had (Khorasan) were collected, six mummies were found on 17 August 1968 (Steiner & Gaisler 1994) and one individual on 4 October 1975 (DeBlase 1980). Etemâd (1984) collected five bats from a crevice at Kelardasht (Mazandaran). Ziâie (1996) and Hemmati (2001) reported on their findings of several individuals in a cave at Takhteduzi near Maku (Azarbaijan). The HMNH and MHNG collections contain *M. blythii* specimens collected in the Shir Abad water cave near Ali Abad in 1997, 1998 (cf. Farrokhi 1999), and 1999. Akmali (2004) reported on the records of torpid individuals in two caves in western Iran, a male was observed in the Tange Rad cave at Aseman Abad near Ilam (Ilam) on 14 October 2002 and a male and a female were found in the Biboneh cave at Harasam near Eslam Abad (Kermanshah) on 3 September 2002. Hemmati (2009) reported on cave records of *M. blythii* from north-western Iran, six bats were collected from a small cave at Amir Abad (Zanjan) on 3 May 2009, 18 bats in the Katale Khor cave or Altinkosh cave near Rudbar (Qazvin) on 7 August 2008 (the same site was mentioned without other details also by Akmali et al. 2011a), and two bats in the Golgik cave near Zanjan (Zanjan) on 7 December 2008. From the latter cave, single individuals were additionally recorded on 7 May 2008 and 28 September 2009. A series of records of single individuals of *M. blythii* in their roosts from the Ardabil province was mentioned by Sheikh-Jabbâri (2008),

Fig. 72. A valley near Chenarbu in the mountain ranges of north-eastern Khorasan, a foraging site of *Myotis blythii*, *Hypsugo savii*, and *Pipistrellus pipistrellus*. Photo by P. Benda.

four of them come from natural shelters (most of them from artificial ones, see below); one male was found in the Ada Kahuli cave at the Daraq ruin near Meshginshahr on 13 May 2006, another male in the Qaranukh Kahul cave at the Daraq ruin on 17 May 2006, one male in a crevice in the Qorban Darasi valley at the Daraq ruin on 17 May 2006, and one male in the Öch Otaqli Kahul cave at Samarin near Ardabil on 6 June 2006.

One male of *M. blythii* was hand-netted in the Moghan cave near Mash'had (Khorasan) in October 1999. One bat in torpor was observed in the Sam cave at Namnik near Minoodasht (Sem- nan) on 19 October 2010 and another one in the Kharmanesar cave at Shahneshin near Abbar (Zanjan) on 27 September 2009. Fifteen bats in deep torpor were found in the Sarab cave at Omid Abad near Shahr-e Kord (Chahar Mahal va Bakhtiari) on 13 August 2010. One female in torpor was found in the Dashkahul cave at Dashkasan near Meshginshahr (Ardabil) on 29 September 2011 (Fig. 200). A group of some 30 individuals of *M. blythii* were observed in the rather complex Tadovan cave near Jahrom (Fars) on 7 October 2011 (for description of this cave see under *Rhinopoma microphyllum*; see Figs. 43, 44); *M. blythii* was reported from this cave also by Akmali et al. (2011a). The latter authors reported *M. blythii* to roost also in three other caves, however, they did not specify the date or season of their records neither details concerning the records (number, sex and/or age of the recorded bats).

A minority of roosts of *M. blythii* in Iran is represented by artificial shelters; however, most of these man-made roost opportunities differ from the natural ones only in their origin, not in their roost conditions which more or less resemble natural underground spaces. Anyway, from Iran, there is no evidence of the synanthropic roosting known from Europe (namely its central part, see Topál & Ruedi 2001) where single individuals or colonies of *M. blythii* occupy attics of buildings.

However, two exceptional records from buildings were published; DeBlase (1980: 168) reported five BMNH specimens "caught in a flour mill 2 miles from Shiraz" [Fars] in mid-June 1920 (the specimens were previously mentioned by Harrison & Lewis 1961, but they did not give any details on the collection). Another such record was reported by DeBlase (1980: 172–173) from Sanandaj (Kordestan) as follows: "On 12 August 1968 in Sanandaj I collected 15 of the 17 to 20 *M. blythi* found hanging in several, small, brick domes of a dark, unused storeroom in the mosque. The 12 males, two females and one of undetermined sex, hung singly or in groups of two to three in the crevices between bricks but flew readily when we approached them. In another room of this mosque I found skeletons of *M. blythi* hanging on a side wall. These three hung in close contact in a normal roosting position […]."

Two records of *M. blythii* in artificial caves were made in the vicinity of Oromiyeh (Azarbaijan); one of them was reported by Lay (1967: 93) as follows: "Approximately 33 km. south-southwest of Rezaiyeh [= Oromiyeh] we visited a region of smoothly-rounded mountains covered with low, desiccated grass. Stubble fields and tracts broken for planting wheat patch-worked the mountainsides. […] A small man-made room cut into solid rock housed one *Myotis blythi* [on 14 September 1962], and people who lived nearby stated that "thousands" of bats sometimes occupy this refuge." Another report was made by DeBlase (1980: 172): "On 1 August 1968 I visited the man-made cave which was 22 km. SE Rezaiyeh [= Oromiyeh] and from which Lay (1967) collected one adult male on 14 September 1962. I found it inhabited by 20 *M. blythi*. These bats were alert and flew readily when we entered the room. All 16 collected bats are adult males." Surprisingly, although originally the localisations of these roosts were noted quite differently (see Records and footnote there, p. 285), DeBlase (1980) considered both of them as one site. Seven *M. blythii* were found to roost (along with one *Plecotus macrobullaris*) in the ruins of Takht-e Soleyman near Takab (Azarbaijan) on 3 October 1998 (Fig. 87), they were taken from fissures between stones or bricks in vaulted corridors leading from the walled area of the monument. Seven records of *M. blythii* individuals from artificial roost conditions were reported by Sheikh-Jabbâri

(2008) from the Ardabil province in different seasons of the year, all of them from fissures in the ceilings of water channels under a road; in six cases only single males were found, while at Niaz near Meshginshahr, two males and one female were recorded on 18 July 2006.

At several sites in Iran, remains of *M. blythii* in cave deposits were collected; the first such evidence was made in the sulphuric caves at Qutur Su (Ardabil) in 1961 (Harrison 1963), one mummified male was found there along with 16 specimens of other five bat species (see Table 24). This site represents an unusually positioned and acting trap for animal life in the Sabalan mountains – the bats and other animals which visit the cave are "overcome by the sulphur fumes in the cave" (Harrison 1963: 301); see under *Eptesicus bobrinskoi* for more details. Skeletal remnants of *M. blythii* were found twice in the Hotu cave near Behshahr (Mazandaran); the first specimen was reported from this cave by Coon (1952), two other skeletons were found there on 14 May 1997 (for description of the cave see Coon 1952). Bone remains of one individual were collected in the Cave I at Kulak near Shemshek in the Alborz Mts. (Tehran).

Roughly in a half of the roosts, *M. blythii* was found to share its shelter with other bat species. At least four bat species were collected from the Mozduran cave on 4 October 1974 (Felten et al. 1977, Kock 1983); in addition to *Myotis blythii*, also *Rhinolophus ferrumequinum*, *R. euryale*, *R. blasii*, and *Miniopterus pallidus*. Steiner & Gaisler (1994) found two species there on 17 August 1968, *M. blythii* and *M. pallidus*. Five bat species were reported by Etemad (1967, 1984) from the Azad-Khan cave, however, it is not clear whether all of them were present in the cave during the same visit; viz. *M. blythii*, *R. ferrumequinum*, *R. hipposideros*, *Barbastella darjelingensis*, and *M. pallidus*. Colonies of five species of bats were found also in the large cave above the Sasan spring at Bishapur during the visit in 2011, besides the colony of *M. blythii* also of *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. muscatellum*, and *M. pallidus*. Aggregations of five bat species were also documented from the Tadovan cave on 7 October 2011, *M. blythii*, *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus blasii*, and *M. pallidus*. The destroyed Mahidasht cave served as a roost of five bat species, *Rhinolophus mehelyi*, *M. blythii*, *M. capaccinii*, *Miniopterus pallidus*, and *Pipistrellus pipistrellus*, with an estimated total population of about 3000 bats. Three bat species besides *M. blythii* were documented from the Sarab cave at Omid Abad, *Rhinolophus ferrumequinum*, *R. hipposideros*, and *M. pallidus*.

A community of three species of bats was documented in the Karaftu cave on 18 October 2011, where *R. ferrumequinum* and *M. pallidus* were found along with *M. blythii*. In the Golgik cave, *M. blythii* was collected together with *Rhinolophus blasii* and *Plecotus macrobullaris*. DeBlase (1980) reported findings of three species in the Gara Tarik cave, besides *M. blythii* also *R. mehelyi* and *M. pallidus*.

In several sites, *M. blythii* shared its roost with one additional bat species. During the same visit, co-roosting with *Miniopterus pallidus* was found in three caves, viz. in the River (= Korie Covat) cave (DeBlase 1980), Darre Duali cave, and Kharmanesar cave. Only *Rhinolophus ferrumequinum* was found simultaneously with *M. blythii* in the wet cave near Oromiyeh and the cave at Khoramabad (DeBlase 1980); and only *Rhinolophus mehelyi* in the Zivieh cave (Hemmati 2001) and Tange Rad cave (Akmali 2004). DeBlase (1980) discovered mummies of *M. blythii* and *R. euryale* in one guano deposit in the Eshkaf Dareze cave. Sheikh-Jabbâri (2008) reported *M. blythii* and *Myotis schaubi* roosting commonly in a water channel at Shâl near Khalkhâl. *M. blythii* and *Rhinolophus hipposideros* were simultaneously collected in the Moghan cave near Mash'had.

In summary, *M. blythii* was found to share its roosts with an enormous number of 14 bat species (the second position after *Miniopterus pallidus* with 15 co-roosting species). Majority of sharings, three sites or more, were found only for five species, viz. (ordered by frequency) *Miniopterus pallidus* (12 roosts), *Rhinolophus ferrumequinum* (6), *R. mehelyi* (4), *R. hipposideros* (3), and *R. blasii* (3).

Several times, *M. blythii* was netted at the entrances to caves and other roosts. DeBlase (1980: 172) reported netting of one *M. blythii* at the Zangamar river cave at Maku (Azarbaijan) as follows: "On the afternoon of 25 July 1968 I observed a *M. blythi* in a deep tight hole in the ceiling near the entrance of a small cave, near the Zangamar River at the east edge of Maku. On the evening of 28 July I mistnetted the entrance of this cave and collected an adult female *M. blythi* as it attempted to fly out at 10:50 P.M. Lay (1967) had collected in this cave on 2 and 6 October 1962 and had found *Miniopterus* and two species of *Rhinolophus*, but no *M. blythi*." Along with *M. blythii*, one individual of *Hypsugo savii* was also netted. Akmali (2004) caught two individuals of *M. blythii* into a harp-net at the Sharif Abad cave near Eslam Abad (Kermanshah) on 2 September 2002. *M. blythii* were netted at two sites near Shahr-e Kord in the Chahar Mahal va Bakhtiari province, two males were caught at an irrigation tunnel near Katak on 13 August 2010 and 14 bats were netted at the Sarab cave near Omid Abad in the summer 2001; during the latter netting session, also *Rhinolophus ferrumequinum* and *Miniopterus pallidus* were caught. Using a mist-net installed in a vaulted corridor leading from the walled area of the monument of Takht-e Soleyman (Azarbaijan), three males of *M. blythii* were captured on 3 October 1998, along with *Myotis schaubi* and *Plecotus macrobullaris*. Twelve males were netted at the entrance to a small cave at Deh Bakri near Bam (Kerman) on 8 April 2000 (Fig. 129); *Rhinolophus ferrumequinum* and *Eptesicus anatolicus* were caught there along with *M. blythii*. Four females were caught into a net stretched across a huge but shallow rocky overhang in the wall of the canyon of a large river at Serizjan, north of Firuz Abad (Fars) on 21 April 2000 (along with one *Tadarida teniotis*). One individual was netted and calls of several other recorded at a small cave in a rocky wall at Shangar near Shiraz (Fars) on 22 April 2000. Nine *M. blythii* emerging from the Tadovan cave (Fars) were netted in front of the cave on 7 October 2011, in this evening also *Rhinopoma microphyllum*, *R. muscatellum*, *M. capaccinii*, and *Miniopterus pallidus* were captured there.

At only several sites, individuals of *M. blythii* were recorded in their foraging habitats. The first such record was indirectly reported by Thomas (1905), who described the subspecies *Myotis myotis omari* [= *M. blythii*, see below] on the basis of two adult males "shot from trees near the village" of Derbent near Esfahan on 14 May 1905 (DeBlase 1980: 168); one *Pipistrellus pipistrellus* was also collected on this occasion. Farhang-Azad (1969a, 1970a) netted four individuals of *M. blythii* in July 1968 and one individual in July 1969 along a stream at Chelmir in the Kopetdagh Mts. (Khorasan); during these two netting sessions, extremely rich bat assemblages were recorded, composed also of *Rhinolophus ferrumequinum*, *R. blasii*, *Myotis emarginatus*, *Eptesicus serotinus*, *E. ognevi*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Nyctalus leisleri*, *Otonycteris leucophaea*, *Miniopterus pallidus*, and *Tadarida teniotis*. DeBlase (1980: 170) reported one female *M. blythii* "mist-netted over scrub on sand dunes" in the Sisangon Forest Park near Chalus (Mazandaran) on 6 August 1970. Two females were caught into a net above the Kyzyluzen river at Abbar (Zanjan) on 21–22 July 2006 (Karataş et al. 2008). An adult male was netted above a shallow stream in the valley west of Chenarbu near Qalandar Abad (Khorasan) on 17 May 2006 (Fig. 72); one *Pipistrellus pipistrellus* was also netted there and calls of *Hypsugo savii* recorded. Two females of *M. blythii* were caught into a net above a haunt for livestock in the dry steppe valley at Bazangan near Mazdavand in the eastern part of the Kopetdagh Mts. (Khorasan) on 18 May 2006; calls of *Eptesicus serotinus* and *Pipistrellus pipistrellus* were recorded during the same evening. One male was netted over a small creek in the pasture valley south-west of Tahir Abad near Mashhad, on the northern slope of the Kopetdagh Mts. (Khorasan) on 21 May 2006 (Fig. 132); besides *M. blythii*, also *Eptesicus serotinus*, *E. ognevi* and *Tadarida teniotis* were netted there and calls of *Pipistrellus pipistrellus* recorded. Twenty-one adult *M. blythii* were netted above a pool at a thermal spring situated in a small valley south of Mina on the northern slope of the Kopetdagh Mts. near Dargaz (Khorasan) on 22 May 2006; the site was ringed by several trees and a small area of riparian vegetation, while the surrounding landscape by dry steppes and pastures (*Hypsugo savii* and *Miniopterus pallidus* were also netted there). One *M. blythii* was captured into a net over a small stream in a broad valley at Dorbadam near Bajgiran on the southern slope of the western Kopetdagh Mts. (Khorasan) on 23 May 2006 (Fig. 214); one *Pipistrellus pipistrellus* and one *Tadarida teniotis* were netted there along with *M. blythii*. Seven individuals of *M. blythii* were netted above a stream passing through an exploited lowland beech forest at Ali Abad (Golestan) (Fig. 76) on 28 May 2006; during this netting session, also *Myotis bechsteinii*, *M. nattereri*, *M. emarginatus*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Eptesicus serotinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri* were caught. An adult male of *M. blythii* was caught into a net installed above a small stream in a pasture valley near Hesar (Fars) on 5 October 2011 and calls of other foraging individual were recorded around (Fig. 143); *Hypsugo savii*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis* were netted along with *Myotis blythii* at the site.

Several direct observations concerning the reproduction of *M. blythii* are available from Iran. Pregnant females were caught at two sites, females in the lactation stage also at two sites. Four pregnant females were netted at Serizjan (Fars) on 21 April, each containing one foetus of the crown-rump length of 11.2–25.7 mm (mean 18.8 mm). Another pregnant female was captured at Ali Abad (Golestan) on 28 May; it contained one foetus of the crown-rump length of 12 mm. Two and twenty lactating females, respectively, were recorded at two sites in Khorasan (Bazangan, Mina) on 17 and 22 May. Sharifi (2004b: 285), describing postnatal development in *M. blythii* in the maternity colony in the Mahidasht cave (Kermanshah), mentioned besides other things: "Although most of the females gave birth within 5–7 days starting on 15th of May, four individuals gave birth during the three weeks thereafter. […] All females collected with young had single offspring. […] The young were able to flutter and glide when dropped from hands at 21 days of age. At 30 days of age they were able to fly freely inside the cave. […] At the age of 50 days most of the young had started to forage […]." These data indicate different timing of parturitions in different parts of Iran; southern (Fars), western (Kermanshah) and north-eastern (Golestan, Khorasan) provinces of the country. While in the south parturitions occur perhaps at the break of April/May or in early May, in the west they occur in the second half of May, and similarly also in the north-east, where the females seem to give birth in late May and early June. The latest terms from north-eastern Iran conform to the data described from Turkey and are slightly earlier than parturition terms reported from Europe (see the review by Topál & Ruedi 2001).

DeBlase (1980: 175–176) summarised the data concerning ecology and phenology of the Iranian populations of *M. blythii* as follows: "The caves and mosque from which I collected on 1, 4, and 12 August [1968] and Lay [1967] collected on 14 and 24 September [1962] appear to be bachelor colonies used exclusively or primarily by males. These are probably not used as hibernacula, since only one specimen was present at 22 km. SE Rezaiyeh on 14 September [1968] and none was present at Maku on 2 and 6 October [1962]. The sex ratio and amount of guano at Gara Tarik indicate that this cave is a nursery site. Korie Cowat, visited on 16 August [1968] it appears as though there is also a nursery, but, if it is, most of the bats had already left for hibernacula by 16 August. The cave visited on 28 August [1968] may be a hibernaculum or merely a transient rest stop. […] The Khurramabad cave visited on 6 September [1968] is probably a nursery site, as shown by the large amount of guano and the mummified bats. The nearby cave visited on 6 and 13 September [1968] probably serves as a hibernaculum and may double as a nursery. The evidence from Gara Tarik and the numerous more northerly all-male roosts strongly indicates that in Iran the sexes of *M. blythi* segregate during the breeding season. Adult males select summer roosts in twilight areas of small, relatively dry caves and cave-like buildings, whereas nursery colonies of females utilize large, relatively damp caves."

Little can be added to this summary besides the above mentioned data on reproduction. The documented nettings of *M. blythii* indicate the annual span of flight activity and thus also the span of hibernation of this species in Iran. At the cave entrances, flying individuals were recorded at least eight times between 8 April and 7 October, at the foraging grounds at least ten times between 14 May and 5 October. Based on these findings as well as on the findings of pregnant females (see above), the rough maximum span of the hibernation period of *M. blythii* in Iran seems to be from mid-October to the end of March (approximately conforming to the European populations; cf. Topál & Ruedi 2001), although in southern Iran it could be even shorter.

Bone remains of *M. blythii* were found in pellets of three owl species originating from 15 sites throughout Iran. It is the most frequently found bat in owl diet in the country; remains of *M. blythii* represent one third of all bat remnants found in owl pellets from Iran (Table 40). *M. blythii* was most frequently found in the pellets of *Bubo bubo*, remains of altogether 34 individuals were found in 13 sites – Bastam and Chuplu (Azarbaijan), Mach Gur (Baluchestan), Bishapur, Dashtak, Sarvestan, Shangar, and Sivand (Fars), Deh Bakri (Kerman), Sarkan (Khuzestan), Lenje Abad and Gholaman (Lorestan), and Badamstan (Zanjan); these remains made up 0.08–25.0% of all prey items (0.1–50.0% of mammal items) in the respective samples and 0.43% of all prey items (0.56% of mammal items) in the whole analysed eagle owl diet from Iran. One left and two right mandibles and three fragments of skulls, representing two individuals of *M. blythii*, were found in pellets of *Strix aluco* collected from the large cave above the Sasan spring at Bishapur (Fars) on 21 April 2000 (Obuch 2011); these remnants made up 1.01% of all prey items (and 8.33% of mammal items) in the respective sample and 0.30% of all prey items (0.75% of mammal items) in the whole analysed diet of the tawny owl from Iran. One right and three left mandibles and two skull fragments of *M. blythii* (i.e. from three bats) were discovered in *Tyto alba* pellets collected at Bisotun (Kermanshah) on 7 October 1998 (Obuch & Khaleghizadeh 2011); they represented 1.07% of all prey items (and 1.20% of mammal items) in the respective sample, and 0.14% of all prey items (0.18% of mammal items) in the whole analysed diet of the barn owl from Iran. From the Middle East, evidence of *M. blythii* in owl diet was previously available from Turkey, Syria, Jordan, and Israel (Nadachowski et al. 1990, Obuch 1994, 2011, Benda & Horáček 1998, Benda et al. 2006, 2010, Obuch & Benda 2009). Strelkov et al. (1978) reported a large proportion of *M. blythii* remains in the pellets of *Falco naumanni* collected at the Baharden [= Baharly] cave on the Turkmenistani side of the Kopetdagh Mts. in May 1967.

Material examined. 5 ♂♂, 2 ♀♀ (NMP 90848, 90851–90854 [S+A], NMP 90849, 90850 [A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda, & A. Reiter; – 2 ♂♂, 12 ♀♀ (ZIN 11227, 11234, 11257, 11275, 11276, 11292, 11294, 11307–11310, 11316, 11325, 11326 [S]), Astrabad' [= Gorgan, Golestan Prov.], 20–30 April 1914, leg. A. I. Kiričenko; – 2 inds. (JOC unnumbered [Sf]), Bastam (Azarbaijan-e Gharbi Prov.), 30 September 1998, leg. J. Obuch; – 2 ♀♀ (NMP 90777, [S+A], NMP 90778 [A]), Bazangan (Khorasan-e Razawi Prov.), 17 May 2006, leg. P. Benda & A. Reiter; – 8 inds. (JOC unnumbered [Sf]), Bishapur (Fars Prov.), 21 April 2000, leg. J. Obuch; – 3 inds. (JOC unnumbered [Sf]), Bisotun (Kermanshah Prov.), 7 October 1998, leg. J. Obuch; – 1 ♂ (NMP 90775 [S+A]), Chenarbu (Khorasan-e Razawi Prov.), 17 May 2006, leg. P. Benda & A. Reiter; – 1 ind. (JOC unnumbered [Sf]), Chuplu (Azarbaijan-e Gharbi Prov.), 2 October 1998, leg. J. Obuch; – 2 ♂♂ (NMW 23474, 23475 [S+A]), Dagbageh bei Khoy [Azarbaijan-e Gharbi Prov.], 1905, leg. E. Zugmayer; – 1 ♀ (NMP 94108 [S+A]), Dashkahul cave, Dashkasan (Ardabil Prov.), 29 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 9 inds. (JOC unnumbered [S+Sk]), Dashtak (Fars Prov.), 3 May 1996, leg. J. Obuch; – 10 ♂♂ (NMP 48355–48362 [S+A], NMP 48353, 48354 [A]), Deh Bakri (Kerman Prov.), 8 April 2000, leg. P. Benda, J. Obuch & A. Reiter; – 1 ind. (JOC unnumbered [Sf]), Deh Bakri (Kerman Prov.), 7 April 2000, leg. J. Obuch; – 1 ♂ (BMNH 5.10.4.14 [S+B], holotype of *Myotis myotis omari* Thomas, 1905), Derbend, 6500 ft, 60 miles W of Isfahan [Esfahan Prov.], 14 May 1905, leg. R. Woosnam; – 1 ind. (ZFMK 85.162 [S+Sk]), Elburs, Höhle I b. Koolak (Strasse nach Shemshak) [Tehran Prov.], 24 June 1978, collector unlisted; – 1 ♂ (HMNH 2009.46.1. [A]), Golgik cave [Zanjan Prov.], 7 May 2008, collector unlisted, don. F. Hemmati; – 1 ♂ (NMP 93868 [S+A]), Hesar (Fars Prov.), 5 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 5 inds. (JOC unnumbered [Sf]), Izeh (Khuzestan Prov.), 13 October 1998, leg. J. Obuch; – 1 ♂, 11 ♀♀ (NMP 90815–90823 [S+A], NMP 90812–90814 [A]), Mina (Khorasan-e Razawi

Table 12. Basic biometric data on the examined Iranian samples of *Myotis blythii* (Tomes, 1857), *M. bechsteinii* (Kuhl, 1817), and *M. emarginatus* (Geoffroy, 1806). For abbreviations see p. 171

	Myotis blythii					*Myotis bechsteinii*					*Myotis emarginatus*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	52	**75.0**	68	81	3.061	10	**50.7**	48	55	2.584	5	**52.4**	49	56	3.050
LCd	51	**63.7**	49	71	3.886	10	**49.0**	45	52	2.357	5	**48.0**	43	52	4.183
LAt	65	**60.26**	56.1	66.7	1.897	10	**43.70**	42.3	46.0	1.288	6	**42.13**	40.6	44.2	1.502
LA	52	**25.63**	22.5	28.0	1.428	10	**27.38**	26.2	28.6	0.827	5	**18.50**	17.1	19.8	1.049
LT	50	**10.46**	9.2	11.7	0.601	10	**11.85**	11.2	12.5	0.458	4	**9.45**	8.8	11.0	1.050
LCr	81	**22.23**	20.97	23.20	0.416	8	**17.79**	17.44	18.07	0.220	10	**16.15**	15.65	16.79	0.384
LCb	81	**21.24**	19.98	22.20	0.427	8	**16.59**	16.22	16.74	0.181	10	**15.31**	14.85	15.83	0.329
LaZ	74	**14.23**	13.22	14.85	0.352	8	**10.56**	10.46	10.84	0.122	10	**9.83**	9.47	10.16	0.221
LaI	88	**5.17**	4.82	5.49	0.153	8	**4.05**	3.93	4.21	0.092	11	**3.63**	3.49	3.88	0.110
LaInf	89	**5.77**	5.37	6.19	0.192	8	**3.90**	3.72	4.09	0.134	10	**3.98**	3.74	4.35	0.186
LaN	86	**9.81**	9.29	10.32	0.206	8	**7.91**	7.62	8.21	0.189	10	**7.47**	7.27	7.63	0.119
LaM	80	**10.31**	9.78	10.72	0.194	8	**8.38**	8.22	8.49	0.089	10	**8.05**	7.88	8.23	0.152
ANc	82	**7.71**	7.24	8.22	0.216	8	**6.00**	5.88	6.19	0.125	10	**5.82**	5.65	6.17	0.151
LBT	54	**3.81**	3.47	4.18	0.151	8	**3.45**	3.36	3.56	0.071	6	**2.91**	2.76	3.02	0.100
CC	82	**5.94**	5.43	6.43	0.201	8	**4.22**	4.08	4.33	0.079	10	**4.16**	3.87	4.58	0.208
M^3M^3	89	**9.21**	8.43	10.33	0.308	8	**7.14**	6.91	7.23	0.126	10	**6.42**	6.18	6.75	0.195
CM^3	84	**9.30**	8.93	9.75	0.187	8	**7.14**	6.98	7.31	0.121	10	**6.64**	6.46	6.94	0.180
LMd	108	**16.98**	15.97	17.87	0.371	8	**12.93**	12.67	13.15	0.191	11	**11.91**	11.28	12.38	0.332
ACo	111	**5.49**	4.99	5.89	0.223	8	**4.11**	3.95	4.27	0.126	12	**3.63**	3.41	3.87	0.144
CM_3	82	**10.03**	9.63	10.59	0.209	8	**7.58**	7.47	7.80	0.115	10	**7.07**	6.78	7.37	0.208

Prov.), 22 May 2006, leg. P. Benda & A. Reiter; – 4 inds. (HMSC moz1, moz3, moz5, moz6 [S]), Mozdooran [Khorasan-e Razawi Prov.], 17 August 1968, leg. H. M. Steiner; – 1 ♂ (HMNH 2007.30.4. [S]), Daraq ruin, Qaranukh Kahul cave [Ardabil Prov.], 17 May 2006, leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari; – 4 ♀♀ (NMP 48459–48462 [S+A]), Serizjan (Fars Prov.), 21 April 2000, leg. P. Benda & A. Reiter; – 6 ♂♂, 2 ♀♀ (HMNH 2007.3.16.–2007.3.23. [S]), Shir Abad cave [Golestan Prov.], October 1997, leg. S. Ashrafi, M. Peymani & H. Zohoori; – 2 ♂♂ (MHNG 1869.10A, 1869.10B [S]), Shirabad cave, 65 km SW Gorgan [Golestan Prov.], 1998, leg. S. Farrokhi; – 1 ♂ (HMNH 2000.6.1. [A]), Shir Abad cave [Golestan Prov.], June 1999, leg. S. Ashrafi, M. Peymani & H. Zohoori; – 3 ♂♂, 1 ♀ (HMNH 2008.37.3.–2008.37.6. [A]), Shir Abad cave [Golestan Prov.], 2008, leg. H. Zohoori; – 1 ♂ (BMNH 20.2.9.18 [S+B], holotype of *Myotis myotis risorius* Cheesman, 1821), Shiraz [Fars Prov.], date unlisted, leg. J. E. B. Hotson; – 5 inds. (JOC unnumbered [Sf]), Sivand (Fars Prov.), 30 April 1996, leg. J. Obuch; – 1 ♂ (NMP 93881 [S+A]), Tadovan cave (Fars Prov.), 7 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♂ (NMP 90799 [S+A]), Tahir Abad (Khorasan-e Razawi Prov.), 21 May 2006, leg. P. Benda & A. Reiter; – 6 ♂♂, 1 ♀ (NMP 48131–48137, 48142–48144 [S+A]), Takht-e Soleyman (Azarbaijan-e Gharbi Prov.), 3 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Myotis blythii* are shown in Table 12. For the material examined see above.

M. blythii is generally considered a polymorphic species (Ellerman & Morrison-Scott 1951, Harrison & Lewis 1961, Topál 1971, Strelkov 1972, 1981a, Felten et al. 1977, Corbet 1978, Koopman 1994, Benda & Horáček 1995, Topál & Ruedi 2001, Simmons 2005, Benda et al. 2006, 2009b, 2011c, Dzeverin & Strelkov 2008, Evin et al. 2008, etc.); four subspecies are currently recognised; viz. *M. b. blythii* (Tomes, 1857) in the north of the Indian subcontinent, Afghanistan and West Turkestan, *M. b. oxygnathus* (Monticelli, 1885) in southern Europe and western Anatolia, *M. b. omari* Thomas, 1905 in most of the Middle East, and *M. b. ancilla* Thomas, 1910 in the eastern Palaearctic from the Altai Mts. to northern China.

Systematic position of the populations of *M. blythii* of the Middle East was first revised by Harrison & Lewis (1961), who assigned the populations from the Levant and Iran to the large-sized subspecies *M. b. omari*; this view was confirmed by the results of several large-scale analyses carried out by a series of subsequent authors (Topál 1971, Strelkov 1972, Felten et al. 1977, Benda & Horáček 1995, Spitzenberger 1996, Benda et al. 2006, 2011c, Aşan & Albayrak 2011, etc.). This form is currently recognised to occur in the broad area bordered by central Anatolia, Cyprus, and the Levant in the west, the Greater Caucasus in the north and Iranian mountains in the east.

The Iranian populations of *M. blythii* were always assigned to the form *M. b. omari* (Harrison & Lewis 1961, Topál 1971, Strelkov 1972, DeBlase 1980, Benda & Horáček 1995, Benda et al. 2006, 2011c). Two names associated with *M. blythii* originate from the territory of Iran, *Myotis myotis omari* Thomas, 1905 (type locality Derbent, 50 mi. W. of Isfahan. 6500'; Thomas 1905: 521) and *Myotis myotis risorius* Cheesman, 1921 (type locality: Persia, Shiraz, 5,200'; Cheesman 1921: 576); both are currently considered junior synonyms of *Vespertilio blythii* Tomes, 1857 (= *Myotis blythii*), the former designating the subspecies occurring in most of the Middle East (see above).

The comparison of forearm and skull dimensions provided here (Table 13) as well as by Benda et al. (2006: 109, Fig. 65) showed the Iranian individuals to be among the largest found within the species. They concur in size with the samples from the Caucasus region, eastern Turkey, Cyprus, and the Levant. The comparison of dimensions of sample sets from four geographically separated areas of Iran (north-western Iran = Ardabil, Azarbaijan, Zanjan; Zagros Mts. = Esfahan, Fars; south-eastern Iran = Kerman; and north-eastern Iran = Golestan, Khorasan; Table 13, Fig. 73) did not show any remarkable metric differences among them, all these groups belong to an identical morphotype. Also the samples of *M. blythii* from the southern, Iranian part of the Kopetdagh Mts. clearly belong to this morphotype, while the populations living in the northern, Turkmenistani part of this mountain range, represent an intermediate form between two subspecies; they are

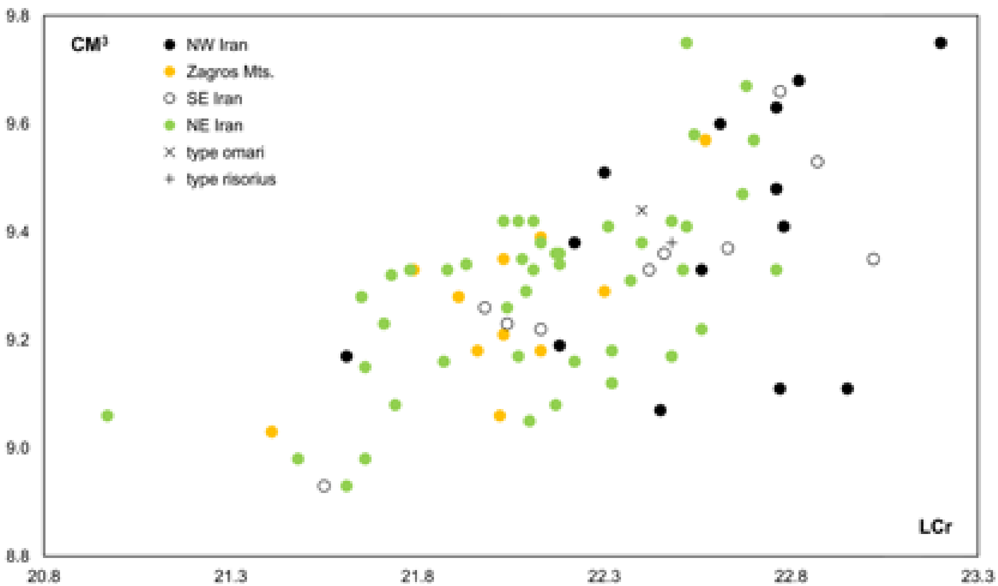

Fig. 73. Bivariate plot of the examined Iranian samples of *Myotis blythii* (Tomes, 1857): greatest length of skull (LCr) against the length of upper tooth-row (CM^3).

Table 13. Comparison of biometric data on four sample sets of *Myotis blythii* (Tomes, 1857) from different geographical parts of Iran with the sample sets of this bat from five regions of south-western Asia. For abbreviations see p. 171

	n	M	min	max	SD	n	M	min	max	SD	n	M	min	max	SD
			NW Iran					SW Iran					SE Iran		
LAt	14	**60.84**	57.7	66.7	2.101	11	**61.35**	58.8	63.2	1.408	12	**59.09**	56.1	61.0	1.432
LCr	14	**22.57**	21.61	23.20	0.397	13	**22.09**	21.41	22.57	0.308	10	**22.39**	21.55	23.02	0.460
LCb	14	**21.63**	20.59	22.20	0.440	13	**21.06**	20.44	21.62	0.277	10	**21.26**	20.48	21.75	0.464
LaZ	14	**14.50**	14.15	14.85	0.234	13	**14.32**	13.56	14.80	0.320	10	**14.25**	13.84	14.74	0.335
LaI	15	**5.28**	5.03	5.49	0.117	13	**5.19**	4.93	5.37	0.153	10	**5.22**	4.98	5.35	0.112
LaInf	15	**5.83**	5.53	6.11	0.171	13	**5.73**	5.47	6.02	0.164	10	**5.85**	5.58	6.15	0.201
LaN	15	**9.94**	9.61	10.32	0.211	14	**9.84**	9.31	10.18	0.230	10	**9.84**	9.63	10.07	0.140
LaM	14	**10.46**	10.25	10.72	0.138	14	**10.31**	10.21	10.44	0.087	10	**10.42**	10.18	10.67	0.170
ANc	14	**7.87**	7.54	8.19	0.195	14	**7.67**	7.34	7.91	0.154	10	**7.85**	7.56	8.22	0.189
CC	14	**6.08**	5.83	6.35	0.162	14	**5.84**	5.62	6.15	0.147	9	**5.89**	5.59	6.02	0.143
M^3M^3	15	**9.42**	8.84	10.33	0.374	14	**9.18**	8.81	9.36	0.141	10	**9.16**	8.81	9.59	0.228
CM^3	14	**9.39**	9.07	9.75	0.230	15	**9.27**	9.03	9.57	0.149	10	**9.33**	8.93	9.66	0.194
LMd	15	**16.80**	10.03	17.83	1.903	15	**16.92**	16.63	17.24	0.182	10	**17.10**	16.54	17.63	0.364
ACo	15	**5.72**	5.32	5.89	0.153	15	**5.43**	5.13	5.74	0.211	10	**5.59**	5.28	5.83	0.190
CM_3	14	**10.15**	9.63	10.59	0.271	14	**9.67**	5.34	10.44	1.263	10	**10.01**	9.68	10.27	0.211
			NE Iran					Turkmenistan					E West Turkestan		
LAt	28	**60.04**	56.9	62.9	1.875	19	**58.01**	53.4	60.6	1.918	149	**57.06**	53.2	61.0	1.765
LCr	44	**22.13**	20.97	22.76	0.378	28	**21.67**	20.70	22.75	0.597	152	**21.08**	20.02	22.47	0.390
LCb	44	**21.16**	19.98	21.81	0.383	28	**20.63**	19.53	21.55	0.567	150	**20.06**	18.92	21.32	0.398
LaZ	36	**14.10**	13.22	14.83	0.350	22	**13.74**	12.85	14.55	0.481	135	**13.61**	12.82	19.89	0.635
LaI	45	**5.13**	4.82	5.47	0.158	28	**4.96**	2.07	5.37	0.586	154	**4.99**	4.55	5.42	0.171
LaInf	45	**5.77**	5.40	6.19	0.196	28	**5.69**	5.43	6.06	0.186	154	**5.66**	5.03	6.08	0.209
LaN	45	**9.75**	9.29	10.24	0.196	28	**9.52**	9.00	9.97	0.271	154	**9.56**	9.02	10.07	0.188
LaM	42	**10.23**	9.78	10.72	0.200	28	**9.88**	9.32	10.48	0.311	154	**9.92**	9.35	10.47	0.226
ANc	44	**7.63**	7.24	8.07	0.204	28	**7.44**	6.80	7.95	0.287	149	**7.39**	6.94	7.96	0.202
CC	45	**5.94**	5.43	6.43	0.215	28	**5.77**	5.25	6.22	0.251	154	**5.64**	4.83	6.13	0.225
M^3M^3	45	**9.16**	8.43	9.88	0.317	28	**8.95**	8.20	9.58	0.383	154	**8.86**	8.08	9.98	0.307
CM^3	45	**9.29**	8.93	9.75	0.179	28	**9.06**	8.63	9.93	0.293	154	**8.71**	7.95	9.27	0.210
LMd	45	**17.00**	15.97	17.87	0.308	28	**16.60**	15.67	17.32	0.451	153	**16.02**	15.08	16.97	0.358
ACo	45	**5.44**	5.08	5.84	0.189	28	**5.20**	4.65	5.65	0.283	153	**5.09**	4.67	5.62	0.166
CM_3	45	**10.01**	9.64	10.42	0.177	28	**9.85**	9.53	10.32	0.230	153	**9.45**	8.84	10.92	0.237
			Levant					E Turkey & Transcaucasia					India, Afghanistan, Tajikistan		
LAt	40	**59.48**	55.4	64.5	1.836	30	**58.08**	52.6	61.4	2.139	5	**57.74**	55.9	61.5	2.405
LCr	44	**22.04**	20.93	22.72	0.394	29	**22.14**	21.27	22.97	0.391	11	**21.03**	20.25	21.57	0.352
LCb	43	**21.03**	19.92	21.75	0.372	29	**21.13**	20.27	21.94	0.438	11	**19.94**	18.98	20.68	0.425
LaZ	36	**14.22**	13.24	14.68	0.315	28	**14.09**	11.80	15.23	0.571	7	**13.67**	13.28	13.96	0.235
LaI	44	**5.21**	4.86	5.53	0.169	30	**5.23**	4.90	5.67	0.153	12	**5.03**	4.82	5.20	0.120
LaInf	44	**5.67**	5.36	6.24	0.213	30	**5.81**	5.18	6.38	0.246	12	**5.77**	5.49	6.04	0.205
LaN	44	**9.87**	9.52	10.41	0.211	30	**9.81**	8.97	10.42	0.320	10	**9.55**	9.07	9.91	0.217
LaM	35	**10.35**	9.99	10.72	0.187	29	**10.28**	9.55	10.76	0.278	10	**9.99**	9.75	10.92	0.351
ANc	43	**7.70**	7.32	8.17	0.204	29	**7.74**	7.22	8.27	0.240	11	**7.45**	7.18	7.74	0.181
CC	43	**5.90**	5.48	6.38	0.193	26	**5.85**	4.97	6.41	0.301	11	**5.70**	5.30	6.02	0.224
M^3M^3	45	**9.16**	8.41	9.70	0.254	30	**9.15**	8.00	9.58	0.309	12	**8.90**	8.67	9.45	0.209
CM^3	45	**9.24**	8.65	9.75	0.221	30	**9.21**	8.05	9.58	0.311	12	**8.75**	8.48	9.32	0.234
LMd	45	**16.83**	15.79	17.48	0.362	30	**16.92**	14.88	17.75	0.516	12	**15.93**	15.42	16.47	0.302
ACo	45	**5.45**	5.04	5.87	0.168	30	**5.46**	4.90	5.87	0.211	12	**5.11**	4.74	5.41	0.165
CM_3	45	**9.75**	2.75	10.37	1.094	30	**9.82**	5.36	10.31	0.879	12	**9.30**	8.22	9.98	0.414

smaller than *M. b. omari* of the Middle Eastern and Caucasus regions and larger than the West Turkestani, Afghanistani and Kashmiri *M. b. blythii*. They create a similar medium-sized form intermediating between two size-characterised subspecies as the bats from Crete, Aegean Islands, and western Anatolia, bordering the ssp. *omari* and *oxygnathus* (see Benda et al. 2006, 2009b, Aşan & Albayrak 2011 and Georgiakakis et al. 2012).

Ziâie (1996) reported a record of *M. myotis* (Borkhausen, 1797) from the Iranian-Turkish border area (Takhteduzi, 7 km NW of Maku, Azarbaijan), i.e. some 300 km eastwards from the eastern margin of the species distribution range in Anatolia (Aşan et al. 2010); therefore, such finding could represent the easternmost record of the species and its first record in Iran (see Sharifi et al. 2000). Although the respective specimens have been lost, the author gave several of their measurements, viz. head and body length 80–85 mm, tail length 50–60 mm, forearm length 59–64 mm; according to these limited data, the bats certainly represented *M. blythii* that did not differ dimensionally from other samples from the respective region (see Table 12), and not *M. myotis* (see the dimensional data on this bat by e.g. Benda et al. 2006).

Karataş et al. (2008) described karyotype of the species from specimens originating from north-western Iran (Kermanshah, Zanjan): the diploid number of chromosomes 2n=44, the fundamental number of arms NF=54, the number of autosomal arms NFa=50, X chromosome metacentric.

Echolocation. *Myotis blythii* produces frequency-modulated echolocation calls with the frequencies falling from 120 kHz to 26 kHz. The peak frequencies measured from bats of the European populations (i.e. from *M. b. oxygnathus*, see above) varied between 33–53 kHz (Russo & Jones 2002, Obrist et al. 2004, Papadatou et al. 2008). There are no data available from the Asian part of the species range (i.e. all other subspecies, including Iranian *M. b. omari*). We recorded a single call sequence of *M. blythii* in Iran, its basic echolocation characteristics are given in Table 3. The calls were recorded from an individual foraging at Hesar (Fars), it produced frequencies of maximum energy between 41–53 kHz; these values conform to the data published from Europe.

Feeding ecology. *Myotis blythii* is a large bat applying ground gleaning and slow hawking foraging strategies (Arlettaz 1996a, Arlettaz et al. 1997, Güttinger et al. 1998). Previous studies of the diet composition of *M. blythii* from various parts of its distribution range (Switzerland, Turkey, Azerbaijan, Syria, Jordan) showed Orthoptera and Coleoptera to be the most important diet items (Arlettaz 1996, Rahmatulina 2005, Benda et al. 2006, 2010, Whitaker & Karataş 2009).

From Iran, the diet composition of *M. blythii* was analysed from eleven sites in various parts of the country (Fig. 74); 229 faecal pellets and 14 digestive tracts were studied from the provinces of Ardabil, Azarbaijan, Fars, Golestan, Khorasan, and Kerman. By far the most important food item was Orthoptera, which were found in all sample sets (Fig. 74), with the only exception of the set from Mina (Khorasan) where Coleoptera (Carabidae) prevailed. Among orthopterans, we identified Ensifera (among them quite frequently Gryllidae and/or Gryllotalpidae) to be the most abundant, but Caelifera were also present. In the ten digestive tracts collected at Deh Bakri in early April, we observed also a relatively high proportion of Coleoptera, in that case all Scarabaeidae (Melolonthinae). The presence of Chilopoda, Araneae, Coleoptera larvae and Caelifera indicates ground gleaning in *M. blythii* and these results thus well correspond with the published data.

Records of ectoparasites. **Original data**: I s c h n o p s y l l i d a e: *Ischnopsyllus dolosus*: 1 fa (CMŠ [P]) from 1 fs (NMP 94108), Dashkasan, Dashkahul cave (Ardabil Prov.), 29 September 2011. – N y c t e r i b i i d a e: *Nycteribia latreillii*: 1 ma, 2 fa (CMŠ [P]) from 2 fa (NMP 90777, 90778), Bazangan (Khorasan-e Razawi Prov.), 17 May 2006. – *Penicillidia dufourii*: 5 ma, 1 fa (CMŠ [A]) from 2 ma (incl. NMP 93881), Tadovan, Tadovan cave (Fars Prov.), 7 October 2011. – S p i n t u r n i c i d a e: *Spinturnix myoti*: 4 ma, 9 fa, 2 m deutonymphs, 2 protonymphs (CMŠ [P]) from 4 ma, 1 ms, 1 fa, 1 fs (NMP 90848–90854), Ali Abad (Golestan Prov.), 28 May 2006; – 2 ma, 7 fa (CMŠ [P]) from 1 ma (NMP 93881), Tadovan, Tadovan cave (Fars Prov.), 7 October 2011. – **Published data**: N y c t e r i b i i d a e: *Nycteri-*

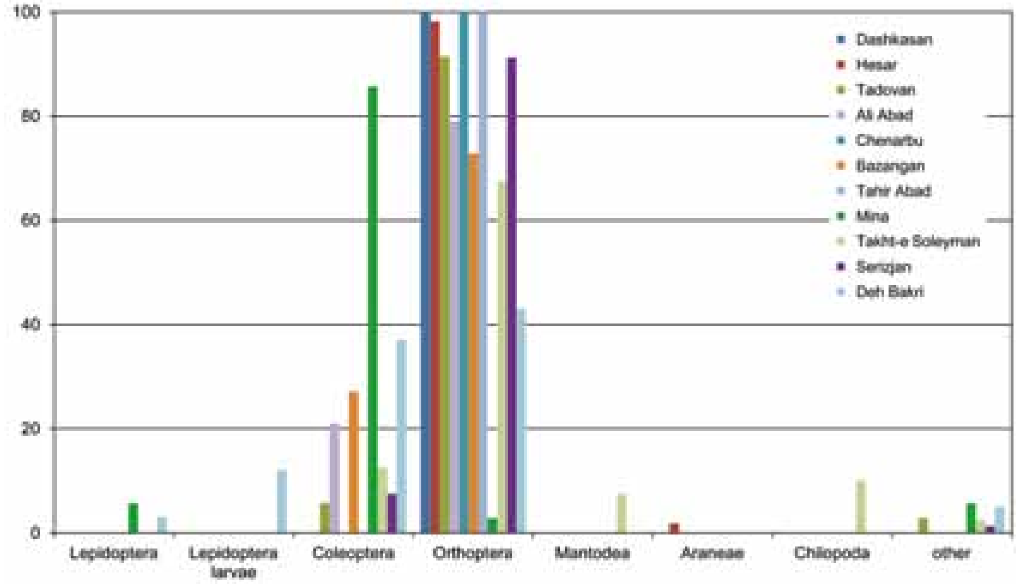

Fig. 74. Percentage volume of particular food items in the diet of *Myotis blythii* (Tomes, 1857) in Iran. Material analysed: Dashkasan (two faecal pellets / from one bat), Hesar (14 / 1), Tadovan (97 / 2), Ali Abad (20 / 7), Chenarbu (7 / 1), Bazangan (7 / 1), Tahir Abad (8 / 1), Mina (30 / 11), Takht-e Soleyman (28 / 7), Serizjan I (30 pellets collected from under a perch), Serizjan II (four digestive tracts), Deh Bakri (ten digestive tracts); other = Coleoptera larvae, Nematocera, Brachycera, Heteroptera, Hymenoptera.

bia vexata: 1 ma, Elburz Mountains (Theodor 1967). – *Penicillidia dufourii*: Mt Elburz (Theodor 1967). – *Penicillidia* sp.: Mahidasht cave (Kermanshah Prov.), Karafto cave (Koredestan Prov.), Ghaladidar cave (Hamadan Prov.) (Sharifi et al. 2008). – I x o d i d a e: *Ixodes vespertilionis*: 5 inds. (larvae, nymph and adult stages) from unknown number of inds., Mahi-Dasth Limy cave (Kermanshah Prov.) (Vatandoost et al. 2010). – *Ixodes* sp.: Mahidasht cave (Kermanshah Prov.), Karafto cave (Kordestan Prov.), Ghaladidar cave (Hamadan Prov.) (Sharifi et al. 2008); – S p i n t u r n i c i d a e: *Spinturnix* sp.: Mahidasht cave (Kermanshah Prov.), Karafto cave (Kordestan Prov.), Ghaladidar cave (Hamadan Prov.) (Sharifi et al. 2008); – Spinturnicidae sp.: 18 inds. from unknown number of inds., Mahi-Dasth Limy cave (Kermanshah Prov.) (Vatandoost et al. 2010). – C h i r o d i s c i d a e: *Alabidocarpus calcaratus*: 6 ma, 8 fa, immatures, Janch, 25 m from Kuhrang on Shakurd road, Zagros Mt., Bakhitiari province [Chahar Mahal va Bakhtiari Prov.] (Fain 1982).

Comments on ectoparasites. The bat flea *Ischnopsyllus dolosus* Dampf, 1912 from *Myotis blythii* collected in the Iranian part of the Caucasus region is the first record of this parasite from the country. It is a species with a relatively limited distribution range, covering the Caucasus and Transcaucasia; the type specimen was collected from *Plecotus* sp. originating from Nalčik, Russian Caucasus (cf. Hopkins & Rothschild 1956). From the northern Caucasus, records of *I. dolosus* are known from *M. blythii* (Labunec & Deetâreva 1985, Medvedev 1992), from the Middle East there are findings from Turkey collected from *Myotis mystacinus*, *M. brandtii*, *Eptesicus serotinus*, and *Pipistrellus pipistrellus* (Aktaş 1987).

M. blythii ranks among the main hosts of the bat flies *Nycteribia latreillii* (Leach, 1817), *N. vexata* Westwood, 1835, and *Penicillidia dufourii* Westwood, 1834 (Hůrka 1964), they belong to its commonly collected parasites in Iran (two of these species were documented also from *Myotis capaccinii*). The distribution ranges of these flies correspond with the distribution of their principal host species, covering the southern part of the Palaearctic (Hůrka 1964). *N. latreillii* is here reported from Iran for the first time.

Spinturnix myoti (Kolenati, 1856) is an oligoxenic parasite of *M. myotis* and *M. blythii* (Rudnick 1960); here, it is recorded from Iran for the first time. However, it is a common mite species; it is a permanent ectoparasite and its distribution range reflects the occurrence of its host – it was reported from most of the neighbouring countries – Turkey, Transcaucasia, and West Turkestan (Beron 1974, Stanyukovich 1997). The cosmopolitan mite species *Alabidocarpus calcaratus* Lawrence, 1952 was found on *M. blythii* in Iran by Fain (1982), its record is available also from neighbouring Armenia (Dusbábek & Arutunian 1976).

Myotis bechsteinii (Kuhl, 1817)

Records. **Original data**: G o l e s t a n: oak forest 5 km E of Tunel-e Golestan [1], 44 km E of Kalaleh, 26 May 2006: net. 3 ma, 1 fs (NMP 90834–90837; Fig. 75); – valley 2 km SSE of Ali Abad [2], beech forest, above a stream, 28 May 2006: net. 2 ma, 2 fG, 1 fa (NMP 90858–90862). – M â z a n d a r a n: beech forest 6 km SW of Galugah [3], 19 km E of Behshahr, 29 May 2006: net. 1 fG (NMP 90882). – **Published data**: G o l e s t a n: Mohammed Reza Shah National Park [4], June 1969: 1 fa, UMM (DeBlase 1980).

Distribution. *Myotis bechsteinii* is a rare bat species in Iran, only four record sites are available from the northern part of the country (Fig. 59). The species was first and only indicated from Iran by DeBlase (1980), who reported one individual from the Mohammed Reza Shah National Park (= today the Golestan NP) at the easternmost edge of the Golestan province. At that time, this locality was the easternmost record within the species distribution range isolated by 1400 km from the nearest known record in Transcaucasia (Zugdidi, western Georgia). The currently known distribution range of *M. bechsteinii* in Iran comprises only the dense and humid Hyrcanian mixed forests on the northern slopes of the Alborz Mts. in Golestan with a minute extension to easternmost Mazandaran. This ca. 250 km long belt of known occurrence remains separated from the south--west-Asian range by some 700 km along the southern and south-western coast of the Caspian Sea to NE Azerbaijan. The forested area of the transition between Golestan and Khorasan, from where two records originated (incl. the DeBlase's one), still represents the easternmost margin of the species range (cf. Horáček et al. 2000).

The closest area of distribution of *M. bechsteinii* to the Iranian spot of occurrence lies in north-eastern Turkey and Transcaucasia, however, this range is composed only of several very dispersed and isolated records. The only locality in eastern Turkey (with repeated evidence) is available from the Artvin province (Albayrak 1990, 2003). Only three record sites are known from Transcaucasia; two localities, Zugdidi and Boržomi, were reported from Georgia (Buhnikašvili et al. 2004), and one site, Həzrə, in north-eastern Azerbaijan (Rahmatulina 2005). The latter locality is geographically closest to the limited Iranian range (see above). To the west, the Transcaucasian range of *M. bechsteinii* continues to the forests of the north-western Caucasus in Russia, where at least nine localities are available (Gazarân 2001), and the east-Turkish range to western Anatolia and the Balkans (see Benda & Horáček 1998, Hanák et al. 2001, Petrov 2006).

Field notes. No roosts of *Myotis bechsteinii* have been recorded in Iran, all available records are related only to foraging individuals. *M. bechsteinii* was not found in osteological material from owl pellets collected in Iran (Table 40).

The only previously recorded individual was reported by DeBlase (1980: 166): "The […] Iranian specimen is an adult female collected in an old field (shooting or mistnet?) during June, 1969. There is no mention of reproductive activity on the specimen label."

The newly collected bats were all mist-netted in relatively dense patches of broad-leaved or mixed forests, some of them looking as under almost natural conditions without any massive impact of human activities on more or less steep slopes of the Alborz mountains (namely that at Galugah, Mazandaran, see Fig. 83, and perhaps also at Tunel-e Golestan, Golestan), while the netting site at Ali Abad (Golestan) was certainly an exploited lowland forest used also as a recreation area by the locals. In all sites the nets were installed above streams running through forests (Fig. 76).

M. bechsteinii was documented as a part of the typical bat community of temperate mixed forests of northern Iran. This is true namely for the Ali Abad netting site, where a high number of other species was netted, besides *M. bechsteinii* also *Myotis blythii*, *M. nattereri*, *M. emarginatus*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Eptesicus serotinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri*, and for the Tunel-e Golestan site, where also *Pipistrellus pipistrellus* and *Barbastella barbastellus* were netted and echolocation calls of *Nyctalus leisleri* and *Tadarida teniotis* were detected. In the forest at Galugah, a female of *M. bechsteinii* was netted along with a female of *M. nattereri*.

From two sites in Iran, direct evidence of reproduction in *M. bechsteinii* is available. A pregnant female, containing a foetus of the crown-rump length 21.4 mm, was collected at Galugah on 29 May 2006; one post-partum female along with two pregnant females, each containing one foetus of the crown-rump lengths 12.5 and 17.0 mm, respectively, were collected at Ali Abad on 28 May 2006. These two findings suggest the parturition period in *M. bechsteinii* populations of northern Iran to occur at the break of May and June. From a colony examined in north-eastern Azerbaijan, Rahmatulina (2005) reported newborns as well as volant juveniles observed in the second half of June; this finding roughly conforms to the estimation for the Iranian populations.

Fig. 75. *Myotis bechsteinii* (Kuhl, 1817) from Tunel-e Golestan (Golestan). Photo by A. Reiter.

Fig. 76. Beech forest south of Ali Abad (Golestan), a foraging habitat of *Myotis blythii*, *M. bechsteinii*, *M. nattereri*, *M. emarginatus*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Eptesicus serotinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri*. Photo by A. Reiter.

However, this period seems to be earlier (by about 2–4 weeks) than the estimated occurrence of births in the European populations (see Baagøe 2001a).

Material examined. 2 ♂♂, 3 ♀♀ (NMP 90858, 90859, 90861, 90862 [S+A], NMP 90860 [A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 90882 [S+A]), Galugah (Mazandaran Prov.), 29 May 2006, leg. P. Benda & A. Reiter; – 3 ♂♂, 1 ♀ (NMP 90834, 90836, 90837 [S+A], NMP 90835 [A]), Tunel-e Golestan (Golestan Prov.), 26 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Myotis bechsteinii* are shown in Table 12. For the material examined see above.

M. bechsteinii is traditionally considered a monotypic species (Ryberg 1947, Ellerman & Morrison-Scott 1951, Corbet 1978, Koopman 1994, Horáček et al. 2000, Baagøe 2001a, Simmons 2005). The only previously known specimen from Iran was examined by DeBlase (1980), however the author avoided to give any conclusion concerning its taxonomic affiliation, perhaps he accepted

Table 14. Comparison of biometric data on three sample sets of *Myotis bechsteinii* (Kuhl, 1817). For abbreviations see p. 171

	Iran					Central Europe					Balkans				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LAt	10	**43.70**	42.3	46.0	1.288	34	**42.23**	40.1	44.5	1.161	27	**42.77**	40.5	46.0	1.494
LCr	8	**17.79**	17.44	18.07	0.224	36	**17.42**	16.84	17.92	0.316	25	**17.56**	16.88	18.15	0.360
LCb	8	**16.59**	16.22	16.74	0.181	36	**16.21**	15.46	16.72	0.305	25	**16.36**	15.57	17.03	0.352
LaZ	8	**10.56**	10.46	10.84	0.122	37	**10.21**	9.79	10.88	0.224	23	**10.38**	9.92	10.98	0.237
LaI	8	**4.05**	3.93	4.21	0.092	43	**4.08**	3.66	4.27	0.133	25	**4.11**	3.93	4.25	0.090
LaInf	8	**3.90**	3.72	4.09	0.134	41	**3.88**	3.64	4.17	0.132	23	**3.87**	3.64	4.16	0.147
LaN	8	**8.04**	7.62	9.03	0.441	37	**7.88**	7.67	8.24	0.148	25	**7.88**	7.54	8.25	0.189
LaM	8	**8.38**	8.22	8.49	0.089	35	**8.30**	8.05	8.54	0.131	23	**8.38**	8.08	8.67	0.177
ANc	8	**6.00**	5.88	6.19	0.125	37	**5.84**	5.49	6.27	0.198	25	**5.92**	5.67	6.25	0.162
LBT	8	**3.45**	3.36	3.56	0.071	35	**3.47**	3.21	3.84	0.131	23	**3.50**	3.24	3.69	0.110
CC	8	**4.22**	4.08	4.33	0.079	41	**4.04**	3.69	4.32	0.141	25	**4.13**	3.92	4.44	0.118
P^2P^2	8	**3.88**	3.75	4.04	0.088	41	**3.83**	3.52	4.04	0.124	23	**3.87**	3.58	4.17	0.159
M^3M^3	8	**7.14**	6.91	7.23	0.126	43	**6.81**	6.45	7.21	0.174	25	**6.92**	6.69	7.22	0.145
IM^3	8	**8.38**	8.11	8.71	0.185	42	**8.10**	7.65	8.37	0.183	23	**8.22**	7.88	8.57	0.159
CM^3	8	**7.14**	6.98	7.31	0.121	44	**6.90**	6.62	7.19	0.144	25	**7.00**	6.72	7.31	0.140
M^1M^3	8	**3.94**	3.83	4.11	0.103	42	**3.75**	3.55	3.91	0.081	23	**3.82**	3.62	3.97	0.098
CP^4	8	**3.28**	3.04	3.47	0.125	42	**3.33**	3.09	3.67	0.122	23	**3.31**	3.02	3.61	0.133
LMd	8	**12.93**	12.67	13.15	0.191	41	**12.55**	11.81	12.97	0.244	25	**12.65**	11.98	13.18	0.301
ACo	8	**4.11**	3.95	4.27	0.126	40	**3.94**	3.66	4.17	0.125	25	**4.12**	3.64	4.98	0.270
IM_3	8	**8.78**	8.64	9.06	0.139	38	**8.49**	7.87	8.83	0.209	23	**8.59**	8.23	8.99	0.163
CM_3	8	**7.58**	7.47	7.80	0.115	40	**7.34**	6.98	7.58	0.140	25	**7.44**	7.11	7.81	0.141
M_1M_3	8	**4.33**	4.14	4.51	0.130	39	**4.16**	3.97	4.34	0.087	23	**4.20**	3.96	4.38	0.106
CP_4	8	**3.37**	3.31	3.42	0.042	39	**3.33**	3.11	3.51	0.122	23	**3.36**	3.13	3.72	0.133
P^2P^2/LCr	8	**0.218**	0.208	0.225	0.006	34	**0.220**	0.200	0.236	0.007	23	**0.221**	0.202	0.232	0.008
ANc/LCr	8	**0.337**	0.327	0.349	0.008	35	**0.336**	0.313	0.360	0.011	25	**0.337**	0.319	0.355	0.007
CM^3/LCb	8	**0.430**	0.417	0.437	0.007	36	**0.427**	0.411	0.442	0.006	25	**0.428**	0.419	0.438	0.005
M^3M^3/LCb	8	**0.430**	0.423	0.438	0.005	36	**0.420**	0.400	0.441	0.010	25	**0.423**	0.410	0.442	0.008

the reported monotypy of this species. The values of forearm length and skull dimensions of the respective specimen given by DeBlase (1980: 392) fall to the ranges of dimensions of Iranian samples and mostly also to those of European bats (Tables 13, 14).

However, no revision of geographic variation in morphological traits in *M. bechsteinii* is available. On the other hand, Kerth et al. (2008), evaluating the genetic structure of this species throughout Europe and western Asia and phylogenetic relations of its particular populations, demonstrated existence of two main lineages in the analysed sequences of the mitochondrial DNA, one comprising samples from the whole European range including southern peninsulas, and the other one from Anatolia and the Caucasus. Divergence detected between these two lineages was relatively deep, it ranged between 5.2–6.8% of the uncorrected *p* distance in the 482 bp fragment of the ND1 gene. These results suggest possible existence of two separate evolutionary units/taxa within the species (Kerth et al. 2008).

Although Kerth et al. (2008) did not specify accurately the origin of the Asian samples used in their analysis – they used only the terms 'Anatolia' and 'Caucasus' – it seems to be clear that the specimens used did not come from Iran. However, the Iranian populations of *M. bechsteinii* represent an extension from the populations of Transcaucasia, which are again a continuation from the Caucasus as well as from north-eastern Anatolia. Therefore, the Iranian populations

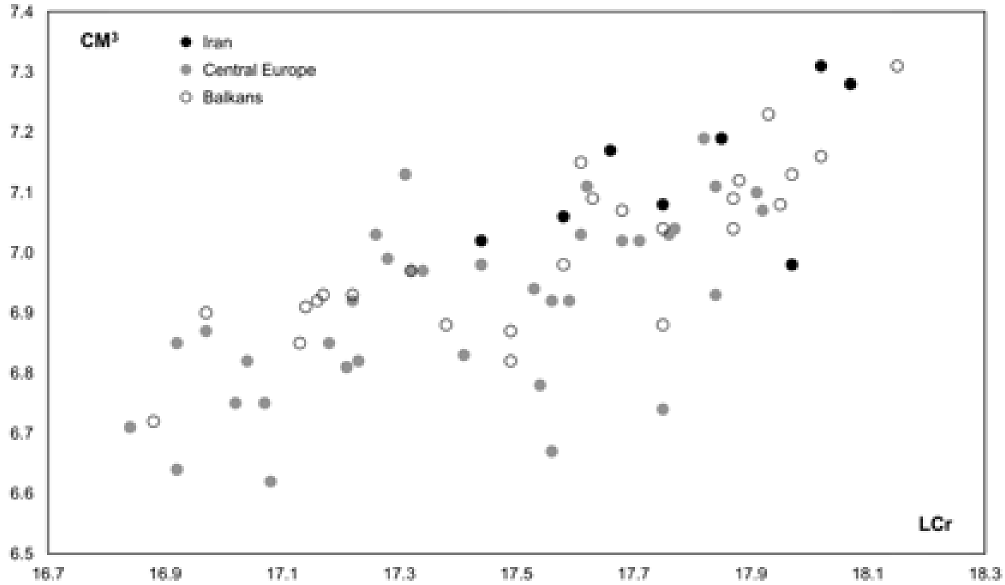

Fig. 77. Bivariate plot of the examined Iranian and comparative samples of *Myotis bechsteinii* (Kuhl, 1817): greatest length of skull (LCr) against the length of upper tooth-row (CM^3).

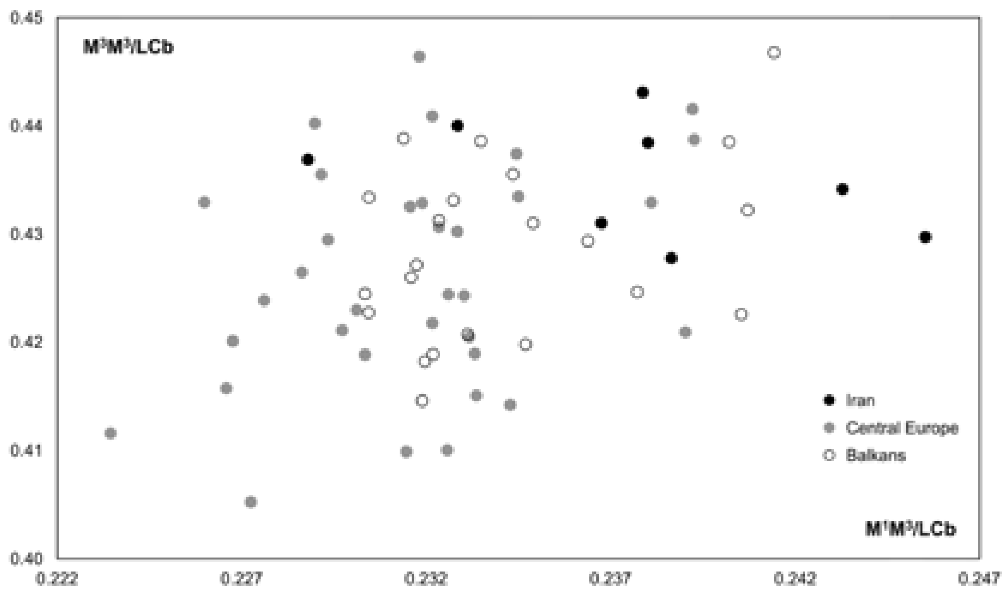

Fig. 78. Bivariate plot of the examined Iranian and comparative samples of *Myotis bechsteinii* (Kuhl, 1817): relative length of the molar-row (M^1M^3/LCb) against the relative width of rostrum at the last molars (M^3M^3/LCb).

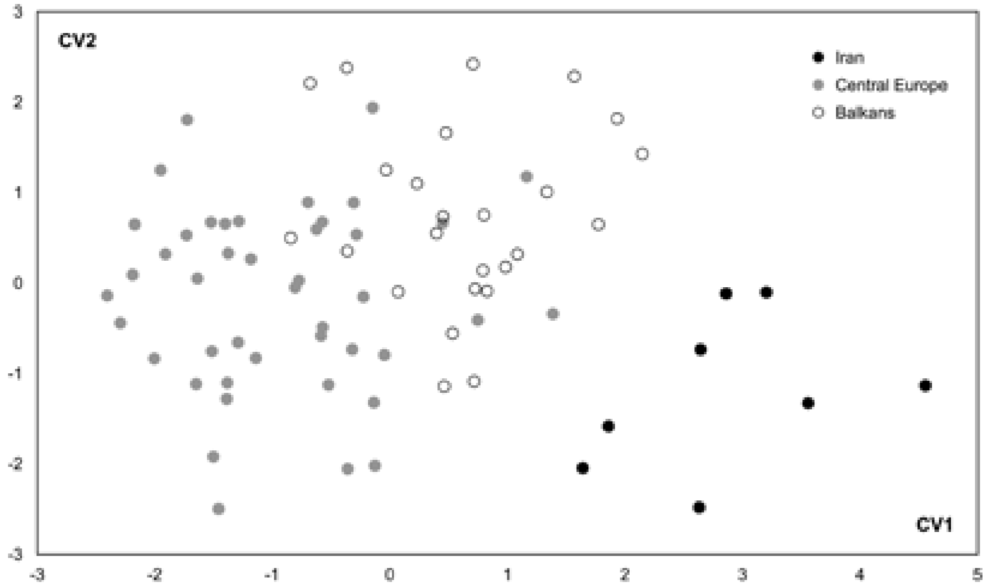

Fig. 79. Bivariate plot of the examined Iranian and comparative samples of *Myotis bechsteinii* (Kuhl, 1817): results of the canonical discriminant analysis of skull dimensions and relative dimensions.

could perhaps belong to the separate lineage of *M. bechsteinii* described from Anatolia and the Caucasus, although this should be proved solely by a molecular genetic comparison.

Since no detailed morphological data are available on the Anatolian and Caucasian populations of *M. bechsteinii* and the samples used by Kerth et al. (2008) are not available to us for examination, we compared the Iranian specimens solely with European bats (Table 14). This comparison showed a slightly peculiar position of the Iranian *M. bechsteinii*. On average, the Iranian bats are larger in body and skull size than the European samples, although the dimensional ranges overlap with the ranges of the European bats in most of the dimensions (Fig. 77, Table 14). The distal parts of rostrum of the Iranian *M. bechsteinii* are on average relatively longer and broader than in European bats (Fig. 78), i.e. molars are more massive in the Iranian specimens in their absolute and relative dimensions. The canonical analysis performed from the stepwise discriminant function analysis of all skull dimensions and relative dimensions (see Table 14) showed the cluster of Iranian samples to be well separated from the clusters of Central European and Balkan samples (Fig. 79); however, this separation is based mainly on skull size differences rather than shape characters (CV1=82.84% of variance, CV2=17.16%).

However, although the Iranian samples of *M. bechsteinii* slightly differ from the European representatives in size, areas of occurrence of these populations are separated by about 2500 km of aerial distance and the populations living in this extensive gap may interconnect the two extreme size categories in Europe and Iran by their metric parameters. Differences in size characters are well known in several other species of the genus *Myotis*, in which the Middle Eastern representatives exceed in size the bats from Europe (Benda & Horáček 1995); in some cases this difference has a taxonomic expression, while in others, a cline shift in body size is present.

Considering the above results as well as the results by Kerth et al. (2008), the populations of *M. bechsteinii* in Iran can (1) represent a taxon separated from the nominotypical populations of Europe, or (2) belong to the identical taxon as in Europe. To solve which of these possibilities is more real, morphological characteristics of the Caucasus and Turkish populations as well as genetic traits of the Iranian bats need to be examined in detail. Being rigorous in consideration of taxonomy strictly according to the available evidence, the Iranian populations of *M. bechsteinii* belong to the nominotypical form of Europe, since the respective populations largely agree in all so far examined traits.

Echolocation. *Myotis bechsteinii* produces frequency-modulated signals descending from ca. 100 kHz to 35 kHz (Dietz et al. 2007). Frequencies of maximum energy vary among the European populations (UK, Switzerland, Greece) between ca. 44–73 kHz (Parsons & Jones 2008, Obrist et al. 2004, Papadatou et al. 2008). The echolocation characteristics of *M. bechsteinii* have not yet been studied in the Asian part of its distribution range.

Feeding ecology. *Myotis bechsteinii* is a medium-sized foliage gleaner; its diet was studied in Europe (Wolz 1993, Siemers & Swift 2006, Andreas et al. 2012b). These studies suggested flexible use of the available prey and the analysed diet was dominated by beetles (Coleoptera), spiders (Araneae), orthopterans, earwigs (Dermaptera), and moths (Lepidoptera).

We analysed three sample sets from Iran, consisting altogether of 44 faecal pellets (Fig. 80). The diet of one bat from Galugah (Mazandaran) was composed solely of beetles; the diet of four bats from Tunel-e Golestan (Golestan) was dominated by Lepidoptera; and the five bats from Ali Abad (Golestan) consumed namely Orthoptera. Since the samples were collected in a short period of four days within the same season (26–29 May 2006), certain local differences are apparent there.

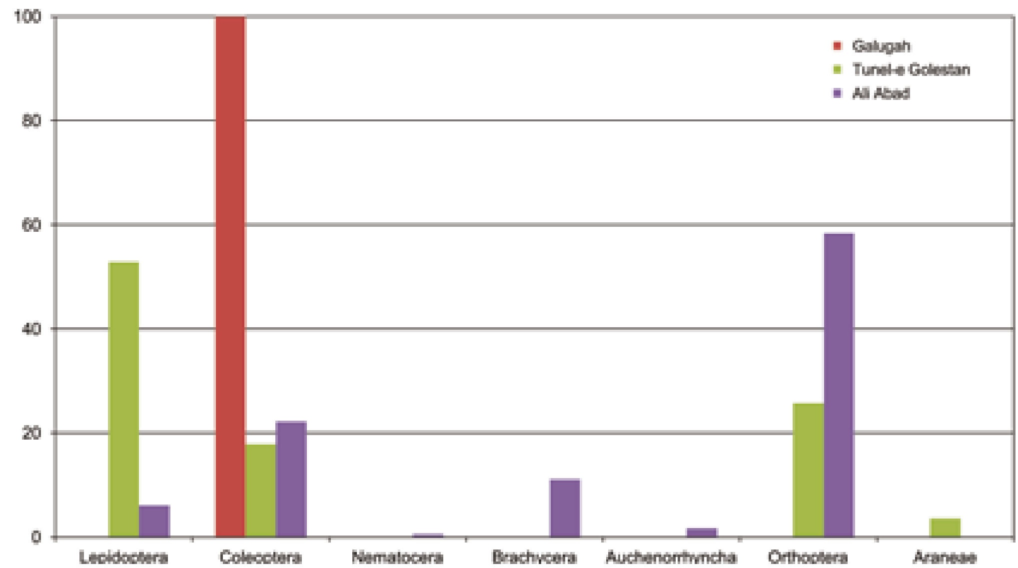

Fig. 80. Percentage volume of particular food items in the diet of *Myotis bechsteinii* (Kuhl, 1817) in Iran. Material analysed: Galugah (four faecal pellets / from one bat), Tunel-e Golestan (20 / 4), Ali Abad (20 / 5).

However, the whole set of samples is rather limited to be able to draw reasonable conclusions. Anyway, the general pattern of the data corresponds well with the results of previous studies.

Records of ectoparasites. **Original data**: N y c t e r i b i i d a e: *Basilia nana*: 1 ma, 1 fa (CMŠ [A]) from 1 fs (NMP 90835), Tunel-e Golestan (Golestan Prov.), 26 May 2006; – 4 ma, 5 fa (CMŠ [A, P]) from 1 ma, 1 ms, 3 fa (NMP 90858–90862), Ali Abad (Golestan Prov.), 28 May 2006; – 1 fa (CMŠ [A]) from 1 fa (NMP 90882), Galugah (Mazandaran Prov.), 29 May 2006.

Comments on ectoparasites. In Iran, only one ectoparasite species was discovered from *Myotis bechsteinii*, the bat fly *Basilia nana* Theodor et Moscona, 1954. This fly species was recorded from Iran for the first time; however, it was collected also from *Myotis nattereri* (see below).

M. bechsteinii probably represents the primary host of this parasite (Hůrka 1964). Its known distribution range covers the arboreal zone of the western Palaearctic from Sweden to Israel and Azerbaijan (Hůrka 1984a). However, in Transcaucasia and the Middle East, *B. nana* parasitises mainly *Myotis nattereri* (Hůrka 1984a). In the Mediterranean region, the records from Israel and Jordan represented the easternmost margin of the range (Theodor & Moscona 1954, Benda et al. 2010). The Hyrcanian region of northern Iran is currently the easternmost part of the species range.

Myotis nattereri (Kuhl, 1817)

Records. **Original data**: G o l e s t a n: valley 2 km SSE of Ali Abad [1], beech forest, above a stream, 28 May 2006: net. 1 ma (NMP 90855). – M â z a n d a r a n: beech forest 6 km SW of Galugah [2], 19 km E of Behshahr, 29 May 2006: net. 1 fG (NMP 90883; Fig. 82).

Distribution. *Myotis nattereri* is a very rare bat species in Iran – only two record sites are available from the country, from a very limited area adjacent to the south-eastern coast of the Caspian Sea (Fig. 81). All previous records of *M. nattereri* from Iran summarised by DeBlase (1980) were revised by Horáček & Hanák (1984) and assigned to *M. schaubi* (see below). Here reported two localities represent the only known distribution spot of *M. nattereri* s.str. in Iran, the species in its contemporary sense (see Koopman 1993, Simmons 2005) is thus here reported from Iran for the first time. Its range in the country resembles the occurrence pattern of *M. bechsteinii* (see Fig. 59); two Iranian records of *M. nattereri* are available only from the dense and humid Hyrcanian mixed forests on the northern slopes of the Alborz Mts. at the Mazandarani-Golestani border. Unlike the situation in *M. bechsteinii* (see above), these records are not the easternmost ones within the local range of *M. nattereri*, two other localities were reported from the Turkmenistani side of the Kopetdagh Mts., Čuli and Arpaklen (Kuzâkin 1935, Strelkov et al. 1978). The Čuli canyon, 30 km west of Ašgabat, represents the easternmost point of the whole species distribution range.

The group of Golestani-Kopetdagh localities around the Iranian-Turkmenistani border, lying in a belt of ca. 400 km stretching to the east from the Caspian Sea, is separated by some 600 km along the southern Caspian shore from another part of the range, the continuous European and south-western Asian range (see also the map by Benda et al. 2006: 112, Fig. 67). The absence of records of true *M. nattereri* from most of the northern and from western parts of Iran is rather surprising, since this species does not seem to be quite rare in the neighbouring countries. Its presence can thus be expected in the forested areas of the northern slopes of the Gilani and Mazandarani mountains. From Azerbaijan, Rahmatulina (2005) summarised seven localities, including several in the Lənkəran area and in the Upper Karabakh (see also Benda et al. 2011c), both groups being situated closely to the Iranian border. From eastern Turkey, the record closest to the Iranian territory originates from Muradiye at Van, where Obuch (1994) found osteological remains; other records are known from Ardanuç near Artvin (von Helversen 1989) and from near

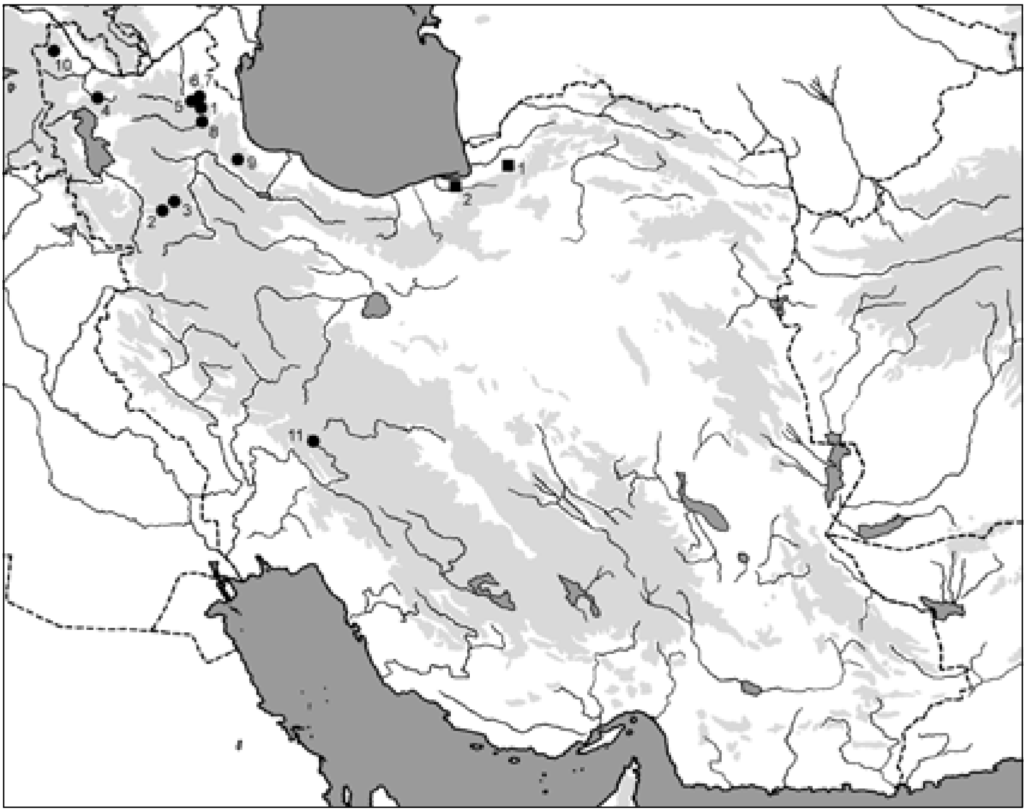

Fig. 81. Records of *Myotis nattereri* (Kuhl, 1817) (squares) and *M. schaubi* Kormos, 1935 (circles) in Iran.

Sarıkamış (Benda & Horáček 1998). One record was also reported from Qali Ali Beg at Arbil in the northernmost Iraq (Rzebik-Kowalska et al. 1978). To the west of this Middle Eastern range, the distribution of *M. nattereri* s.str. continues from the Levant (incl. Cyprus), via southern and western Turkey to the Balkans and Central Europe (cf. Horáček & Hanák 1984, Horáček et al. 2000, Benda et al. 2006, 2010).

Field notes. No roosts of *Myotis nattereri* have been recorded in Iran, the two known records represent nettings of foraging individuals. No remains of *M. nattereri* were found in the material from owl pellets collected in Iran (Table 40).

Similarly as the previous species, *M. nattereri* was mist-netted solely in patches of rather dense beech forests. One site, Galugah (Mazandaran), represents a relatively well preserved natural habitat without any massive impact of human activities on a steep slope of the Alborz Mts. (Fig. 83). Another site, Ali Abad (Golestan), is an exploited lowland forest, partially used as a recreation area by the locals. In both sites the nets were installed above streams running through the forested areas (Fig. 76).

M. nattereri represents a part of the bat community of temperate mixed forests of northern Iran, as it was shown in Ali Abad, where a high number of other forest species was netted, viz. *Myotis*

Fig. 82. Portrait of *Myotis nattereri* (Kuhl, 1817) from Galugah. Photo by A. Reiter.

blythii, *M. bechsteinii*, *M. emarginatus*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Eptesicus serotinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri*. In the forest at Galugah, a female of *M. nattereri* was netted along with a female of another typical forest dweller, *M. bechsteinii* (see above).

From one site in Iran a direct evidence of reproduction in *M. nattereri* is available. A pregnant female collected at Galugah on 29 May, contained a foetus of the crown-rump length 20.0 mm.

Fig. 83. Forest on the northern foothills of the Alborz Mts. near Galugah (Mazandaran) above the Caspian plain (Caspain Sea in the background); in this forest *Myotis bechsteinii* and *M. nattereri* were caught. Photo by A. Reiter.

Table 15. Basic biometric data on the examined Iranian samples of *Myotis nattereri* (Kuhl, 1817), *M. schaubi* Kormos, 1935, and *M. capaccinii* (Bonaparte, 1837). For abbreviations see p. 171

	Myotis nattereri					*Myotis schaubi*					*Myotis capaccinii*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	2	**45.5**	44	47	2.121	4	**50.5**	48	53	2.380	5	**54.0**	53	55	1.000
LCd	2	**48.0**	47	49	1.414	4	**48.8**	48	49	0.500	5	**45.0**	41	47	2.449
LAt	2	**40.45**	40.3	40.6	0.212	7	**42.81**	41.3	44.1	0.953	6	**41.97**	41.0	43.2	0.776
LA	2	**19.45**	19.2	19.7	0.354	4	**20.30**	19.2	21.3	1.105	5	**15.96**	14.9	18.1	1.236
LT	2	**11.30**	10.7	11.9	0.849	6	**11.15**	10.5	11.9	0.561	5	**6.86**	6.1	7.7	0.594
LCr	2	**15.81**	15.68	15.93	0.177	7	**17.19**	16.83	17.44	0.212	5	**15.37**	15.11	15.57	0.189
LCb	2	**14.82**	14.62	15.02	0.283	7	**16.08**	15.67	16.23	0.189	5	**14.20**	13.92	14.36	0.172
LaZ	2	**9.99**	9.92	10.05	0.092	7	**10.72**	10.27	10.88	0.205	5	**9.32**	9.07	9.51	0.168
LaI	2	**3.58**	3.53	3.63	0.071	7	**4.03**	3.82	4.18	0.135	5	**3.56**	3.52	3.64	0.051
LaInf	2	**3.73**	3.72	3.73	0.007	7	**4.26**	4.11	4.34	0.106	5	**3.79**	3.64	3.90	0.096
LaN	2	**7.66**	7.63	7.68	0.035	7	**8.24**	7.92	8.52	0.224	5	**7.81**	7.51	7.97	0.178
LaM	2	**7.84**	7.82	7.85	0.021	7	**8.45**	8.41	8.48	0.033	5	**7.95**	7.83	8.08	0.091
ANc	2	**5.61**	5.52	5.69	0.120	7	**5.99**	5.74	6.19	0.169	5	**5.77**	5.62	5.83	0.089
LBT	2	**2.86**	2.79	2.93	0.099	7	**3.02**	2.87	3.28	0.191	5	**3.13**	2.83	3.44	0.293
CC	2	**3.95**	3.88	4.02	0.099	7	**4.46**	4.27	4.54	0.093	5	**3.92**	3.89	3.97	0.031
M^3M^3	2	**6.45**	6.43	6.46	0.021	7	**7.03**	6.74	7.28	0.183	5	**6.08**	5.93	6.23	0.123
CM^3	2	**6.34**	6.28	6.39	0.078	7	**6.74**	6.60	6.90	0.103	5	**5.73**	5.66	5.88	0.088
LMd	2	**11.63**	11.49	11.76	0.191	7	**12.53**	12.23	12.81	0.199	7	**10.77**	10.56	10.90	0.124
ACo	2	**3.20**	3.12	3.28	0.113	7	**3.87**	3.77	4.02	0.084	7	**2.98**	2.91	3.03	0.048
CM_3	2	**6.66**	6.60	6.72	0.085	7	**7.22**	7.07	7.37	0.107	5	**6.15**	5.98	6.23	0.101

This finding suggests the parturition period in *M. nattereri* populations of northern Iran to occur at the break of May/June. It conforms to the records by Aşan Baydemir & Albayrak (2006) from Turkey, where pregnant females were found in May, and by Rahmatulina (2005) from Azerbaijan, where volant juveniles were found in the second half of June. However, this period is slightly delayed compared the parturition terms in the Levant suggested by Harrison (1964), Mendelssohn & Yom-Tov (1999) and Benda et al. (2006), but it rather concurs with the records from southern Europe (see Topál 2001).

Material examined. 1 ♂ (NMP 90855 [S+A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 90883 [S+A]), Galugah (Mazandaran Prov.), 29 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Myotis nattereri* are shown in Table 15. For the material examined see above; these two specimens represent the only known representatives of the species from Iran, all the previously mentioned records of *M. nattereri* (Harrison 1963, DeBlase 1971a, 1980) were re-identified by Horáček & Hanák (1984) as *M. schaubi* Kormos, 1934 (see also below).

M. nattereri is a rather invariable species in which two subspecies are currently recognised (Horáček & Hanák 1984, Koopman 1994, Horáček et al. 2000, Simmons 2005, Benda et al. 2006), viz. *M. n. nattereri* Kuhl, 1817 (type locality: Laacher See [Rhineland-Palatinate, Germany]; Kuhl 1817: 27) and *M. n. tschuliensis* Kuzâkin, 1935 (type locality: Čuli, Kopet-Dag [Ahal Prov., Turkmenistan]; Kuzâkin 1935: 434); see also a detailed review of the taxonomy of the *nattereri* group in the western Asia by Benda et al. (2006). The nominotypical form occurs in Europe and the Mediterranean coastal areas of the Middle East from western Anatolia to northern Israel and Jordan (including Cyprus), *M. n. tschuliensis* is distributed in the Caucasus region and adjacent areas including north-eastern Turkey, Caucasus and Transcaucasia, northern Iraq, and southern Turkmenistan. These two subspecies differ significantly in body and skull size, see Horáček & Hanák (1984), Benda & Horáček (1995) and Benda et al. (2006). According to the metric characters of the specimens (comp. Table 15 and Benda et al. 2006: 115, Table 18) as well as the geographic positions of their records (see Benda et al. 2006: 112, Fig. 67), the Iranian populations clearly belong to the larger Middle Eastern subspecies, *M. n. tschuliensis*.

However, the phylogenetic analysis by Jones et al. (2006) showed the form *tschuliensis* (based on a specimen from Turkey) to constitute a sister taxon to the larger sympatric form of the *nattereri* complex, *M. schaubi* (based on a specimen from Iran, see below); these two forms (Fig. 84; *schaubi*, *tschuliensis*) belong to a clade which is a parallel to the clade containing European *M. nattereri*. Hence, these three forms could be regarded as separate species, *M. nattereri*, *M. tschuliensis*, and *M. schaubi*. Nevertheless, since this tentative conclusion is based on a comparison of very limited samples, we retain here the classical taxonomic arrangement of the species complex before a profound analysis is done, and rather only indicate the possible taxonomic change (contra e.g. Benda et al. 2006).

Although several species other than *M. nattereri* s.str. have been recently recognised within the *Myotis nattereri* group in the western Mediterranean region (Ibáñez et al. 2006, García-Mudarra et al. 2009, Salicini et al. 2011, Puchmaille et al. 2012), these taxonomic discoveries do not seem to concern the eastern Mediterranean and Middle Eastern populations of the complex.

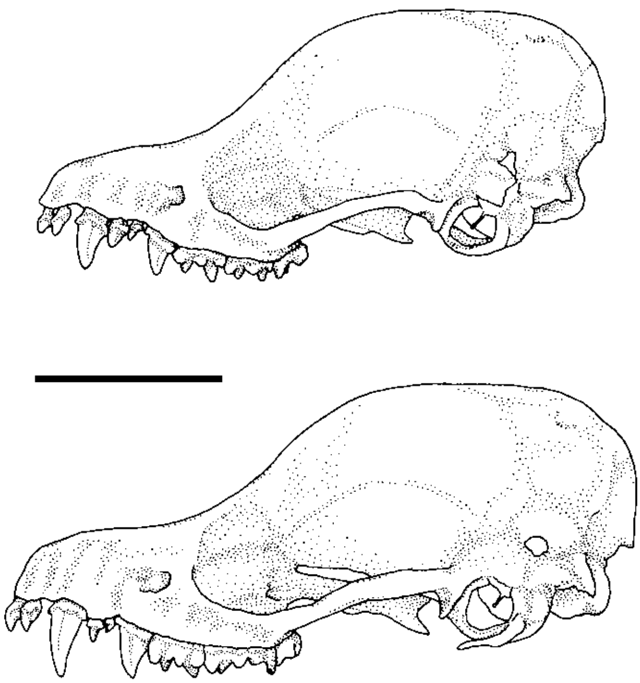

Fig. 84. Skulls of *Myotis nattereri* (Kuhl, 1817) and *M. schaubi* Kormos, 1935 from Iran. Top – *M. nattereri*, NMP 90855, Ali Abad (Golestan); bottom – *M. schaubi*, NMP 48146, Takht-e Soleyman (Azabaijan). Scale bar – 5 mm.

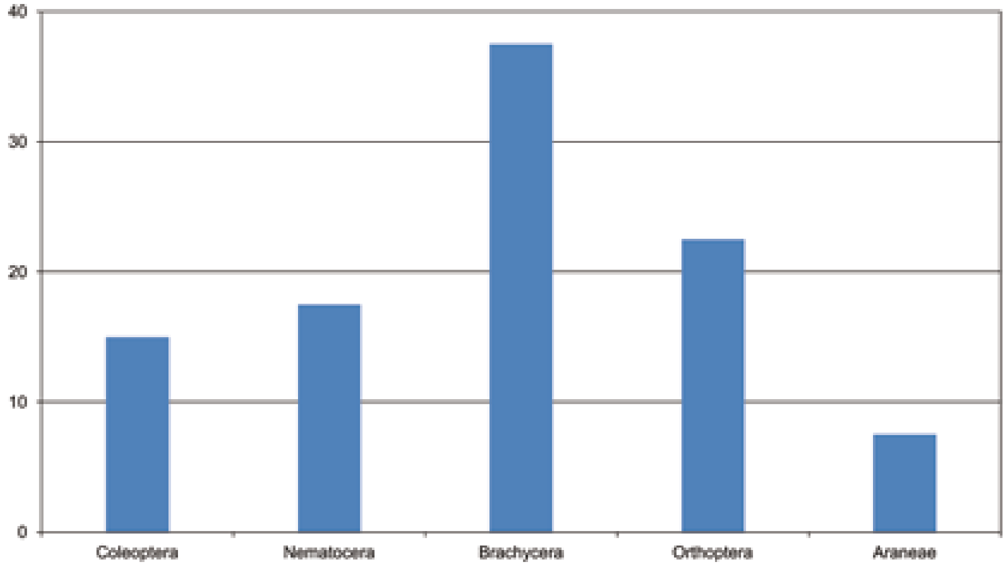

Fig. 85. Percentage volume of particular food items in the diet of *Myotis nattereri* (Kuhl, 1817) in Ali Abad, Golestan, Iran. Four faecal pellets from one bat were analysed.

Echolocation. *Myotis nattereri* produces frequency-modulated calls with a very broad frequency range (20–150 kHz; Siemers & Schnitzler 2000, Dietz et al. 2007). We did not record echolocation calls of *M. nattereri* in Iran and there are only limited data regarding this issue in the Asian part of the species range. Benda et al. (2010) provided basic echolocation parameters from four recordings of *M. nattereri* in Jordan and concluded slightly lower values of SF, EF and FMAX frequencies than those obtained in the European populations (Obrist et al. 2004, Russo & Jones 2002). The values obtained from Jordan conform to the limited data from Israel (Shalmon et al. 1993, Mendelssohn & Yom-Tov 1999).

Feeding ecology. *Myotis nattereri* is a medium-sized foliage gleaner; however, ground gleaning and the ability to hunt swarming nematocerans in the open air was also observed (Arlettaz 1996b, Swift 1997, Topál 2001). High regional and seasonal variation in the diet composition was documented throughout Europe in a lot of studies (Bauerová & Červený 1986, Gregor & Bauerová 1987, Beck 1995, Siemers & Swift 2006, Andreas et al. 2012b, etc.); *M. nattereri* was reported to feed especially on Diptera, Araneae, Coleoptera, Trichoptera, Lepidoptera, and Dermaptera. The analyses of diet of the Middle Eastern populations of this bat were carried out in Turkey, Syria, Jordan, and Israel (Whitaker et al. 1994, Benda et al. 2006, 2010, Whitaker & Karataş 2009). Namely Heteroptera, Coleoptera, Araneae, Lepidoptera, Diptera, and Orthoptera comprised the diet in this region.

From Iran, one sample set from one site was analysed, we collected four faecal pellets from one individual from Ali Abad (Golestan). The analysis showed that this bat fed on Brachycera, Orthoptera, nematoceran Diptera (Tipulidae), beetles (Coleoptera, Curculionidae) and spiders (Araneae) (Fig. 85). This result is fully concordant with the previous studies (see above) and conforms to the foliage gleaning foraging strategy as previously suggested for this species (Siemers & Swift 2006, Andreas et al. 2012b).

Records of ectoparasites. **Original data:** N y c t e r i b i i d a e: *Basilia nana*: 1 ma (CMŠ 3284, A) from 1 fa (NMP 90883), Galugah (Mazandaran Prov.), 29 May 2006.

Comments on ectoparasites. Similarly as in *Myotis bechsteinii*, only one ectoparasite species was collected from *Myotis nattereri* from Iran, the bat fly *Basilia nana* Theodor et Moscona, 1954 (for comments see under *Myotis bechsteinii*). Occurrence of another bat fly species, *Basilia nattereri* (Kolenati, 1857), on *M. nattereri* in Iran cannot be excluded. However, records of this fly are very rare (see Hůrka 1964), its easternmost occurrence spot is known from the Crimea (Theodor & Moscona 1954, Theodor 1967).

Myotis schaubi Kormos, 1935

Records. **Original data**: A r d a b i l: Qutur Su [1], 17 km SE of Meshginshahr, sulphuric caves, 29 September 2011: carcasses of 2 fa found in a cave (NMP 94103, 94104). – Â z a r b â i j a n - e G h a r b i: rocky valley 7 km SE of Chuplu [2], 10 km NW of Takab, small cave, 2 October 1998: net. 1 ma (NMP 48130; cf. Ruedi & Mayer 2001, Benda et al. 2006, Jones et al. 2006); – Takht-e Soleyman [3], 25 km NNE of Takab, 3 October 1998: net. 1 ma, 1 ms, 1 fs (NMP 48145–48147; cf. Benda et al. 2006). – Â z a r b â i j a n - e S h a r q i: Shah Abbasi Caravanserai [4], 8 September 2006: coll. 1 ma (HMNH 2007.30.5.; leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari). – **Published data**: A r d a b i l: between Âlni and Jahâd Âbâd [5], 8 km NE Meshginshahr, ceiling of water channel under road, 13 September 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Banelar, Lâhrud, Dastkand cave [6], 25 km NE Meshginshahr, 31 May 2007: coll. 1 f (Sheikh-Jabbâri 2008); – Banelar, Lâhrud, Qaranuh kahul cave [7], 25 km NE Meshginshahr, 13 September 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Guter-Su [= Qutur Su] [1], Sulphur Caves, north of Mt. Sabalan, 21 August 1961: 1 m, 1 ind., BMNH (Harrison 1963 [as *M. nattereri*], Benda et al. 2006); – Sa'in Caravanserai (between Nir and Sarâb) [8], 10 km NW Nir, 31 May 2007: coll. 1 m (Sheikh-Jabbâri 2008); – Shâl, 40 km SE Khalkhâl, ceiling of water channel under road [9], 12 May 2007: coll. 1 m (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: Maku [10], garden at the north edge of the town, 26 July 1968: 1 mj, FMNH (DeBlase 1971a [as *M. nattereri*]). – C h a h â r M a h â l v a B a k h t i â r i: 6 miles NW Kuh Rang [11], 25 September 1968: shot 1 fj, FMNH (DeBlase 1971a, 1980 [as *M. nattereri*]).

Distribution. *Myotis schaubi* belongs to uncommon bat species in Iran, only eleven record sites are available from the country (Fig. 81). The records come mainly from a limited area of north--western Iran, from the provinces of Ardabil and Azarbaijan; only one site of occurrence lies in the

Fig. 86. Carcass of *Myotis schaubi* Kormos, 1935 from Qutur Su (Azarbaijan). Photo by A. Reiter.

Fig. 87. Ruins of the ancient monument of Takht-e Soleyman (Azarbaijan), a roost and foraging site of *Myotis blythii*, *Myotis schaubi*, and *Plecotus macrobullaris*. Photo by A. Reiter.

central part of the Zagros Mts. (Kuh Rang; DeBlase 1971a). However, all localities are situated in mountainous plateaus, representing climatic/vegetation conditions of continental steppes within the Mediterranean zone. DeBlase (1980) reported only three records of this bat (under the name *M. nattereri*, but see Horáček & Hanák 1984), however, these records well demarcate its whole contemporarily known range in Iran (Fig. 81).

According to Horáček & Hanák (1984), *M. schaubi* is an endemic of the broader Caucasus region, distributed only in Armenia and Iran (Horáček et al. 2000). Although some localities of this bat lie very close to the borders of other countries (Turkey, Georgia, Azerbaijan, Iraq), no records were reported from these territories (Harrison & Bates 1991, Benda & Horáček 1998, Buhnikašvili et al. 2004, Rahmatulina 2005). The occurrence in Iran thus delineates the southernmost and easternmost margins of the whole species distribution range as well as its largest part (some 60–80% of the whole area).

FIELD NOTES. *Myotis schaubi* was recorded in Iran mainly in or at its roosts, only few records could be considered to represent foraging bats. No remains of *M. schaubi* were found in the material from owl pellets collected in Iran (Table 40).

The first record of the species in Iran was made in the sulphuric caves at Qutur Su (Ardabil) in 1961 (Harrison 1963; under *M. nattereri araxenus*), two mummified individuals were found there along with 15 specimens of other five bat species (*Myotis blythii*, *M. mystacinus*, *Eptesicus serotinus*, *E. bobrinskoi*, and *Plecotus macrobullaris*; see Table 24); two more dead individuals were found in these caves in 2011 (Fig. 86), along with two other bats of two species (*Myotis emarginatus*, *M. mystacinus*). This site represents an unusually positioned and acting trap for animal life in the Sabalan mountains – the bats and other animals which visit the cave are "overcome by the sulphur fumes in the cave" (Harrison 1963: 301); see under *Eptesicus bobrinskoi* for more details.

Sheikh-Jabbâri (2008) reported on the findings of two individuals (a male and a female) in two caves at Banelar near Lahrud (Ardabil); in the Dastkand cave on 31 May 2007 and in the Qaranuh Kahul cave in 13 September 2006 (in the latter cave, one *Plecotus macrobullaris* was collected on another occasion). Besides these two cave roosts, this author also reported on findings of solitary males in artificial shelters. One *M. schaubi* was found on a ceiling of water channel under the road between Alni and Jahad Abad near Meshginshahr on 13 September 2006 (where also one *Myotis blythii* was found on another occasion), another bat in the same type of roost was collected at Shal near Khalkhal (together with one *M. blythii*) on 9 May 2007. Also two artificial aboveground roosts of *M. schaubi* were documented from Iran; Sheikh-Jabbâri (2008) collected one male in Sa'in Caravanserai (Ardabil) on 31 May 2007 and one male is available in the HMNH collection that was collected also by Sheikh-Jabbâri & Sheikh-Jabbâri in Shah Abbasi Caravanserai on 8 September 2006. Although Sheikh-Jabbâri (2008) did not give any additional details on these records, the collections of the individuals in the caves, drainage channels and old (ruined) caravanserais suggest that all these natural and artificial, underground and aboveground, rocky spaces are used by solitary *M. schaubi* as its roosts during the summer season. In this habit, this bat resembles some other bat species from the Middle East, namely *Myotis blythii* and *Plecotus macrobullaris*.

Foraging individuals of *M. schaubi* were recorded only few times, mostly at their (potential) roosts. The only exception is the record from near Kuh Rang (Chahar Mahal va Bakhtiari), its circumstances were described by DeBlase (1980; under *M. n. araxenus*) as follows (p. 164): "The Kuh rang specimen, a female young of the year, was shot on 25 September 1968 as it flew over our camp […]." (p. 289): "our camp, which was at an elevation of 2,592 m. in a broad stream valley." (see also DeBlase 1980: 290, Fig. 150, showing steppe valley between low hills). Two males and one female were netted in the ruins of Takht-e Soleyman near Takab (Azarbaijan) on 3 October 1998 (together with several individuals of *Myotis blythii* and *Plecotus macrobullaris*) into a mist-net installed in a vaulted corridor leading from the walled area of the monument (Fig. 87). Another male of *M. schaubi* was netted in a locality situated closely to the previous site, at the entrance to a small cave in the valley of a river near Chuplu (Azarbaijan) on 2 October 1998 (along with seven *Plecotus macrobullaris*, while solitary individuals of *Rhinolophus ferrum-equinum* and *R. hipposideros* were recorded inside the cave). However, rather than the foraging flights, the latter two records probably represent bats approaching their roosts, although also the swarming behaviour could be expected in the respective season.

DeBlase (1971a, 1980) described an unusual record of an individual of *M. schaubi* (under *M. n. araxenus*) that was collected at Maku (Azarbaijan); DeBlase (1980: 342) wrote: "On 26 July 1968 I visited a tunnel excavated into the face of the huge cliff that overhangs the northern side of Maku. […] As we descended the slope toward the inhabited part of the city, a young boy brought us a freshly dead *Myotis nattereri* that he said he found dead in the nearby garden. A thorough search of the many ruins and crevices in the cliff yielded no further bats or sign of bats." (p. 164): "The Maku specimen was found dead in a garden […]. This immature male was fresh when found and had obviously only recently died. The area in which it was discovered had several fairly large trees, numerous inhabited buildings, and a complex of ruins and tunnels cut into the face of the huge cliff overhanging the north side of the town."

No direct data on reproduction of *M. schaubi* are available from Iran. An immature male was found freshly dead on 26 June, a young female of the year was shot on 25 September (DeBlase 1980, see above) and some October records represent subadult bats. Dal' (1947) reported a newborn juvenile and females contained full-grown foeti from Armenia on 22–23 June. Similar parturition terms as in Armenia could be expecteted also in Iran (the second half of June).

Material examined. 1 ♂ (NMP 48130 [S+A]), Chuplu (Azarbaijan-e Gharbi Prov.), 2 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 ♀♀ (NMP 94103, 94104 [S+Sk]), Qutur Su (Ardabil Prov.), 29 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (HMNH 2007.30.5. [S+A]), Shah Abbasi Caravanserai [Ardabil Prov.], 8 September 2006, leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari; – 2 ♂♂, 1 ♀ (NMP 48145–48147 [S+A]), Takht-e Soleyman (Azarbaijan-e Gharbi Prov.), 3 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

MORPHOLOGY AND VARIATION. External and cranial dimensions of the Iranian specimens of *Myotis schaubi* are shown in Table 15. For the material examined see above.

M. schaubi Kormos, 1935, a name of a fossil bat species, was introduced into the taxonomy of Recent bats by Horáček & Hanák (1984); however, all extant populations of this species were previously included into the only form, *Myotis nattereri araxenus* Dal', 1947 (type locality: Amagu, Vajkskoj hrebet (bassejn Araksa), Mikoânskij rajon Arm. SSR [= Amaghu, Vajq / Daralegaz range (Araxes river basin), Vayoc Dzor Dist., Armenia]; Dal' 1947: 173, 178). All specimens of *M. nattereri* known previously from Iran were also assigned to this subspecies (Harrison 1963, DeBlase 1971a, 1980); they represent *M. schaubi* according to the revision by Horáček & Hanák (1984). Since this bat was described from the Upper Pliocene of Hungary, Horáček & Hanák (1984) considered this fossil (Pliocene and Lower Pleistocene) form to constitute a nominotypical subspecies of *M. schaubi*, while the Upper Pleistocene and Recent populations to belong to *M. schaubi araxenus*. According to the available data (Dal' 1947, DeBlase 1980, Horáček & Hanák 1984, Benda et al. 2006, etc.), no marked metric variation has been recorded in *M. schaubi* in its limited Recent distribution range of Armenia and Iran (see Distribution); thus, all these populations should be regarded a single taxon.

ECHOLOCATION. No data on echolocation of *Myotis schaubi* are available.

FEEDING ECOLOGY. *Myotis schaubi* is a medium-sized bat resembling slightly larger *M. nattereri* (see above); there are no data available concerning its ecology and diet. Here, we present the first data on the diet composition in this species.

From Iran, two sample sets of diet of *M. schaubi* were analysed, eight faecal pellets of a bat collected at Chuplu and three digestive tracts from bats collected in the Takht-e Soleyman ruins (both in Azarbaijan). The pellets contained 95% volume of spiders (Araneae) and 5% of larger brachyceran Diptera. The digestive tracts also contained spiders (70% of volume) and diurnal brachyceran dipterans (30%). These two diet items clearly indicate foliage gleaning as the dominating feeding strategy in *M. schaubi*.

Myotis emarginatus (Geoffroy, 1806)

RECORDS. **Original data**: A r d a b i l: Qutur Su [1], 17 km SE of Meshginshahr, sulphuric caves, 29 September 2011: carcass of 1 fa found in the cave (NMP 94106). – B u s h e h r: Qal'eh Sefid [2], Mârâl caves, 5 km N of Dâlaki, 18 November 2009: obs. (leg. V. Akmali). – F â r s: Kuh-e Jahani [3], 13 km ENE of Khurab, salt cave, 2 April 2009: obs. 1 ind. in a cave (photo; leg. M. Filippi). – G o l e s t a n: valley 2 km SSE of Ali Abad [4], beech forest, above a stream, 28 May 2006: net. 1 ma (NMP 90856; Fig. 89; cf. Benda et al. 2006). – H o r m o z g â n: valley 7 km SE of Gishan [5], 50 km N of Bandar Abbâs, above river, 19 April 2000: net. 1 fG (NMP 48448; Fig. 90; cf. Benda et al. 2006); – Isin [6], 15 km N of Bandar Abbâs, 30 April 1977: net. 1 fa (NMP 48465; cf. Benda et al. 2006). – K h o r a s â n - e R a z a w i: valley 10 km E of Bazangan [7], 14 km N of Mazdavand, 8 October 2002: remnants of 1 ind. (pair of mandibles, incomplete skull) found in *Bubo bubo* pellets. – M â z a n d a r a n: valley 8 km W of Pul [8], 26 km SSE of Chalus, above a river, 1 June 2006: net. 1 fG (NMP 90884; cf. Benda et al. 2006). – Q a z v i n: Emamzadeh Mousa [9], 3 km E of Razmiyan, dry valley, 12 May 2006: net. 1 fs (NMP 90765; cf. Benda et al. 2006). – **Published data**: F â r s: Kazerun [10], June 1968: 1 f, IPHR (DeBlase 1980); – Konar-Takhteh [11], Kazerun, Spring 1965: 1 f (Etemad 1967, 1969, DeBlase 1980). – K e r m â n s h a h: Kerend cave [12], 5 km W Kerend-e Gharb (Akmali et al. 2011a); – Mar Ab Canyon [13], 57 km. W Shahabad, 25 August 1968: 1 m, 1 f, FMNH (DeBlase 1980). – K h o r a s â n - e R a z a w i: Chelmir [14], over a stream, 16 July 1968: net. 1 m, 3 f, IPHR (Farhang-Azad 1969a, DeBlase 1980); – "seemingly near Mashad" [= Mashhad] [15] (Lay 1967, cf. Kuzâkin 1950). – M a r k a z i: Azad-Khan cave in Mahalat [16], Summer 1964: 1 f, BMNH (Etemad 1967, DeBlase 1980, Benda et al. 2006), March 1965: 1 m (Etemad 1969). – M â z a n d a r a n: Babolsar [= Babol] [17], [Summer 1964]: 1 m (Etemad 1967, DeBlase 1980), Barfurush [= Babol], house of Imperial Bank of Persia, 4 and 6 July [1927?], 1 m, 1 f, 1 ind., BMNH (Lay 1967, DeBlase 1980); – Tir Tash [18], loft of Tobacco Institute, 28 August 1970: 1 f, BMNH, 4 September 1970: 20 f, BMNH, MMTT (DeBlase 1980). – S i s t â n v a B a l u c h e s t â n: Jalk [19], Balúchistán, 3000['], several specimens (Blanford 1875 [as *Vespertilio desertorum*]), 9 inds. (Blanford 1876 [as

V. desertorum]), Talk, Baluchistan, 2 fa, BMNH (Dobson 1878, Trouessart 1879), 3,000 ft, 1872: 5 fa, IMC (Anderson 1881), Jalq, 3 f, BMNH (DeBlase 1980, Benda et al. 2006); – Shastun [20], Dizak District, Persian Beluchistan, 3,820', 28 July 1916: 1 fa, BMNH (Thomas 1920a [as *M. lanceus*], Wroughton 1920 [as *M. lanaceus*]).

Distribution. *Myotis emarginatus* ranks among medium-frequent bats in Iran, 20 record sites are available from different parts of the country (Fig. 88). Although DeBlase (1980) summarised only a half of the currently known number of records (Table 1), the current pattern of the general distribution in Iran remains very similar to that presented by the latter author. The localities lie in various parts of the country in very different climatic zones, both in northern humid areas and southern arid lowlands, but mostly at rather lower elevations of around 1000 m a. s. l. The records of *M. emarginatus* originate from several rather separated regions of Iran, (1) the Alborz Mts. and the Caspian coastal plain, (2) mountains of north-eastern Khorasan, (3) the northern and south--western Zagros Mts., (4) the Hormozgan plain, and (5) the east-Baluchestani ranges (Fig. 88).

M. emarginatus is a bat with a broad south-west-Palaearctic distribution, it occurs from the Maghreb and western Europe through Central and Mediterranean Europe to the Caucasus, Levant, southern Arabia (incl. Yemen and Oman), West Turkestan and Afghanistan (Horáček et al. 2000, Benda et al. 2006). The Iranian occurrence of this species lies on a crossroad within the Middle

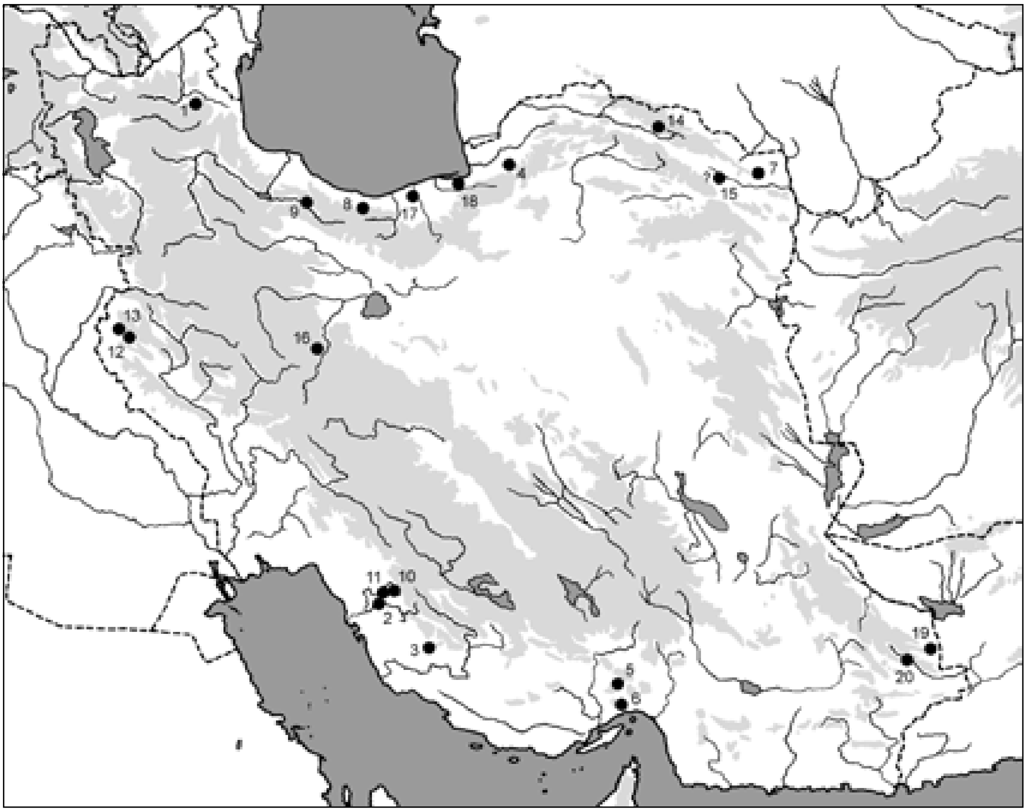

Fig. 88. Records of *Myotis emarginatus* (Geoffroy, 1806) in Iran.

Fig. 89. *Myotis emarginatus* (Geoffroy, 1806) from Ali Abad (Golestan). Photo by A. Reiter.

Fig. 90. Portrait of *Myotis emarginatus* (Geoffroy, 1806) from Gishan (Hormozgan). Photo by A. Reiter.

Eastern part of its distribution range, it continues in almost all directions (see Benda et al. 2006: 128, Fig. 78). In the south, over the Strait of Hormuz, the occurrence continues to the mountains of north-eastern Oman where scattered records are available (Harrison 1977, own unpubl. data); in the north-west to Turkey and Transcaucasia (Benda & Horáček 1998, Rahmatulina 2005); and in the north-east to Afghanistan and Turkmenistan (Meyer-Oehme 1965, Strelkov et al. 1978).

FIELD NOTES. In Iran, *Myotis emarginatus* was originally recorded in its roosts (Etemad 1969, DeBlase 1980), the new data represent mainly foraging individuals recorded by netting. At one site, remains of *M. emarginatus* were recorded in the osteological material from owl pellets (Table 40).

At least one record is most probably an evidence of nursery colony; DeBlase (1980: 161) examined three BMNH specimens collected in the house of the Imperial Bank of Persia in Babol (Mazandaran) on 4 and 6 July (first published by Lay 1967) and wrote: “The male from Barfurush (= Babol) is an immature which, together with the early July date, indicates that the bank was used as a nursery site.” However, neither Lay (1967) nor DeBlase (1980) gave any details concerning the finding of the bats, i.e. part of the house where the bats were found to roost or the size of the possible colony. Similarly, a BMNH and MMTT material of twenty females of *M. emarginatus* collected “from roost in loft of Tobacco Institute” in Tir Tash (Mazandaran) on 4 September 1970 (DeBlase 1980: 158) indicates a colony record. Although DeBlase (1980) did not give any close data on this record (age of the females and their reproduction status), it is very probable that this finding represents a rest of a former maternity colony in the house attic. These two indirect indications of nursery roosts of *M. emarginatus* come solely from artificial roosts and namely, only

Fig. 91. Valley at Emamzadeh Mousa near Razmiyan (Qazvin), a foraging habitat of *Myotis emarginatus* and *Tadarida teniotis*. Photo by P. Benda.

from the limited area of the northern province of Mazandaran (Caspian coastal plain); no records of maternity roosts in natural shelters are available from Iran, although the distribution range of the species cover whole country (see above).

Several records of *M. emarginatus* are known from natural caves, however, these findings represent only solitary bats (where the number of bats is available). A female was collected from the Azad-Khan cave at Mahalat (Markazi) in the summer 1964 (Etemad 1967) and a male in March 1965 (Etemad 1969). The latter record as well as that made by V. Akmali in the Maral caves at Qal'eh Sefid (Bushehr) on 18 November 2009 (the number of bats is unknown) perhaps represent evidences of hibernation in *M. emarginatus*, considering the period of record. On 2 April 2009, i.e. in the transient period or the end of the hibernation period, a torpid individual was observed in a cave in the salt karst in the Kuh-e Jahani range near Khurab. Akmali et al. (2011a) reported a record of *M. emarginatus* from the Kerend cave at Kerend-e Gharb (Kermanshah), but they did not specify the number of bats nor the date of observation.

DeBlase (1980: 161) reported on a finding of a small aggregation of *M. emarginatus* in a transient roost in the Mar Ab Canyon near Shahabad (Kermanshah), which he specified as follows: "The one male and one female *M. emarginatus* collected at Mar Ab Canyon were two of the approximately 10 individuals of this species roosting under huge, jumbled boulders on 25 August 1968 […]. […] The Mar Ab Canyon specimens are adults. There was not enough guano under the roosting sites to indicate that this location was used as a nursery and it was much too exposed to be used as a hibernaculum. It is most likely only a temporary roost used during fall movements to their hibernacula." (for more details on the site see under *Rhinolophus ferrumequinum*).

A carcass of an adult female was found in the sulphuric caves at Qutur Su (Ardabil) during the visit of the caves in 2011 (along with three other bats of two species, *Myotis schaubi* and *M. mystacinus*; see Table 24). This site represents an unusually positioned and acting trap for animal life in the Sabalan mountains – the bats and other animals which visit the cave are killed by the sulphuric fumes; see under *Eptesicus bobrinskoi* for more details.

M. emarginatus shared most of the above reviewed roosts with other species of bats. From the house of the Imperial Bank of Persia in Babol, DeBlase (1980) reported also collections of *Rhinolophus hipposideros* and *Pipistrellus pipistrellus*. In the loft of the Tobacco Institute in Tir Tash, *Rhinolophus ferrumequinum* and *Pipistrellus pipistrellus* were also found along with the numerous group of *M. emarginatus*. Etemad (1967, 1984) reported also *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis blythii* and *Miniopterus pallidus* from the Azad-Khan cave at Mahalat. In the Maral caves at Qal'eh Sefid, *Rhinopoma microphyllum* and *R. muscatellum* were netted and *Asellia tridens* observed. Akmali et al. (2011a) reported also *Rhinolophus euryale*, *Myotis blythii*, and *Pipistrellus pipistrellus* from the Kerend cave at Kerend-e Gharb. DeBlase (1980) found the small group of *M. emarginatus* roosting with a larger aggregation of *Rhinolophus ferrumequinum* under boulders in the Mar Ab Canyon near Shahabad.

Several times, foraging individuals of *M. emarginatus* were recorded by netting. Fahrang-Azad (1969a) reported on the netting session carried out above a small stream at Chelmir (Khorasan) within the main range of the Kopetdagh Mts. where four *M. emarginatus* were collected on 16 July 1968. A male was netted above a stream passing through an exploited lowland beech forest at Ali Abad (Golestan; Fig. 76) on 28 May 2006, used also as a recreation area by the locals. A female *M. emarginatus* was caught into a net installed above a river at Pul (Mazandaran) on 1 June 2006, within a forested landscape of the northern slope of the Alborz Mts., with scattered fields and orchards. Another female was netted in a dry valley at Emamzadeh Mousa near Razmiyan (Qazvin) on 12 May 2006, on the dry southern slope of the Alborz Mts. covered by steppes and pastures (Fig. 91). A female of *M. emarginatus* was also netted above a pool of remaining water in an almost dried valley at Gishan (Hormozgan) on 19 April 2000 (Fig. 92), in the arid rocky landscape. Another individual was netted in a very similar landscape at Isin, near Bandar Abbas (Hormozgan), on 30 April 1977. All netted bats were recorded above river beds (dried, with running or still water) in valleys of various vegetation types – from humid forests to very arid steppes, illustrating a wide plasticity in ecological requirements of *M. emarginatus* in the Middle East.

In most of these sites, *M. emarginatus* was recorded foraging together with other bat species. During the netting session covering probably more nights at Chelmir, an extremely rich community of bats was recorded, composed of nine species (Fahrang-Azad 1969, DeBlase 1980); additionally also *Rhinolophus ferrumequinum*, *Myotis blythii*, *Eptesicus serotinus*, *E. ognevi*, *Hypsugo savii*, *Otonycteris leucophaea*, *Miniopterus pallidus*, and *Tadarida teniotis* were netted. At Ali Abad, *M. emarginatus* was documented as a part of the bat community of temperate forests of northern Iran, where also *Myotis blythii*, *M. bechsteinii*, *M. nattereri*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Eptesicus serotinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri* were recorded. At Isin, *M. emarginatus* was netted together with *Eptesicus pachyomus*, and ten *R. aegyptiacus* were shot there. In the valley at Gishan, along with one *M. emarginatus*, six individuals of *Tadarida teniotis* were netted. In the forest in the valley at Pul, calls of several *Pipistrellus pipistrellus* were also detected, while at Emamzadeh Mousa there were additionally detected calls of *Tadarida teniotis*.

Concerning the reproduction of *M. emarginatus* in Iran, DeBlase (1980: 161) concluded based on the few available data: "it can be assumed that young are born in June or late May. By my own observation one of the Chelmir specimens collected in July is a barely volant immature." These very scarce data could be complemented by new observations of pregnant females from both northern and southern Iran. One pregnant female was netted at Pul (Mazanadaran) on 1 June, it

Fig. 92. Pool of remaining water in the valley near Gishan (Hormozgan), a foraging habitat of *Myotis emarginatus* and *Tadarida teniotis*. Photo by A. Reiter.

contained one relatively less developed foetus of the crown-rump length 12.3 mm; another pregnant female was netted at Gishan (Hormozgan) on 19 April, it contained a foetus of the crown-rump length 19.0 mm. These findings suggest different temporal occurrence of parturitions in northern and southern parts of the country; in the north they probably occur in the first half of June (more or less conforming to DeBlase's assumption and other observations from different parts of the Middle East, see the data by Rahmatulina 2005 and the review by Benda et al. 2006), while in southern Iran the period of parturitions seems to occur a month earlier, in the second half of April or early May.

Skull fragments and a pair of mandibles, i.e. remains of one individual of *M. emarginatus* were found in the pellets of *Bubo bubo* collected in a valley at Bazangan near Mazdavand (Khorasan). This record represented 0.68% of all prey items (and 0.95% of mammal items) in the respective sample and 0.013% of all prey items (0.017% of mammal items) in the whole analysed eagle owl diet from Iran (Table 40). From the Middle East, such exceptional evidence of *M. emarginatus* in owl diet was recorded also in Turkey and Syria (Obuch 1994, Benda et al. 2006).

Material examined. 1 ♂ (NMP 90856 [S+A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 1 ♂ (BMNH 77.828 [S+B]), Azad-Khan cave, Mahallet [Markazi Prov.], date unlisted, leg. E. Etemad; – 1 ind. (JOC unnumbered [Sf]), Bazangan (Khorasan-e Razawi Prov.), 8 October 2002, leg. J. Obuch; – 1 ♀ (NMP 90765 [S+A]), Emamzadeh Mousa (Qazvin Prov.), 12 May 2006, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 48448 [S+A]), Gishan (Hormozgan Prov.), 19 April 2000, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 48465 [S+A]), Isin (Hormozgan Prov.), 30 April 1977, leg. B. Pražan; – 1 ♀, 3 inds. (BMNH 74.11.21.29, 74.11.21.30, 9.1.4.33 [S], MSNG 44541 [A], type series of *Vespertilio desertorum* Dobson, 1875), Jalk, Baluchistan [Sistan va Baluchestan Prov.], 1872, leg. W. J. Blanford; – 1 ♀ (NMP 90884 [S+A]), Pul (Mazandaran Prov.), 1 June 2006, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 94106 [S+Sk]), Qutur Su (Ardabil Prov.), 29 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Myotis emarginatus* are shown in Table 12. For the material examined see above.

M. emarginatus was for a long time considered a variable species, up to four subspecies were recognised; however, the opinions on geographic variation in this species were based on the comparison of colour morphs and/or on an insufficient number of specimens. Existence of at least two forms has been mentioned from the Middle East; while in Asia Minor and in the Levant, only the nominotypical subspecies has been reported to occur (type locality: fortifications de Charlemont [Givet, Champagne-Ardenne, France]; Geoffroy-Saint-Hilaire 1806: 198), from the easternmost part of the species range, i.e. Transcaucasia, Iran, Afghanistan, and West Turkestan, the populations have been assigned to one of four subspecies described from this limited area (*desertorum*, *lanaceus*, *turcomanicus*, *kuzyakini*), see the detailed review of the taxonomic history of *M. emarginatus* in Asia by Benda et al. (2006).

Two names originate even from the territory of Iran, *Vespertilio desertorum* Dobson, 1875 (type locality: Jalk, Balúchistán [Iran]; Blanford 1875: 309) and *Myotis lanaceus* Thomas, 1920 (type locality: Shastun, Dizak district, Persian Baluchistan [Iran]; Thomas 1920a: 934). However, the latter name is broadly considered to be a junior synonym of the former name as they were described from sites situated only 50 km away and their colouration and body size are very similar (Ognev 1928, Ellerman & Morrison-Scott 1951, DeBlase 1980). On the other hand, the form *desertorum* was primarily considered to be a separate species present from eastern Transcaucasia to Iran and West Turkestan (Dobson 1878, Satunin 1896, 1914, Thomas 1920a). Later on, this name was introduced into synonymy of *M. emarginatus* by Ognev (1928) and considered to be a subspecific name of the Iranian populations (Ellerman & Morrison-Scott 1951, Strelkov 1963, 1981a, Kuzâkin 1965, Corbet 1978).

DeBlase (1980) determined two to three colour forms in Iran which he co-identified with subspecies; he restricted the form *desertorum* to south-eastern Iran only; in south-western, western and northern Iran he identified *M. e. emarginatus*; and he detected a possible third form in three specimens from Babol (Mazandaran) that showed "very red pelage, with hairs of both the dorsum and ventrum conspicuously tipped with brick-red" (DeBlase 1980: 160).

Concerning the taxonomy of *M. emarginatus* based on pelage colouration, Benda et al. (2006: 125) concluded: "the authors who evaluated larger series of *M. emarginatus* from different types of habitats […], found a mosaic of coloration morphs. These morphs are most probably connected with humidity of the habitat, as a rule, but individual variation may also play a role in the variation. Paler individuals occur in lowland semi-arid regions of Central Asia and Iran, while individuals found in the Mediterranean arboreal and similar habitats of Asia are mainly darker reddish- or orange-brown. Therefore, in the western part of the species distribution range (North Africa, Mediterranean and sub-Mediterranean regions of Europe, the Levant), only one basic coloration morph has been described. […] Thus, we consider the pelage coloration as a varying character which is adaptive to habitat and can not have a direct reflection in the species taxonomy."

Benda et al. (2006) revised geographic variation in *M. emarginatus* with the help of a detailed morphometric analysis of some 330 specimens. Its results revealed three groups of size morphotypes within the distribution range of the species, which were used by the authors as a basis for revision of intraspecific taxonomy in *M. emarginatus*, comprising two subspecies. The large-sized morphotype comprises populations of the eastern parts of the species range (Crimea, Transcaucasia, Iran, Afghanistan, West Turkestan) and was identified as a separate subspecies under the prior synonym in the region, *M. e. desertorum* (Dobson, 1875) (with *lanaceus* Thomas, 1920, *turcomanicus* Bobrinskoj, 1925, *saturatus* Kuzâkin, 1934, and *kuzyakini* Rossolimo et Pavlinov, 1979 as junior synonyms). The small-sized morphotype of populations from south-western and central Europe and the northern part of the Balkans, and the medium-sized morphotype originating from separate regions, from the Maghreb, and from the southern Balkans to the Levant, both these

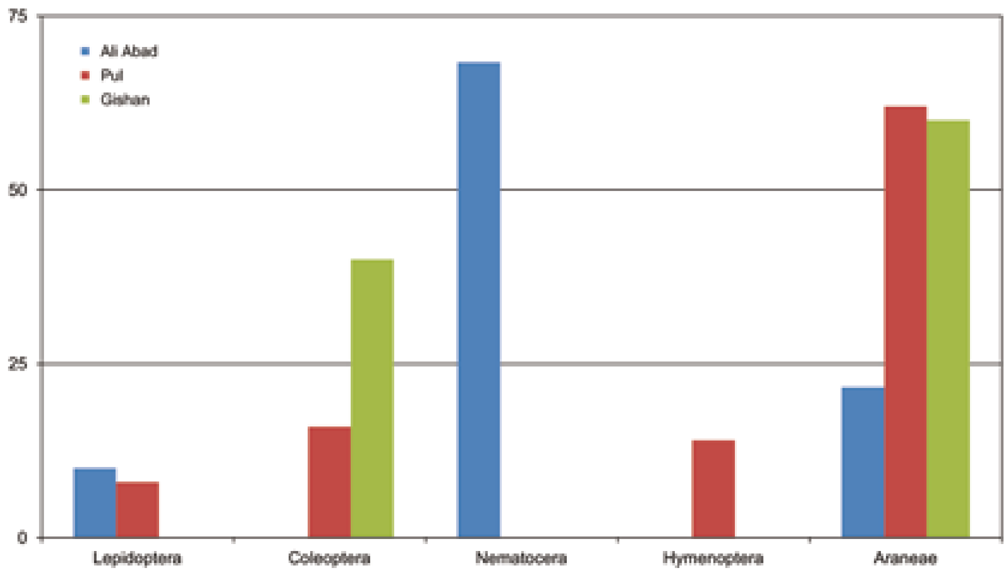

Fig. 93. Percentage volume of particular food items in the diet of *Myotis emarginatus* (Geoffroy, 1806) in Iran. Material analysed: Ali Abad (six faecal pellets / from one bat), Pul (5 / 1), Gishan (one digestive tract).

morphotypes were considered by Benda et al. (2006) to represent the nominotypical subspecies. While particular populations of this form create a geographical continuum with clinal transitions between morphotypes along the Mediterranean from the Maghreb over southern and central Europe to the Levant, the eastern subspecies *M. e. desertorum* lives in a range separated by the most continental parts of the Middle East in the eastern half of Anatolia, and thus, it represents a geographically as well as morphologically well-defined taxon. The Iranian populations of *M. emarginatus* also belong to this subspecies.

Results of the available genetic analyses (Ibáñez et al. 2006, Mayer et al. 2007, García-Mudarra et al. 2009) correspond in a limited extent with the revision by Benda et al. (2006). The samples from Morocco, southern and northern Iberia, Belgium, Germany, Greece, and Israel belong to one clade with a very low divergence (perhaps less than 1% of genetic distance, according to indirect indications by the respective authors). This is in accordance with the above opinion that the whole Mediterranean area incl. the southern parts of Central Europe is inhabited by only one taxon, the nominotypical subspecies. Unfortunately, the molecular genetic revision of the mutual relations of *M. e. emarginatus* and *M. e. desertorum* still remains to be carried out.

Echolocation. *Myotis emarginatus* produces frequency-modulated calls, often with a very high start frequency (more than 140 kHz; Dietz et al. 2007). The ranges of frequencies of maximum energy were reported between 43–87 kHz from the European populations (Russo & Jones 2002, Obrist et al. 2004, Papadatou et al. 2008). We did not obtain call recordings from Iran; however, range of frequencies of maximum energy was between ca. 46–50 kHz in Oman (own unpubl. data).

Feeding ecology. *Myotis emarginatus* is a small- to medium-sized foliage gleaner (Krull et al. 1991). In Europe, the species was found to feed especially on Araneae, Lepidoptera, brachyceran Diptera, and Lepidoptera larvae (Bauerová 1986, Beck 1995, Steck & Brinkmann 2006, Goiti et al. 2011). As far as the Middle Eastern populations of *M. emarginatus* are concerned, Diptera, Lepidoptera, Coleoptera, and Homoptera prevailed in the diet of this bat in Azerbaijan (Rahmatulina 2005); Araneae and Brachycera were found to be the most important food items in Syria (Benda et al. 2006); and Hemiptera, Araneae, and Brachycera were reported from two sample sets collected in Turkey (Whitaker & Karataş 2009). Araneae and Brachycera in the diet of *M. emarginatus* suggest the foliage gleaning foraging strategy in this bat. A quite unusual diet composition was documented in this bat from Jordan, where very high proportions of the medium-sized scarabaeid beetles were recorded (Benda et al. 2010).

From Iran, we analysed diet of three individuals of *M. emarginatus* from three localities (Fig. 93); eleven faecal pellets from Ali Abad (Golestan) and Pul (Mazandaran) and one digestive tract from a bat collected at Gishan (Hormozgan). The pellets from Ali Abad we found to be dominated by nematoceran Tipulidae, two remaining samples were dominated by spiders (Fig. 93). An important proportion of beetles (Curculionidae) was recorded in the digestive tract from Gishan.

The high proportion of Tipulidae in the diet of *M. emarginatus* in Iran as well as the high proportion of scarabaeid beetles in the samples by Benda et al. (2010) from Jordan remarkably differ from the diet composition usually documented in the northern parts of the distribution range of the species (see above). These results thus suggest a certain level of flexibility of the trophic niche in *M. emarginatus*.

Myotis mystacinus morpho-group

Records. **Original data**: A r d a b i l: Qutur Su [1], 17 km SE of Meshginshahr, sulphuric caves, 31 August 2010: carcass of 1 ind. (NMP 93914) found in the cave, 29 September 2011: carcass of 1 ma (NMP 94105) found in the cave. – Â z a r b â i j a n - e G h a r b i: Bastam [2], 6 km W of Qarah Ziya'oddin, above a river, 30 September 1998: net.

2 ma (NMP 48119, 48120; cf. Benda & Tsytsulina 2000, Benda & Karataş 2005, Benda et al. 2006 [as *M. nipalensis*], Tsytsulina et al. 2012 [as *M. aurascens* and *M. transcaspicus*]). – G o l e s t a n: valley 2 km SSE of Ali Abad [3], beech forest, above a stream, 28 May 2006: net. 1 ma (NMP 90857). – **Published data**: A r d a b i l: Ahmad Beiglu [4], 10 km W Meshginshahr, crevice in a bridge, 18 July 2006: coll. 1 f[a, HMNH] (Sheikh-Jabbâri 2008 [as *M. mystacinus*]); – Benmâr [5], 25 km W Ardabil, an orifice in a boulder, 7 June 2006: 1 m (Sheikh-Jabbâri 2008 [as *M. aurascens*]); – Guter-Su [= Qutur Su] [1], Sulphur Caves, north of Mt. Sabalan, 21 August 1961: 3 m, BMNH (Harrison 1963, Findley 1972 [as *M. mystacinus*], Benda & Tsytsulina 2000, Benda & Karataş 2005, Benda et al. 2006 [as *M. aurascens*]); – Jamâirân [6], 25 km NW Ardabil, suture in tractor trailer, 7 August 2006: coll. 1 m (Sheikh-Jabbâri 2008 [as *M. mystacinus*]); – Daraq ruin [7], Qorbân Darasi valley, 35 km E of Meshginshahr, crevice, 13 May 2006: coll. 1 m (Sheikh-Jabbâri 2008 [as *M. mystacinus*]). – Â z a r b â i j a n - e G h a r b i: 2 km. west of Maku [8], over a stream, 5 October 1962: 1 fa, FMNH (Lay 1967, DeBlase 1980 [as *M. mystacinus*]); – 10 km. southwest of Rezaiyeh [= Oromiyeh] [9], grist mill, 14 September 1962: 1 ma, FMNH (Lay 1967, DeBlase 1980 [as *M. mystacinus*]); – 18 km. southwest of Rezaiyeh [= Oromiyeh] [10], over water, 24 September 1962: 1 fa, FMNH (Lay 1967, DeBlase 1980 [as *M. mystacinus*]); – "seemingly Khwoy" [11] (Lay 1967 [as *M. mystacinus*], cf. Vereŝagin 1959). – G i l â n: Siahkal [12], 15 June 1969: 1 m, IPHR (Farhang-Azad 1970a ex DeBlase 1980 [as *M. mystacinus*]). – G o l e s t a n: Astrabad', ber. Kaspiâ, Sever. Persiâ [= Astrabad (= Gorgan), shore of the Caspian Sea, northern Persia] [13], 1 ind., ZIN (Satunin 1910 [as *M. mystacinus*], cf. Kuzâkin 1944), Gorgan, ZIN (Strelkov 1983a [as *M. mystacinus*]); – 9 km. north of Gorgan [14], over a pool, 29 October 1962: shot 1 ma, FMNH (Lay 1967, DeBlase 1980 [as *M. mystacinus*]). – K e r m â n s h a h: 6.4 km. N Kermanshah [15], over a stream, 20 August 1968: net. 1 fa, FMNH (DeBlase 1980 [as *M. mystacinus*]); – 8 km. N Kermanshah [16], village building, 22 and 24 August 1968: 1 ma, 1 fa, FMNH (DeBlase 1980 [as *M. mystacinus*]). – K h o r a s â n - e R a z a w i: 71 km SE Mashhad

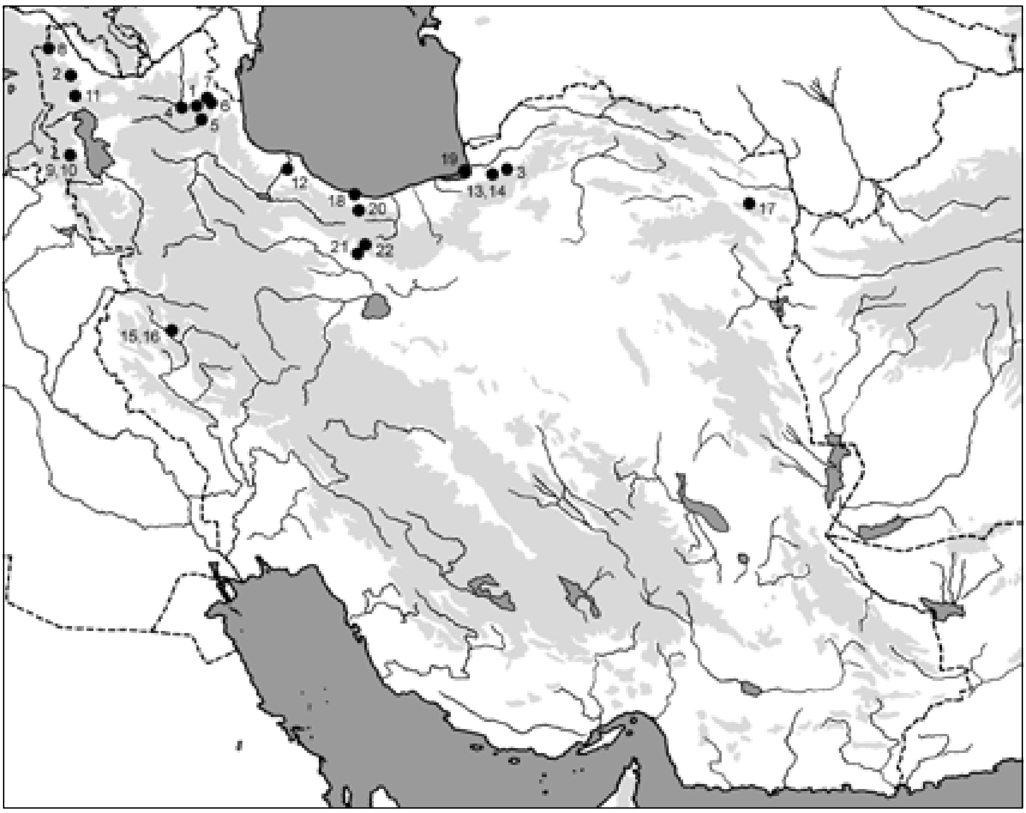

Fig. 94. Records of bats of the *Myotis mystacinus* morpho-group in Iran.

[17], 29–30 July 1969: 1 ind. (Farhang-Azad 1970a ex DeBlase 1980 [as *M. mystacinus*]). – M â z a n d a r a n: 15 km. W Chalus [18], Khoshamian Forest, 12 June 1969: 1 fa, IPHR (Farhang-Azad 1970a ex DeBlase 1980 [as *M. mystacinus*]); – o-v'Ašur'-ade, Persia [= Ashuradeh island, Iran] [19], 1874: 1 ind. (Bianki 1917 [as *M. mystacinus*]); – Sama [20], over a stream, 18 August 1962: net. 1 fs, FMNH (Lay 1967, DeBlase 1980 [as *M. mystacinus*]). – T e h r â n: Tehran [21], 23 July 1952: 1 ms, SMNS (DeBlase 1980 [as *M. mystacinus*]); – Zargende bliz Tegerana [= Zargandeh near Tehran] [22], ZIN (Strelkov 1983a [as *M. mystacinus*]). – Iran (undef.): Iran, ZIN (Tsytsulina et al. 2012 [as *M. transcaspicus*]); – Farusk, ZIN (Strelkov 1983a [as *M. mystacinus*]).

Distribution. Representatives of the *Myotis mystacinus* morpho-group were documented from at least 23 record sites in Iran (Fig. 94). The localities are scattered mostly over the northernmost part of Iran, in a belt stretching from western Azarbaijan to eastern Khorasan, i.e. from the most humid parts of the country; only two records are known from relatively southward positioned sites near Kermanshah (DeBlase 1980). Here summarised picture of distribution well conforms to that given by DeBlase (1980), who, however, reported only two thirds of the currently known localities (Table 1).

The Iranian range composes a part of the southern margin of distribution of this bat group in western Asia. The records from the Kermanshah province belong to the southernmost ones in the Asian Palaearctic along with those from the Mediterranean Levant (Mendelssohn & Yom-Tov 1999, Horáček et al. 2008). Since these records more or less correspond with the southernmost records in other regions of the distribution range of the group (Morocco, Levant, Kashmir), there is only a limited possibility of the occurrence of the morpho-group more to the south in Iran*. In the north, the Iranian distribution continues to areas of more abundant occurrence in Transcaucasia and West Turkestan (Strelkov 1983a, Benda et al. 2011c) as well as to eastern Turkey and northern Afghanistan (Bates & Harrison 1997, Benda & Karataş 2005).

Field notes. In Iran, bats of the *M. mystacinus* morpho-group (= *M.* cf. *mystacinus*) were recorded in their roosts as well as in their foraging grounds, however, remains of these bats were not found in the osteological material from owl pellets (Table 40).

With one extraordinary exception (see below), all records of *M.* cf. *mystacinus* roosts were made in artificial conditions. The first such finding was reported by Lay (1967: 140) from a settlement lying near Oromiyeh (Azarbaijan), where a solitary male was found on 14 September 1962: "The individual caught 10 km. south of Rezaiyeh [= Oromiyeh] roosted alone in a dimly lit water-powered grist mill that was operated daily." DeBlase (1980: 314) reported another finding from a synanthropic roost: "[… A] boy brought us a *M. mystacinus* that he had captured in the […] village [on 22 August 1968,] but he refused to show us exactly where he had collected it. On 24 August, just as we were leaving our Kermanshah camp for Ilam, this same boy brought us another *M. mystacinus*." The bats, a male and a female, originated from a village situated 8 km north of Kermanshah, DeBlase (1980: 154) stated that they were: "purchased, said to be collected from building in village."

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*DeBlase (1980: 150) mentioned an additional report on the southern occurrence of *M. mystacinus* s.l. in Iran: "Ognev (1928, p. 347) listed Baluchistan and "southern Persia" for this species but mentioned no specimens or precise localities." DeBlase (1980) used the English translation of the book by Ognev (1928) issued in Israel in 1962 but originally published in Russian in 1928. The original Russian text (Ognev 1928: 452) says: "В более южных частях средней Азии эта мышь найдена в Непале на Гималаях (Dobson, 1878), в Пекине, Белючистане, в южной Персии и Ашур-аде в Персии (см. Бианки, 1917)." [= In more southwards lying parts of Central Asia this bat was found in the Himalayas in Nepal (Dobson 1878), in Beijing, Baluchestan, in southern Persia and in Ashuradeh in Persia (see Bianki 1817).] However, Dobson (1878: 315) stated solely as follows: "in Asia hitherto found in Syria, at Pekin [= Beijing], and in the Himalayas only." and Bianki (1917: viii) reported on six specimens of *M. mystacinus*, five from the former Russian Empire (from the Caucasus, western Kazakhstan, Russian Far East, and two from north-eastern Europe) and one from Ashuradeh, Persia (a former Russian military base on the occupied Persian territory). It shows that Ognev (1928) did not give any evidence for his mention of the occurrence of *M. mystacinus* in Beluchestan and southern Persia, which thus rather seems to be a mistake, namely in the light of the current knowledge of the group distribution in the Middle East.

Sheikh-Jabbâri (2008) reported four roost records of solitary individuals of *M.* cf. *mystacinus* from the Ardabil province in 2006; a male found in a crevice of the Daraq ruin near Meshginshahr on 13 May, a male in an orifice in boulder at Benmar near Ardabil on 7 June, an adult female in a crevice of a bridge at Ahmad Beiglu near Meshginshahr on 18 July, and a male in a suture in a tractor trailer at Jamairan near Ardabil on 7 August.

Harrison (1963) reported a finding of three carcasses of adult individuals from the sulphuric caves at Qutur Su (Ardabil) in 1961 (along with mummies of *Myotis blythii*, *M. schaubi*, *Eptesicus serotinus*, *E. bobrinskoi*, and *Plecotus macrobullaris*; see Table 24); another specimen was collected there in 2010 and another one during the visit of the caves in 2011 (along with *Myotis schaubi* and *M. emarginatus*). This site represents an unusually positioned and acting trap for animal life in the Sabalan mountains – the bats and other animals visiting the cave are killed by the sulphuric fumes; see under *Eptesicus bobrinskoi* for more details.

Foraging bats of the *M. mystacinus* morpho-group were recorded at least at seven sites in Iran. Lay (1967) reported on a collection (netting/shooting?) of an adult female over a stream at Maku on 5 October 1962 and of an adult female over water near Oromiyeh on 24 September 1962 (both Azarbaijan). Lay (1967: 100) caught a subadult female in a net "set in a small clearing on a low bluff overlooking […] stream" at Sama (Mazandaran) on 18 August 1962 (see under *Eptesicus nilssonii* for details of the site). An adult male was shot as it "flew over a pool in the Qareh Su drainage on the plain 9 km. north of Gorgan" (Golestan) on 29 October 1962 (Lay 1967: 76). Lay (1967: 160) additionally specified, concerning his whole catch: "All five of the specimens captured flew low over and along streams and lagoons."

DeBlase (1980: 314) reported on a collection of an adult female over a stream near Kermanshah on 20 August 1968: "Mistnets were set at several locations across the stream and along the edge of the relatively lush riparian vegetation in an open field. These nets and some shooting yielded one *Myotis mystacinus*, […]." Two adult males were netted above a river at Bastam among mountain steppes near Qarah Ziya'oddin (Azarbaijan) on 30 September 1998, one adult male was caught in a net stretched over a stream passing through a dense beech forest at Ali Abad (Golestan) on 28 May 2000 (Fig. 76).

While most of the roosts were inhabited solely by *M.* cf. *mystacinus*, foraging bats were largely documented along with other species. Lay (1967) reported also two *Pipistrellus pipistrellus* from Maku, one *Eptesicus serotinus* from Sama, and one *Pipistrellus pipistrellus* and one *Miniopterus pallidus* from near Gorgan. DeBlase (1980) reported also a collection of four *Pipistrellus pipistrellus* and one *P. kuhlii* from near Kermanshah. In the beech forest near Ali Abad, also *Myotis blythii*, *M. bechsteinii*, *M. nattereri*, *M. emarginatus*, *Vespertilio murinus*, *Eptesicus serotinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri* were netted, and above the river at Bastam also one *Pipistrellus kuhlii* was caught.

Very few data are available on reproduction of the *M. mystacinus* morpho-group in Iran. Already DeBlase (1980: 156) summarised all then available knowledge, to which no new data have been added: "Immature specimens (by epipihysial ossification) have been collected only on 23 July and 18 August and a lactating female was taken on 12 June." The former pair of specimens refers to a record of a subadult male from Tehran (circumstances not described; DeBlase 1980) and a subadult female from Sama (see above; Lay 1967); the latter specimen refers to the female collected in the Khoshamian Forest near Chalus (Mazandaran) with no other details provided (DeBlase 1980).

Material examined. 1 ♀ (HMNH 2007.30.3. [S+A]), Ahmad Beigloo [Ardabil Prov.], 18 July 2006, leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari; – 1 ♂ (NMP 90857 [S+A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 2 ♂♂ (NMP 48119, 48120 [S+A]), Bastam (Azarbaijan-e Gharbi Prov.), 30 September 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 3 ♂♂ (BMNH 63.1196–63.1198 [S]), Guter-Su, N. of Mount Sabalan, 38° 10' N, 47° 40' E [Ar-

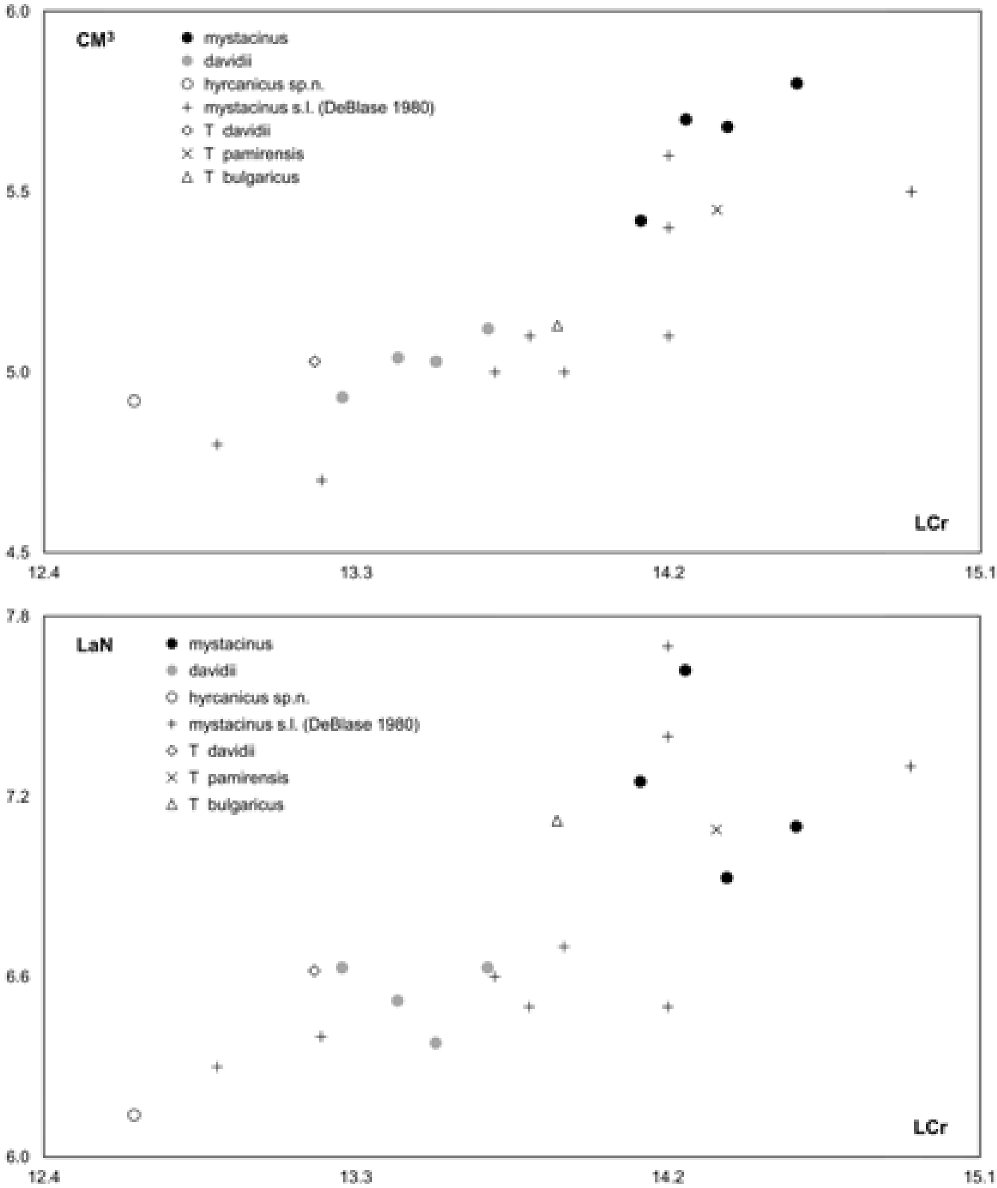
Table 16. Basic biometric data on the type specimen of *Vespertilio Davidii* Peters, 1869 and on the examined Iranian samples of the *Myotis mystacinus* morpho-group: *M. mystacinus* (Kuhl, 1817) and *M. davidii* (Peters, 1869). For abbreviations see p. 171

	Myotis mystacinus				*Myotis davidii*				*V. Davidii*
	NMP 94105	BMNH 63.1196	BMNH 63.1197	BMNH 63.1198	NMP 48119	NMP 48120	NMP 93914	HMNH 2007.30.3.	MNHN 1987-296
LC	–	–	–	–	50	46	–	–	–
LCd	–	–	–	–	42	42	–	–	–
LAt	36.1	–	–	–	35.0	34.9	34.9	35.0	32.2
LA	15.5	–	–	–	13.0	13.2	–	–	–
LT	9.8	–	–	–	7.6	7.8	–	–	–
LCr	14.37	14.57	[14.25]	14.12	13.68	13.42	13.53	13.26	13.18
LCb	13.71	14.02	14.15	–	12.88	12.77	12.86	12.68	12.42
LaZ	8.39	–	–	–	8.41	8.32	8.08	8.42	–
LaI	3.65	3.78	3.94	3.87	3.46	3.33	3.27	3.24	3.58
LaInf	3.53	3.62	3.56	3.25	3.43	3.13	3.16	3.32	3.38
LaN	6.93	7.10	7.62	7.25	6.63	6.52	6.38	6.63	6.62
LaM	7.16	–	–	–	7.06	6.94	6.68	6.96	–
ANc	4.98	5.52	–	–	4.88	4.73	4.59	4.79	4.57
LBT	2.84	–	–	–	2.97	2.75	2.68	2.81	–
CC	3.57	3.60	3.60	3.42	3.20	3.22	3.26	3.29	3.43
M^3M^3	5.41	5.80	5.65	5.62	5.33	5.12	5.24	5.29	5.26
CM^3	5.68	5.80	5.70	5.42	5.12	5.04	5.03	4.93	5.03
LMd	10.45	10.27	10.83	10.17	9.53	9.47	9.39	9.60	9.30
ACo	2.89	3.05	3.05	2.75	2.65	2.67	2.69	2.83	2.55
CM_3	5.97	6.03	6.00	5.76	5.48	5.40	5.39	5.25	5.40

dabil Prov.], 21 August 1961, leg. Aberystwyth University Expedition; – 1 ind. (NMP 93914 [S+Sk]), Qutur Su (Ardabil Prov.), 31 August 2010, leg. K. Faizolahi; – 1 ♂ (NMP 94105 [S+Sk]), Qutur Su (Ardabil Prov.), 29 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of the *Myotis mystacinus* morpho-group are shown in Tables 16, 19. For the material examined see above.

The western Palaearctic populations of the bats of the *Myotis mystacinus* morpho-group or the whiskered bats were primarily classified as one highly variable species, *M. mystacinus* (Kuhl, 1817) (Tate 1941, Ellerman & Morrison-Scott 1951, Kuzâkin 1935, 1944, 1950, 1965, Strelkov 1963, etc.). Based on a morphological comparison, *M. brandtii* (Eversmann, 1845) was identified within the morpho-group as a separate species (Hanák 1965, 1970, Gauckler & Kraus 1970), and this bat was confirmed to occur in the broad area of the Palaearctic from western Europe to the Far East, including the north-western parts of the Middle East and Caucasus regions (Strelkov 1983a, b, Albayrak 1990, 2003, Steiner & Gaisler 1994, Benda & Karataş 2005). The Middle Eastern populations of *M. mystacinus* in its traditional sense were assigned to various subspecies by various authors (see Benda & Karataş 2005 for a review); viz. *mystacinus* Kuhl, 1817, *przewalskii* Bobrinskoj, 1926, *aurascens* Kuzâkin, 1935, and *hajastanicus* Argiropulo, 1939. However, in the last years, several karyological, morphological, and/or genetic studies have revealed a further hidden diversity in the *M. mystacinus* morpho-group (Volleth 1987, von Helversen 1989, Kruskop & Borissenko 1996, Benda & Tsytsulina 2000, Tsytsulina 2000, 2001, von Helversen et al. 2001, Benda & Karataş 2005, Tsytsulina et al. 2012). Besides others, these authors suggested even five species of the group to occur in the Middle East, viz. *M. mystacinus*, *M. brandtii*, *M. aurascens*, *M. hajastanicus*, and *M. nipalensis* (Dobson, 1871). However, these papers concerned the Iranian populations of the whiskered bats only marginally.



Figs. 95, 96. Bivariate plots of the examined Iranian samples of the *Myotis mystacinus* morpho-group and relevant type material. 95 – greatest length of skull (LCr) against the length of upper tooth-row (CM^3). 96 – greatest length of skull (LCr) against the neurocranium width (LaN). Data given by DeBlase (1980) are included (including the BMNH specimens from Qutur Su, examined also by authors of this paper, to show the comaparability of both data sets). T = holotype specimen.

The Iranian samples of the *M. mystacinus* morpho-group were first evaluated by Harrison (1963) and DeBlase (1980), however, both authors failed to assign any subspecies name to these bats. Additionally, DeBlase (1980) mentioned a considerable variation within a set of nine specimens in their skull shapes and tooth characters. Based on a profound morphological comparison with other populations of the western Palaearctic, Benda & Tsytsulina (2000) recognised two species of the morpho-group in the north-western part of Iran (Azarbaijan), large-sized *M. aurascens* (based on three BMNH specimens from Qutur Su, cf. Harrison 1963) and small-sized *M. nipalensis* (based on two newly collected NMP specimens). On the other hand, the occurrence of *M. mystacinus* s.str. was doubted by these authors. This picture of the group taxonomy in Iran was reported also by Benda & Karataş (2005) and Karami et al. (2008).

Tsytsulina et al. (2012) published results of a molecular genetic analysis of the *M. mystacinus* morpho-group concerning samples from the whole Eurasia, including the NMP specimens from Iran evaluated also by Benda & Tsytsulina (2000). Tsytsulina et al. (2012) found several genetic lineages within the group, but only the '*aurascens*' and '*mystacinus*' lineages in the Caucasus region and only the '*aurascens*' lineage in Iran. So, they identified both *M. aurascens* and *M. nipalensis* morphotypes (sensu Benda & Tsytsulina 2000) within one lineage and considered them as one species under the former name.

The metric comparison of the few examined specimens of the *M. mystacinus* morpho-group from Iran (Tables 16, 19) combined with the data on specimens examined by DeBlase (1980: 391–392) revealed three size categories among these bats that overlapped only marginally in several dimensions (Figs. 95, 96); a group of large-sized bats (LAt 36.0–36.5 mm, LCr 14.1–14.9 mm, CM^3 5.4–5.8 mm, LaN 6.9–7.7 mm), a group of medium-sized bats (LAt 34.4–37.0 mm, LCr 13.1–14.2 mm, CM^3 4.7–5.1 mm, LaN 6.4–6.7 mm) and a group of small-sized bats (LAt 32.4–34.4 mm, LCr 12.6–12.9 mm, CM^3 4.8–4.9 mm, LaN 6.1–6.3 mm). While the large-sized and small-sized bats showed relatively long rostra and broad neurocrania (CM^3/LCr 0.38–0.40 and 0.39, LaN/LCr 0.48–0.51 and 0.48) and their small upper premolars (P^3) were situated in the tooth-rows, the medium-sized bats had relatively short rostra and narrow braincases (CM^3/LCr 0.37–0.38, LaN/LCr 0.47–0.50) and their P^3 were displaced from the tooth-rows in the palatal direction, and P^2 and P^3 were almost or even in mesio-distal contact. On the other hand, the large-sized bats had relatively narrow rostra (CC/CM^3 0.62–0.63) and their large upper premolars (P^4) did not bear any remarkable cusp on its cingulum, the medium-sized and small-sized bats had relatively broad rostra (CC/CM^3 0.63–67 and 0.66) and their P^4 bore a rather high cingular cusp (0.07–0.12 mm and 0.14 mm). While in the small-sized bat the crown of the upper canine is almost rounded in occlusal view, in the medium-sized bats the crown is rhomboid in occlusal view and narrow in the palato-labial dimension (only the personally examined bats were used for evaluation of skull shapes and tooth characters, cf. Table 16). Hence, although the material of the whiskered bats from Iran is very limited (some fifteen skulls are available in total), the three size groups that appeared among them clearly represent three distinct morphotypes (Figs. 97, 98). The very characteristic morphotype of *M. brandtii* (see e.g. Benda & Tsytsulina 2000), known from the western Caucasus and northern Turkey (Benda & Karataş 2005), has not been found among the Iranian bats.

We also compared partial sequences of the mitochondrial cytochrome *b* gene from various representatives of the genus *Myotis* and namely of the *M. mystacinus* morpho-group (most of them used already by Tsytsulina et al. 2012 and preceding authors, see Table 17) with the samples from the Iranian populations, including all three size morphotypes. These three morphotypes fall into three distinct lineages (differing 12.3–14.7% of the uncorrected *p* distance; Table 18) and thus, they represent three separate species, in accordance with the interpretations of previous analyses (von Helversen et al. 2001, Simmons 2005, Mayer et al. 2007, Tsytsulina et al. 2012).

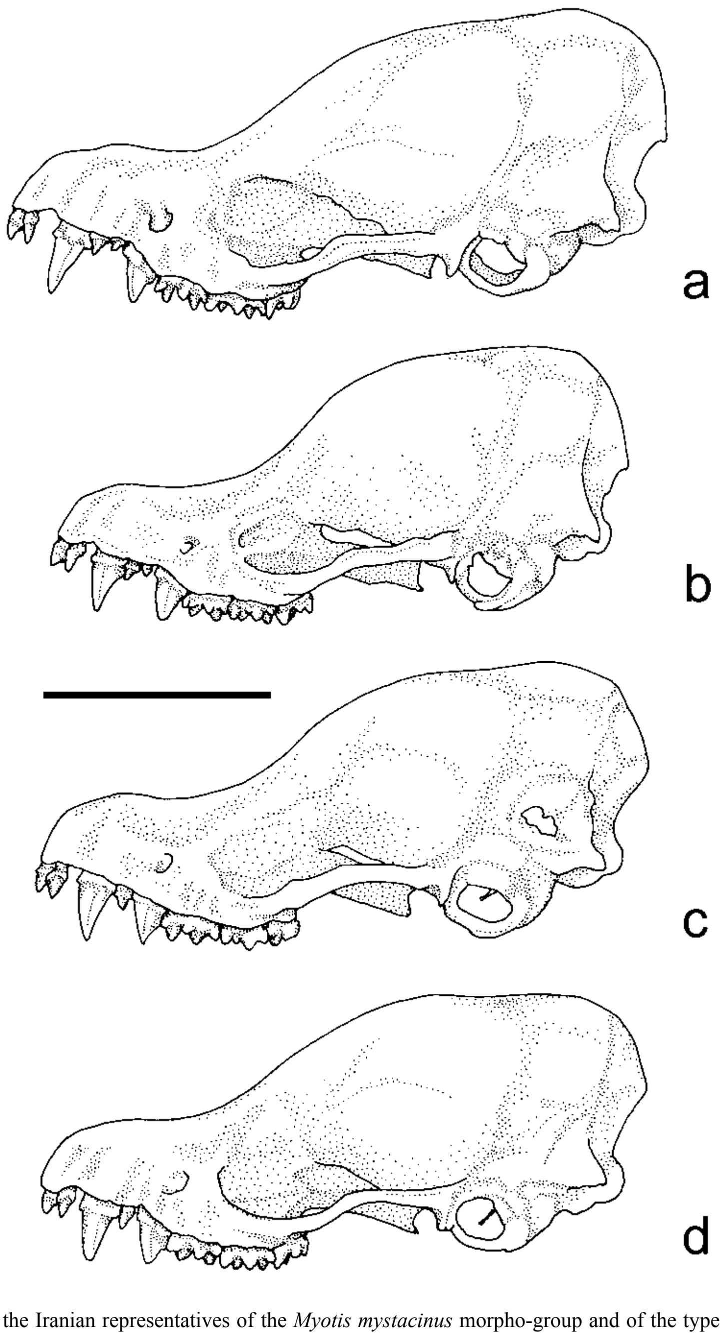


Fig. 97. Skulls of the Iranian representatives of the *Myotis mystacinus* morpho-group and of the type specimen of *Vespertilio Davidii* Peters, 1869; a – *Myotis mystacinus* (Kuhl, 1817), NMP 94105, Qutur Su (Ardabil); b – *M. hyrcanicus* sp. n., holotype, NMP 90857, Ali Abad (Golestan); c – *M. davidii* (Peters, 1869), NMP 48120, Bastam (Azarbaijan); d – *Vespertilio Davidii*, holotype, MNHN 1987-296, Peking (China). Scale bar – 5 mm.

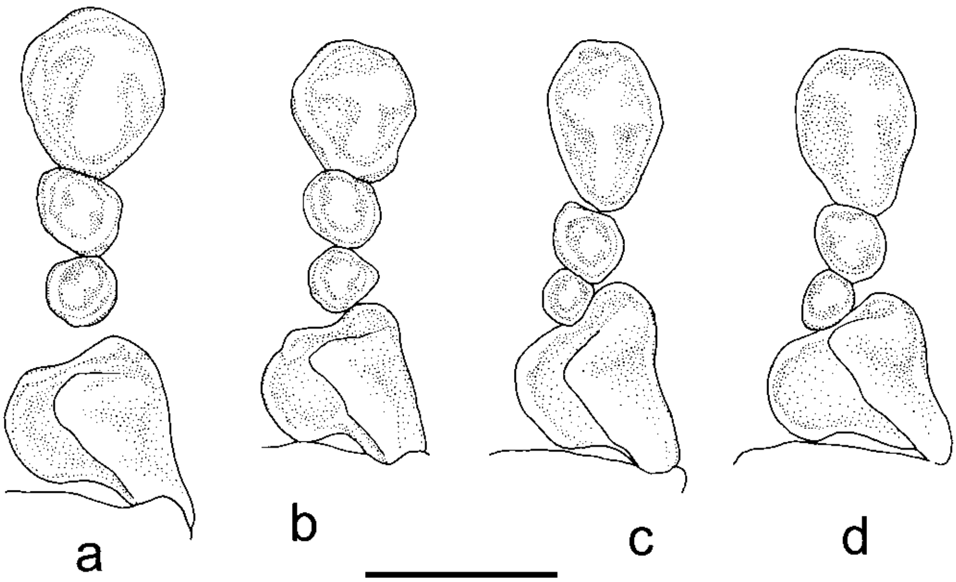


Fig. 98. Occlusal views of the unicuspidal upper tooth-rows of the Iranian representatives of the *Myotis mystacinus* morpho-group and of the type specimen of *Vespertilio Davidii* Peters, 1869; a – *Myotis mystacinus* (Kuhl, 1817), NMP 94105, Qutur Su (Ardabil); b – *M. hyrcanicus* sp. n., holotype, NMP 90857, Ali Abad (Golestan); c – *M. davidii* (Peters, 1869), NMP 48120, Bastam (Azarbaijan); d – *Vespertilio Davidii*, holotype, MNHN 1987-296, Peking (China). Scale bar – 1 mm.

The sequences from two Iranian bats of the medium-sized morphotype (NMP 48119, 48120) clustered into a lineage composed of sequences of *M. aurascens* (sensu Tsytsulina et al. 2012) from a broad area of the Eurasian steppe belt, covering the specimens from Moldavia, Crimea, Russian Caucasus, southern and eastern parts of European Russia, Turkmenistan, Kirghizstan, western and eastern Kazakhstan, Tuva, and South Korea (Fig. 99); the latter three samples (E Kazakhstan, Tuva, Korea) clustered into a sublineage separated by 3.6–6.6% of *p* distance from the rest of the lineage including the Iranian samples and perhaps represent a distinct taxon. Considering both morphological and genetic traits as well the geographical distribution of the samples (see also Tsytsulina et al. 2012: 13, Fig. 7), bats previously assigned to several taxa were assembled into one lineage in this analysis; they were mostly subspecies of *M. mystacinus* s.l. in the sense by e.g. Tate (1941) and Ellerman & Morrison-Scott (1951), i.e. *davidii* Peters, 1869, *nipalensis* Dobson, 1871, *meinertzhageni* Thomas, 1926, *transcaspicus* Ogneff et Heptner, 1929, *sogdianus* Kuzâkin, 1934, *aurascens* Kuzâkin, 1935, *popovi* Strelkov, 1983, and *mongolicus* Kruskop et Borissenko, 1996. The prior name of this lineage is *Vespertilio Davidii* Peters, 1869* (Figs. 97, 98; see also Benda & Karataş 2005), and this name is thus applicable as the name of

* Peters (1869: 402–403) gave the following description of his *Vespertilio Davidii* that perfectly fits the characters of the Iranian and West Turkestani bats: "Diese Art ist sehr ähnlich dem *V. mystacinus* [= *Myotis mystacinus* s.l.] und unterscheidet sich äußerlich nur durch eine weniger breite Schnauze und durch ein wenig längere und am äußerem Rande schwächer eingebuchtete Ohren. Dagegen weicht sie sehr ab durch das Gebiß. Der obere und untere zweite Prämolarzahn sind ganz aus der Reihe heraus nach ihnen gedrängt und sehr klein und die inneren aus dem Cingulum hervorgehenden Zacken der backzähne, welche bei *V. mystacinus* [= *Myotis mystacinus* s.l.] so spitz und sehr entwickelt sind, sind hier nur als stumpfe Höcker vorhanden."

the species as *Myotis davidii* (type locality: Peking (China); Peters 1869: 403); other mentioned names represent its junior synonyms (for dimensions of the type specimens and for type localities see Benda & Karataş 2005: 12, 33). Benda & Tsytsulina (2000) included also the names *Myotis mystacinus przewalskii* Bobrinskoj, 1926 and *M. m. kukunorensis* Bobrinskoj, 1929, relatively

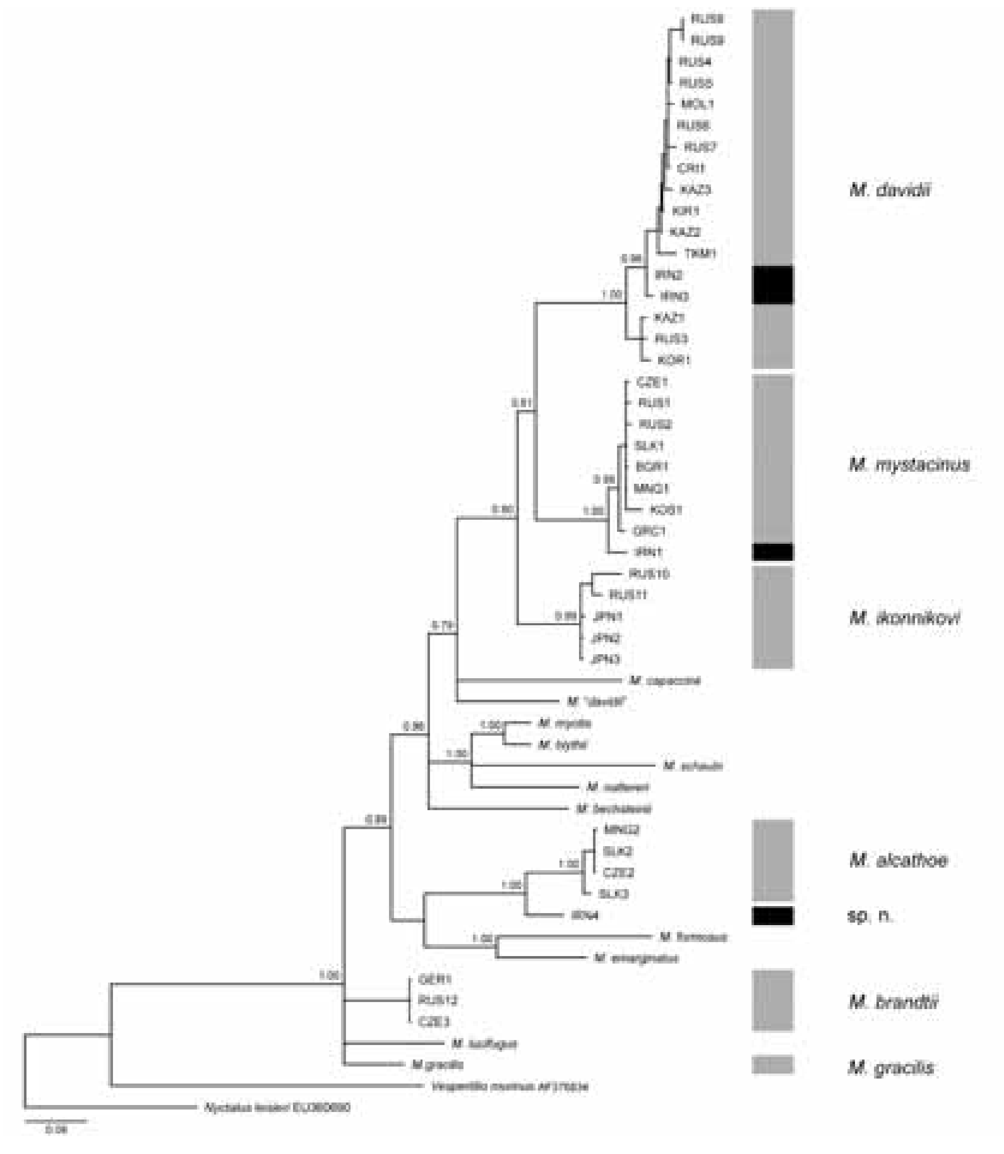


Fig. 99. Bayesian consensus tree showing positions of the Iranian haplotypes (black bands) within the species of the *Myotis mystacinus* morpho-group (vertical bars) (complete cytochrome *b* sequences, see also Tables 17 and 18). Bayesian posterior probability is indicated above the respective branches.

Table 17. GenBank Accession Numbers of the examined specimens of the genus *Myotis* (complete cytochrome *b* gene); for additional data concerning the published haplotypes and the respective vouchers see: * – Tsytsulina et al. (2012), † – Ruedi & Mayer (2001), ‡ – Kawai et al. (2001), ‡‡ – Kawai et al. (2006)

species	haplotype	GBAN	voucher	colection site & date
M. mystacinus	IRN1	KF874510	NMP 94105	Iran, Qutur Su, 29 September 2011
	BGR1	KF874502	NMP 48342	Bulgaria, Gorna Breznica, 25 July 1994
	CZE1	AY665140*	NMP 49495	Czech Republic, Moravský Krumlov, 19 June 1999
	GRC1	KF874503	NMP 49017	Greece, Simopoulo, 23 August 2001
	KOS1	AY665142*	ZIN 35064	Kosovo, Peć/Peja
	MNG1	KF874504	NMP 90226	Montenegro, Plužine, Stabna, 8 August 2002
	RUS1	AY665141*	ZMMU 171262	Russia, Gelendžik
	RUS2	AY665166*	ZIN 82786	Russia, Ural Mts.
	SLK1	AY665167*	NMP 49500	Slovakia, Rovné, 10 August 1997
M. davidii	IRN2	AY665149*	NMP 48119	Iran, Bastam, 1 October 1998
	IRN3	AY665150*	NMP 48120	Iran, Bastam, 1 October 1998
	CRM1	KF874511	NMP pb4408	Ukraine, Crimea, Kamenskoe, 22 September 2009
	KAZ1	AY665146*	ZIN 68247	Kazakhstan, W of the Balkhash lake
	KAZ2	AY665158*	ZIN 68541	Kazakhstan, Aâgoz
	KAZ3	AY665159*	ZIN 65110	Kazakhstan, Kup'sary, Emba river, 10 May 1977
	KIR1	AY665157*	ZIN 65742	Kirghizstan, Issyk-Kul' lake
	KOR1	AY665148*	KM 13093	South Korea, Gangwon Do, Yongwol Gun
	MOL1	AY665153*	ZIN 62425	Moldavia, Chişinău, 22 January 1976
	RUS3	AY665147*	ZMMU 168601	Russia, Tuva
	RUS4	AY665151*	ZIN 78226	Russia, Stavropol region
	RUS5	AY665152*	ZMMU 166220	Russia, Tuapse, 12 August 1998
	RUS6	AY665154*	ZIN 72828	Russia, Volgograd
	RUS7	AY665155*	ZMMU 171259	Russia, Rostov-na-Done
	RUS8	AY665156*	ZMMU 168601	Russia, Engel's
	RUS9	DQ182698*	ZMMU 160787	Russia, Engel's
	TKM1	AY665160*	ZIN 56940	Turkmenistan, Esenguly
M. hyrcanicus sp. n.	IRN4	KF874509	NMP 90857	Iran, Ali Abad, 28 May 2006
M. alcathoe	CZE2	KF874507	NMP pb3995	Czech Republic, Kostelec, 9 September 2008
	MNG2	KF874505	NMP 90228	Montenegro, Plužine, Stabna, 8 August 2002
	SLK2	KF874506	NMP pb3500	Slovakia, Boťany, 21 July 2007
	SLK3	KF874508	NMP 50447	Slovakia, Šurice, Pohanský hrad, 2 August 2001
M. ikonnikovi	JPN1	AB106594‡	OCUMS 6010	Japan, Yamanashi, Narisawayma
	JPN2	AB106595‡	OCUMS 6403	Japan, Tochigi, Kuroiso-shi
	JPN3	AB106596‡	KK 0042	Japan, Hokkaido, Nukabira
	RUS10	AY665162*	ZIN 83809	Russia, Irkutsk region
	RUS11	AY665165*	BM 39061	Russia, Sakhalin
M. brandtii	CZE3	AY665168*	–	Czech Republic, Čížov
	GER1	AF376844†	ER 97	Germany, Neuhaus
	RUS12	AY665139*	ZIN 82729	Russia, Moskva region
M. gracilis		AB243030‡‡	–	Japan, Hokkaido
M. "*davidii*"		AB106591‡	GU 8062	China, Guangzou, Longmen-xian
M. capaccinii		AF376845†	biopsy	Greece, Peloponnese
M. schaubi		AF376868†	NMP 48130	Iran, Chuplu, 3 October 1998
M. nattereri		AF376863†	ER 1633	Greece, Peloponnese
M. myotis		AF376860†	ER 1312	Germany, Bavaria
M. blythii		AF376840†	IZEA 4726	Kirghizstan, Oš
M. bechsteinii		AF376843†	IZEA 3390	Switzerland, Jura
M. emarginatus		AF376849†	ER 99	Greece, Thessaloniki
M. formosus		AB106592‡	OCUMS 5290	South Korea, Jeonranam-do, Kwang-gun
M. lucifugus		AF376854†	UAM 22927	USA, Alaska

distinct morphotypes from the mountain plateaus of East Turkestan and West China, into their *M. nipalensis* (= *M. davidii* under the present recognition); however, positions of these populations / taxa remain open. Another question is the actual taxonomic position of the populations of small--sized *Myotis* assigned to *M. davidii* by some Far Eastern authors of molecular genetic analyses (see e.g. Kawai et al. 2003, You et al. 2010), which is certainly not linked with the *M. mystacinus* morpho-group (see position of this genotype in results of the cyt *b* analysis; Fig. 99). Both these problems can be solved only with the help of a broad analysis combining both morphological and genetic evidence of a large geographical extent and representative sampling. Based mostly on the morphological examination, *M. davidii* is represented in Iran by the specimens collected at Bastam (NMP 48119, 48120), Qutur Su (NMP 93914) and Ahmad Beiglu (HMNH 2007.30.3); considering the available data on the bats examined by DeBlase (1980) perhaps also the specimens collected at Sama (FMNH 96436), near Oromiyeh (FMNH 96437, 96438), and near Kermanshah (FMNH 111236, 111237).

The sequence from one Iranian bat of the large-sized morphotype (NMP 93914) clustered with the sequences from the Czech Republic, Slovakia, Montenegro, Kosovo, Bulgaria, Greece, Russian Caucasus, and the Russian Ural Mts. (Fig. 99); these bats belonged to two morphotypes sensu Benda & Tsytsulina (2000), '*mystacinus*' (specimens from the Czech Republic, Slovakia and the Caucasus) and '*aurascens*' (Montenegro, Kosovo, Bulgaria, Greece). So, in accordance with the suggestion by Mayer et al. (2007), here we tentatively classify these bats under *M. mystacinus* (Kuhl, 1817) in which the '*aurascens*' morphotype represents a subspecies; while Mayer et al. (2007) or Volleth & Heller (2012) suggested the name *M. m. bulgaricus* Heinrich, 1936 (type locality: östl. von Plovdiv [Bulgaria]; Heinrich 1936: 38), here we prefer its senior synonym, *M. m. pamirensis* Kuzâkin, 1935 (type locality: Pamir, oz. Âšil'-Kul' [= Yashil Kul lake, Upper Badakhshan prov., Tajikistan]; Kuzâkin 1935: 431), see also Figs. 95, 96. Formerly, Benda & Tsytsulina (200) and Benda & Karataş (2005) considered the large-sized whiskered bats from the Caucasus and southern Asia to belong to *M. aurascens* (= here *M. davidii*), however, this remains true only for the bats from southern Ukraine and Russia, including the Greater Caucasus – the morphotype '*popovi*' (sensu Strelkov 1983b) is the largest form of *M. davidii*. Here presented results clearly showed the large-sized populations of the mountains at the southern margin of the west-Asian part of the morpho-group range (between the Caucasus and Himalayas) to represent *M. mystacinus* (in the sense by Mayer et al. 2007 and Tsytsulina et al. 2012), while the medium--sized bats *M. davidii*. Also the whiskered bats from the Middle East and south-eastern Europe previously considered as *M. aurascens* by Benda & Tsytsulina (2000), Benda & Karataş (2005), Dietz et al. (2007), Benda et al. (2009b, 2011c), and/or Lanza (2012) can be tentatively assigned to *M. mystacinus pamirensis*. Based mostly on the morphological examination, *M. mystacinus* is represented in Iran by the four specimens collected at Qutur Su (BMNH 63.1196–63.1198, NMP 93914).

The sequence of one Iranian bat of the small-sized morphotype (NMP 90857) represented a lineage of its own, distant by 7.9–8.3% from its sister lineage, composed of the sequences of *M. alcathoe* von Helversen et Heller, 2001 from the Czech Republic, Slovakia and Montenegro (Fig. 99). Considering the deep genetic distance from its closest relative from the forest zone of Europe, this morphotype represents a separate species, for which no name in the synonymy of the *M. mystacinus* morpho-group is available. *Myotis* aff. *alcathoe* is represented in Iran by the specimen collected at Ali Abad (NMP 90857); considering the data on the bats examined by DeBlase (1980), perhaps also the specimen collected at Tehran (SMNS 4056).

To be concluded, the group of whiskered bats contains three species in Iran, the large-sized *Myotis mystacinus* (Kuhl, 1817), the medium-sized *M. davidii* (Peters, 1869), and the small-sized *Myotis* aff. *alcathoe* von Helversen et Heller, 2001. Generally, this finding conforms with the

Table 18. Percent pairwise unncorrected genetic distances among and within reconstructed phylogroups of the *Myotis mystacinus* morpho-group and outgroups. Legend: IR = Iran, WP = western Palaearctic, EP = eastern Palaearctic

p [%]	*davidii* IR	*davidii* WP	*davidii* EP	*mystacinus* IR	*mystacinus* WP	*hyrcanicus* sp. n. IR	*alcathoe*	*ikonnikovi*	*brandtii*	*gracilis*
davidii IR	0.7									
davidii WP	1.4–3.7	0.1–3.6								
davidii EP	3.6–4.4	4.7–6.6	1.1–1.6							
myst IR	12.3–12.7	12.3–13.7	12.0–12.7	–						
myst WP	11.7–12.7	11.1–13.3	12.0–12.9	3.3–4.9	0.3–2.7					
hyrcanicus sp. n. IR	14.3–14.7	13.9–15.7	14.6–15.0	13.1	13.4–14.1	–				
alcathoe	14.7–15.4	13.1–15.3	15.1–16.0	13.4–13.7	12.7–13.9	7.9–8.3	0.1–2.0			
ikonnikovi	10.6–11.7	10.4–13.1	11.0–12.7	10.0–13.1	10.4–13.7	12.6–14.4	13.0–15.4	0.3–4.4		
brandtii	14.6–14.7	14.9–16.3	13.6–14.3	14.6	14.4–15.6	14.4	15.1–16.0	12.9–14.3	–	
gracilis	16.0–16.3	15.6–17.9	14.6–15.0	14.7	14.6–16.1	15.0	15.7–17.0	13.9–14.7	9.6	–
“*davidii*”	14.4–14.6	14.4–15.7	14.3–14.6	14.4	13.4–14.1	14.1	13.1–13.4	13.1–14.0	13.3	15.7
capaccinii	14.0–14.7	14.9–15.3	14.9–15.1	16.1	16.1–16.7	16.9	17.6–18.1	13.9–15.1	15.0	15.6
schaubi IR	15.7–16.1	15.3–16.6	15.7–16.1	13.4	13.1–13.9	15.6	14.6–15.1	14.3–15.1	16.4	16.1
nattereri	14.9–15.0	14.4–16.3	14.3–14.7	15.9	15.1–15.9	15.7	15.9–16.1	14.7–15.3	14.4	13.7
myotis	14.5–14.9	14.1–15.4	14.2–14.7	13.1	13.1–13.9	13.9	14.2–14.4	13.9–15.0	13.1	14.4
blythii	13.4–13.9	13.1–14.3	13.6–14.0	14.4	14.1–14.7	14.7	15.7–15.9	13.1–14.3	12.7	14.4
bechsteinii	15.4–15.9	15.1–16.6	15.4–15.7	14.1	14.4–15.1	14.3	14.6–15.1	13.7–15.1	14.9	14.6
emarginatus	15.0–15.1	14.1–15.6	15.1–15.7	14.6	15.4–15.7	15.1	15.6–16.0	13.1–15.1	14.3	13.3
formosus	16.9–17.1	17.1–18.3	16.6–16.9	14.3	15.1–15.4	14.7	14.0–14.7	14.4–16.6	16.3	15.4
lucifugus	14.6–14.7	14.4–15.7	13.7–14.0	14.9	14.3–15.7	14.3	15.7–15.9	12.9–14.6	12.7	12.4
outgroups	18.3–18.9	17.7–19.4	17.9–18.6	18.1–18.7	18.7–20.0	18.7–19.0	18.9–19.4	16.9–18.9	17.9–18.6	17.4–18.6

opinion by Benda & Tsytsulina (2000) in morphological recognition of two species, although they named these bats differently (*M. aurascens* [by Benda & Tsytsulina 2000] from Qutur Su = *M. mystacinus* [here], *M. nipalensis* from Bastam = *M. davidii*). Since no name is available for the third, small-sized species, it is formally described here as:

Myotis hyrcanicus Benda, Reiter et Vallo, sp. n.

Holotype. Adult male (NMP 90857, field No. pb3258, alcohol specimen with skull extracted), Ali Abad, Golestan Prov., Iran (Fig. 76), 28 May 2006, leg. P. Benda & A. Reiter.

Type locality. Alluvial forest at Korud Abad, 2 km SSE of Ali Abad, Golestan Province, Iran; 36° 53' N, 54° 53' E, 215 m a. s. l.

Description. *Myotis hyrcanicus* sp. n. is a small representative of the genus as well as of the *Myotis mystacinus* morpho-group as defined by Benda & Karataş (2005), in most respects similar to the European *M. alcathoe* von Helversen et Heller, 2001. The size of body and skull is small, the dimensions of the holotype specimens are as follows: forearm length 32.4 mm, ear length 14.2 mm, tragus length 6.6 mm, greatest length of skull 12.7 mm, length of upper tooth-row (CM^3) 4.9 mm. Skull is relatively narrow, both in neurocranial and rostral parts (LaM 6.8 mm, LaM/LCr 0.54; LaInf 3.1 mm, LaInf/LCr 0.25); rostrum is relatively long (CM^3/LCr 0.39), longer than in the comparative samples of *M. alcathoe* (Table 19).

Teeth are large and massive; unicuspidal teeth are massive, upper canine is wide (in the labio-palatal aspect), its crown is rather rounded in occlusal view (LCn/LaCn 1.26), second upper premolar is small (P^3 0.35 mm) in the tooth-row between P^2 and P^4 (i.e. not shifted palatally; Fig. 98), the largest upper premolar is large (P^4 1.23 mm), larger than in *M. alcathoe*, bearing rather high cusp on the mesio-palatal margin of cingulum (ACin 0.14 mm); the molar-rows are long (M^1M^2 2.31 mm, M_1M_3 3.53 mm), the lower molar-row is longer than in *M. alcathoe* (Table 19); upper molars are rather large, bearing moderately developed paralophi, metaconuli and metalophi.

Pelage colouration is brownish (Figs. 100, 101); bases of hairs are dark brown to blackish, distal parts of the dorsal hairs are brown, while those of the ventral hairs whitish or creamy, pale ochre

Figs. 100, 101. *Myotis hyrcanicus* sp. n., holotype, Ali Abad (Golestan). Photo by A. Reiter.

Table 19. Basic biometric data on the holotype specimen of *Myotis hyrcanicus* sp. n. and of a comparative sample set of *M. alcathoe* von Helversen et Heller, 2001. For abbreviations see p. 171

	Myotis hyrcanicus sp. n. NMP 90857, holotype	*Myotis alcathoe* n	M	min	max	SD
LAt	32.4	16	**32.04**	26.7	34.3	1.704
LCr	12.66	23	**12.99**	12.38	13.38	0.267
LCb	12.06	23	**12.43**	11.88	12.84	0.234
LaZ	8.08	17	**8.07**	7.57	8.31	0.194
LaI	3.27	24	**3.25**	3.07	3.48	0.103
LaInf	3.13	24	**3.22**	3.03	3.41	0.094
LaN	6.14	23	**6.35**	6.01	6.64	0.149
LaM	6.79	16	**6.94**	6.75	7.18	0.130
ANc	4.52	23	**4.63**	4.39	4.75	0.120
CC	3.27	23	**3.28**	3.02	3.43	0.109
M^3M^3	5.18	24	**5.15**	4.75	5.27	0.111
IM^3	6.01	24	**5.96**	5.70	6.16	0.116
CM^3	4.92	24	**4.90**	4.68	5.09	0.101
P^4M^3	3.631	24	**3.582**	3.339	3.763	0.102
M^1M^3	2.974	24	**2.939**	2.763	3.421	0.133
M^1M^2	2.307	24	**2.234**	2.090	2.337	0.061
CP^4	2.446	24	**2.364**	2.167	2.585	0.114
P^2P^3	0.722	24	**0.730**	0.660	0.817	0.049
LMd	9.31	24	**9.35**	8.92	9.70	0.190
ACo	2.61	24	**2.70**	2.53	2.82	0.078
IM_3	6.34	24	**6.32**	6.04	6.52	0.115
CM_3	5.24	24	**5.30**	5.01	5.49	0.109
P_4M_3	3.947	24	**3.900**	3.579	4.026	0.111
M_1M_3	3.526	24	**3.265**	3.000	3.368	0.093
CP_4	2.152	24	**2.111**	1.935	2.245	0.095
P_2P_3	0.817	24	**0.834**	0.754	0.900	0.043
ACin	0.136	24	**0.148**	0.105	0.188	0.022
LCn	0.817	24	**0.821**	0.754	0.869	0.035
LaCn	0.649	24	**0.629**	0.544	0.691	0.033
CnR	1.258	24	**1.306**	1.200	1.397	0.056
P^3	0.346	24	**0.349**	0.272	0.408	0.029
P^4	1.225	24	**1.099**	1.016	1.215	0.047
M^1	1.382	24	**1.352**	1.267	1.424	0.046
M^2	1.560	24	**1.533**	1.403	1.633	0.058
M^3	1.424	24	**1.401**	1.288	1.487	0.047
P_3	0.377	24	**0.354**	0.283	0.408	0.032
CM^3/LCr	0.389	23	**0.378**	0.364	0.387	0.006
CC/CM^3	0.624	23	**0.618**	0.572	0.662	0.022
LaN/LCr	0.485	23	**0.489**	0.466	0.511	0.012
ANc/LCr	0.357	23	**0.356**	0.338	0.374	0.009
M^3M^3/CM^3	1.053	24	**1.051**	0.965	1.120	0.031
ANc/LaN	0.736	23	**0.729**	0.681	0.779	0.022
LCb/LCr	0.953	23	**0.957**	0.945	0.969	0.007
M^1M^3/CP^4	0.823	24	**0.805**	0.688	0.877	0.040
M^1M^3/CM^3	0.604	24	**0.599**	0.549	0.695	0.027
M^3/CM^3	0.289	24	**0.286**	0.256	0.307	0.012
M^1/CM^3	0.281	24	**0.276**	0.252	0.293	0.011
M^3/M^1	1.030	24	**1.037**	0.985	1.116	0.029
P^2P^3/CM^3	0.166	24	**0.170**	0.154	0.183	0.008

on the neck. The face, ears and wing membranes are pale greyish-brown, tips of the snout and ears are dark brown. Penis simple, equally wide along its length (Fig. 100); baculum unknown.

Genetics. In comparison with its closest relative *M. alcathoe* von Helversen et Heller, 2001, *Myotis hyrcanicus* sp. n. shows a unique base position within the mitochondrial gene for cytochrome *b* (1140 bp) at 100 sites (i.e. 8.77% of the gene): 737, 990 (A [in *M. alcathoe*] →C [in *M. hyrcanicus* sp. n.]), 47, 102, 232, 348, 390, 411, 466, 579, 582, 624, 813, 855, 867, 876, 1032, 1056, 1098 (A→G), 750 (A→T), 24, 39, 60, 182, 186, 195, 273, 417, 420, 426, 450, 498, 710, 730, 736, 801, 804, 819, 874, 888, 891, 919, 948, 957, 870, 1002, 1047, 1050 (C→T), 93, 562, 576, 873, 945, 985, 1134 (G→A), 252 (T→A), 27, 69, 81, 136, 145, 165, 174, 198, 243, 249, 279, 358, 441, 513, 522, 555, 561, 591, 618, 654, 672, 684, 693, 714, 741, 784, 792, 822, 841, 879, 885, 894, 909, 916, 924, 858, 969, 986, 1003, 1057, 1080, 1110, 1122 (T→C), and 525 (A/G→T).

Dimensions of the holotype. See Table 19.

Mitochondrial sequence of the holotype (complete sequence of the mitochondrial gene for cytochrome *b*; GenBank Accession Number KF874509; 5' end).

atg acc aac att cga aaa tcc cat ccc tta ata aaa att att aat agc tca ttt att gat ctc ccc gcc cca tca aac atc tca tct tga tga aac ttt ggg tct ctc tta gga atc tgc cta gca cta caa att cta aca gga cta ttt cta gct ata cat tac aca tca gac act gca ata gct ttt aac tct gtc acc cat atc tgc cga gac gta aat tac ggc tga gtc cta cgc tat ata cac gca aat gga gct tcc ata ttc ttt att tgc ctt tat ctt cat gta gga cgg ggt ctt tat tac gga tct tat ata tat aca gaa act tga aat att ggg gtt att cta cta ttt gcc gta ata gca aca gct ttc atg ggg tat gta ctt cca tga ggc cag ata tct ttt tga ggt gca act gta att acc aac cta ctt tct gca atc cca tat gtc ggc aca aac ctt gta gaa tga att tga ggt ggt ttt tcc gtt gac aaa gcc acc ctt aca cga ttt ttc gcc ttc cat ttt cta ctc cca ttc atc atc tca gct ata gtg atg gta cat ctc tta ttc ctg cac gaa aca gga tcg aac aac ccg aca gga att ccc tct aac ata gac ata atc ccc ttc cac cct tac tac aca att aaa gac att ctc ggc cta cta att ata att ata gcc cta cta tta cta gta tta ttt tct ccc gat atg ctt gga gac cct gat aat tat ata cca gca aac cca cta aac acc cct ccc cat att aaa cca gag tgg tat ttc cta ttt gca tac gca att cta cga tca att ccg aac aaa cta ggg gga gta ttg gcc cta gtc ctt tct atc ctc atc tta att atc att cct cta tta cac aca tcc aaa caa cga agt ata gct ttt cgt cct cta agc caa tgc tta ttt tga cta tta aca gcc gac cta tta act cta aca tga atc gga gga caa cct gtc gag cat cca tat gtt att att gga cag cta gca tca atc ctt tac ttt tcc att att att att cta atg cca ctt act agc ctt gta gaa aac cat cta tta aaa tga aga

Derivatio nominis. The name *hyrcanicus* reflects the origin of the holotype specimen as well as the presumable area of distribution of the new species (see Distribution), the biogeographical region of the Hyrcanian forest zone in northern Iran, stretching in a narrow strip on the northern slopes of the Talysh and Alborz Mts. along the southern shore of the Caspian Sea. The name of this zone is of Greek origin, coming from Hyrcania, a name of the ancient province of the Persian Empire in the respective area.

Distribution. *Myotis hyrcanicus* sp. n. is known only from the type locality in the Golestan province of Iran; however, considering the ecological conditions of the type locality, occurrence of the species can be expected in the whole zone of Hyrcanian mixed forests along the northern slopes of the Talysh and Alborz Mts. in the provinces of Gilan, Golestan and Mazandaran.

Echolocation. Echolocation parameters of signals of the species within the *Myotis mystacinus* morpho-group are very similar to each other and generally overlap in all values (Dietz et al. 2007). *Myotis mystacinus* s.l. produces frequency-modulated calls starting at 75–120 kHz and ending at ca. 30 kHz. Peak frequency in the Swiss population was reported at ca. 46 kHz (Obrist et al. 2004), being slightly lower than in Greek bats, which emitted the calls with maximum energy at ca. 48 kHz (Papadatou et al. 2008). Echolocation characteristics of the species from the *M. mystacinus* morpho-group in Iran have not yet been studied.

Feeding ecology. Representatives of the *Myotis mystacinus* morpho-group are small bats that apply the aerial hawking foraging strategy and search for its prey quite close to the foliage; Nematoceran Diptera, small Lepidoptera, Araneae, Trichoptera and Neuroptera were found to be the principal diet components in European populations (Rindle & Zahn 1997, Lučan et al. 2009, Danko et al. 2010, own unpubl. results). Diptera, Araneae and Lepidoptera were also reported to prevail in the diet of this species group in Turkey (Whitaker & Karataş 2009) and Ephemeroptera, small and medium-sized moths, Diptera and small Coleoptera comprised the diet in Azerbaijan (Rahmatulina 2005).

From Iran, we analysed four faecal pellets from the specimen of *M. hyrcanicus* sp. n. from Ali Abad (Golestan) and contents of two digestive tracts of *M. davidii* from Bastam (Azarbaijan).

The diet of *M. hyrcanicus* sp. n. was dominated by ants (Hymenoptera, Formicoidea) (Fig. 102); the beetles (Coleoptera) also found in the sample belonged to the family Curculionidae. The presence of Araneae and Brachycera suggests hunting of prey very close to the foliage or even the foliage gleaning strategy in *M. hyrcanicus* sp. n.

Nematoceran Diptera and Auchenorrhyncha prevailed in the diet of the two individuals of *M. davidii* from north-western Iran (Fig. 102).

The high proportion of ants found in the diet of *M. hyrcanicus* sp. n. is quite unusual in European bats (see also Danko et al. 2010), but it is rather frequent in some of the Middle Eastern bat species (see e.g. *Rhinopoma microphyllum* and *R. muscatellum*). Benda et al. (2008) described *Rhinolophus hipposideros* to hunt ants selectively in Sinai; on the other hand, the analyses of diet composition of this species from Europe did not indicate high proportion of ants. So, we can judge that ants are an important food item incorporated in the diet of different species (that use different foraging strategies) in various habitats of the Middle East. A very high proportion of

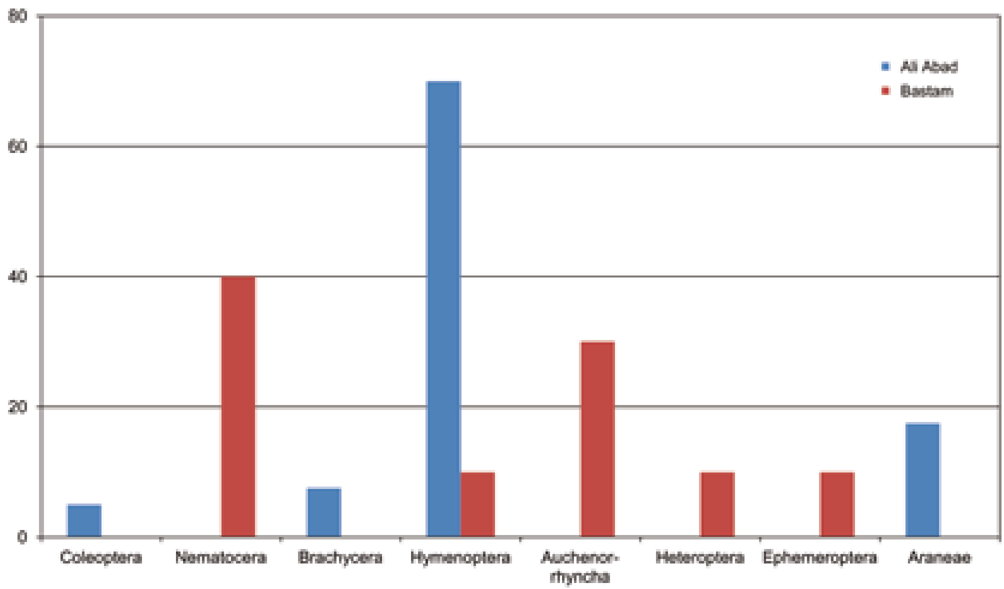


Fig. 102. Percentage volume of particular food items in the diet of bats of the *Myotis mystacinus* morpho-group in Iran. Material analysed: Ali Abad [*M. hyrcanicus* sp. n.] (four faecal pellets from one bat), Bastam [*M. davidii* (Peters, 1869)] (two digestive tracts).

ants was recorded in many diet samples of *Eptesicus anatolicus*, *Hypsugo savii*, and *Pipistrellus pipistrellus* also in Syria (Benda et al. 2006).

The diet composition found in *M. davidii* from Iran, containing a high proportion of nematoceran Diptera is more similar to the results of previous studies of the diet composition of the morpho--group. Higher proportions of homopteran Auchenorrhyncha have been also recorded in diets of many bats of the Middle East, e.g. in *Pipistrellus kuhlii* from Syria (Benda et al. 2006).

Myotis capaccinii (Bonaparte, 1837)

Records. **Original data**: F â r s: Bishapur [1], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April 2000: remnants of 2 inds. (2 left mandibles, skull fragments) found in *Bubo bubo* pellets; – Tâdovân [2], 44 km NW of Jahrom, Tâdovân cave, 7 October 2011: net. 6 ma, 1 ms, 1 fa, 3 fs, coll. 1 ma, 1 fa (NMP 93883, 93884; Fig. 104). – K e r m â n s h a h: Bisotun [3], 28 km E of Kermanshah, small cave, 8 October 1998: net. 1 fs (NMP 48152; cf. Benda et al. 2006). – K h u z e s t â n: valley 2 km NE of Si Mili [4], 26 km SSE of Masjed Soleyman, above a river, 11 October 1998: net. 2 ma (NMP 48158, 48159; cf. Benda et al. 2006). – Z a n j â n: oasis 2 km SE of Garmab [5], above a pool, 30 September 2011: det. & rec. calls of numerous foraging inds. – **Published data**: F â r s: Fars Prov. (Etemad 1963) = 5 km. southeast of Pol-i-Abgineh [6], small cave and well, 27–28 December 1962: 36 inds., resp. 30 inds., FMNH (Lay

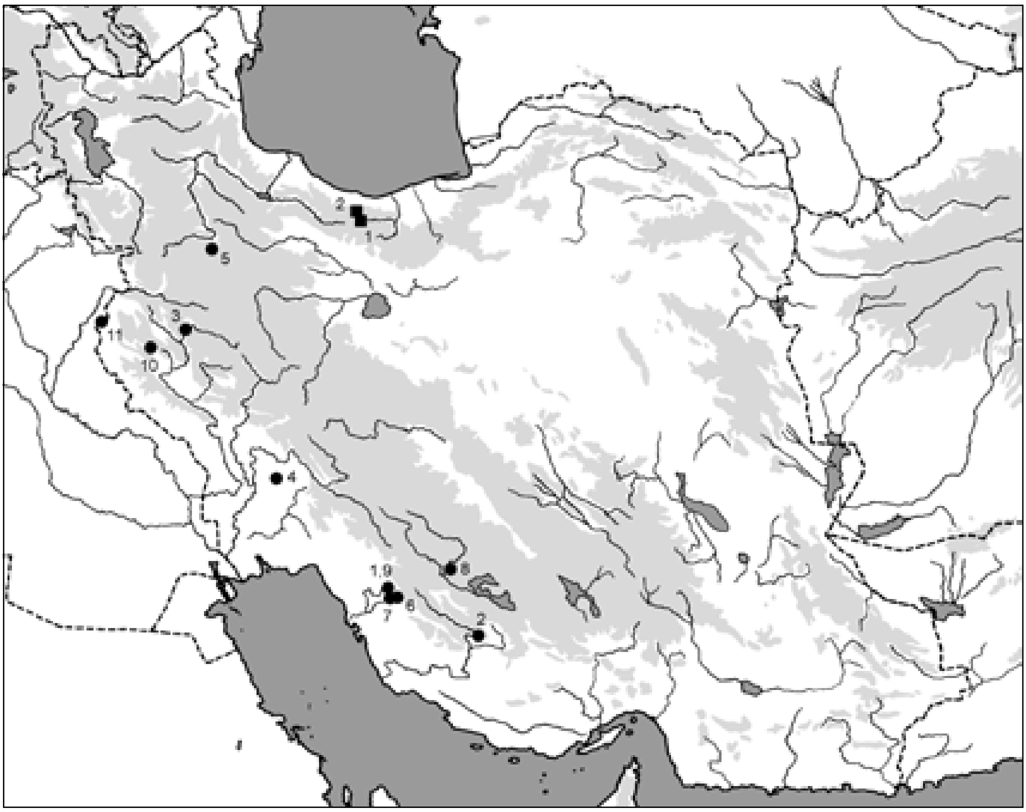


Fig. 103. Records of *Myotis capaccinii* (Bonaparte, 1837) (circles) and *Eptesicus nilssonii* (Keyserling et Blasius, 1839) (squares) in Iran.

Fig. 104. Portrait of *Myotis capaccinii* (Bonaparte, 1837) from the Tadovan cave (Fars). Photo by A. Reiter.

1967, Etemad 1969, DeBlase 1980); – 10 km. SE Kazerun [7], 20 November 1963: 2 m, USNM (DeBlase 1980, cf. Findley 1972); – Canae Gabru Cave [= Tâdovân cave] [2], near Tar Divon [= Tâdovân], 10 November 1968: 1 m, FMNH (DeBlase 1971a); – near the ruins of the ancient city of Persepolis [8], over a pool, 3 October 1968: shot 1 m, 2 f, FMNH (DeBlase 1971a, 1980); – Shahpur Cave [9], 29 December 1962: obs. 30 inds. (Lay 1967, DeBlase 1980), 9 October 1968: 2 m, 1 f, FMNH (DeBlase 1971a). – K e r m â n s h a h: Mâhidasht Cave [10], 30 km SW Kermânshâh, harp-net. 3 m, 2 f (Sharifi & Akmali 2006); – Qasr-e Shirin [11], fish pond, net. 1 m (Sharifi & Akmali 2006).

Distribution. *Myotis capaccinii* is a rather infrequent bat species in Iran, eleven localities are known from the western part of the country (Fig. 103). The localities lie in a belt of areas adjacent to the south-western slopes of the Zagros Mts. and eastern extension of the Mesopotamian lowland. DeBlase (1980) reported only five localities from Iran, all from the Fars province, lying within a radius of some 100 km. Recently, occurrence of *M. capaccinii* has been documented in the Kermanshah (Sharifi & Akmali 2006), Khuzestan and Zanjan provinces; this occurrence prolongates the Iranian distribution range by some 750 km to the northwest. All records were made in basins of larger rivers or even near the rivers.

M. capaccinii is a bat species with an unusual distribution pattern in the Middle East; while in the Mediterranean areas of the Levant, Europe and the Maghreb its distribution resembles that of other Mediterranean faunal elements (see Horáček et al. 2000), in the central parts of the Middle East it occurs in the arid steppe lowlands of Mesopotamia and adjacent regions (Harrison & Bates 1991, Benda et al. 2006). The Iranian range of *M. capaccinii* thus continues in the west to the lowlands of Iraqi and Syrian Mesopotamia and not to the Mediterranean arboreal areas of northern Turkey and Transcaucasia, where this bat is missing. The occurrence of *M. capaccinii* in the Fars province of Iran represents the south-eastern edge of the species distribution range, the colony in the Tadovan cave near Jahrom denotes the southernmost and probably also the easternmost point of the whole species range (see Benda et al. 2006).

FIELD NOTES. *Myotis capaccinii* was recorded in Iran mostly in or at its roosts, only exceptionally it was documented in its foraging habitats. However, most of the roost records represent the evidences of hibernation aggregations or individuals. Lay (1967: 141) reported a collection of several specimens gathered 5 km. southeast of Pol-i-Abgineh (Fars) and specified: “They came from a large colony that roosted in a vertical well shaft.” The circumstances of this record were, however, well described by DeBlase (1980: 178–179): “According to Lay’s field catalog three of the male *M. capaccinii* from 5 km. SE Pol-i-Abgineh were removed “from small dim cave in a small hole in ceiling” on 28 December 1962. The remaining specimens from this locality were received on 27 December when “a boy brought a net of nearly 50 specimens that he said he took from their roost in a well” […]. This well “consisted of a shaft approximately 4 ft. [= 1.2 m] in diameter with a water table at a depth not more than 20 ft. [= 6.1 m] below ground surface. At ground level rocks had been piled up to form a rim around the opening. The top opening was loosely covered with sticks.” The series from this well is interesting as it includes 23 males, two females, and one undetermined sex. It is apparent that the sexes were segregated, with females either occupying a portion of the well not sampled or occupying a completely different roost site.”

Another hibernation roost of *M. capaccinii* was discovered by Lay (1967) in the Shahpur Cave (Fars; see the description of the cave under *Rhinolophus ferrumequinum*), who mentioned (p. 141): “These bats also occupied the hot chamber […] of Shahpur cave. Several wary individuals hung singly, and two groups, located by their periodic squeaking, were jammed into shallow small-

Fig. 105. Pool in the oasis near Garmab (Zanjan), a foraging habitat of *Myotis capaccinii*, *Pipistrellus pipistrellus*, and *P. kuhlii*. Photo by A. Reiter.

-mouthed pockets in the ceiling." (pp. 60–61): "Numerous small inter-connected tunnels led down from this last chamber toward the Shahpur valley side where we entered the cave. To this point the cave possessed a cool (ca. 60°–65° F. [= 15.6–18.3 °C]), moist atmosphere. Paralleling the valley, another steep, slippery incline ascended to a level some 15 m. higher and terminated in a small 9 by 9 m. chamber with a ceiling 1–1.5 m. high. A temperature of approximately 80° F [= 26.7 °C]. contrasted this small portion to the rest of the cave. A colony of about 30 *Myotis capaccinii* occupied the ceiling of this space." Later on, DeBlase (1980: 178) added: "In his field journal Lay […] said that "a few individuals were observed [on 29 December 1962] hanging solitarily at the entrance to that (very, very hot and humid) upper chamber … on close examination of the source of a chattering noise, I found two colonies packed into holes in the ceiling with very small openings. Exactly how many bats occupied each hole I didn't ascertain, yet one shot killed four and I saw others still inside. These bats were very active and flew at the slightest provocation." […] When I visited the same cavern room on 9 October 1968, it was inhabited by […] only two male and one female *M. capaccinii*. The *Myotis* hung individually, in torpor, and well separated from the other species." (pp. 300–301): "On 9 October when the 1968 Street Expedition visited this cave […, it] found numerous *M. schreibersi* [= *M. pallidus*], three *M. capaccinii*, two *R*[*hinolophus*]. *hipposideros*, and two *R. ferrumequinum*. All bats were in torpor as we approached, though this area at the top of the slope was quite warm. […] *M. capaccinii* and two of the *R. ferrumequinum* were collected with handnets. […] Shahpur cave is apparently a major hibernaculum for *R. mehelyi*, *M. capaccinii*, and *M. schreibersi* [= *M. pallidus*] […]."

One male *M. capaccinii* in torpor was collected from the Canae Gabru Cave [= Tadovan cave; see Figs. 43, 44] on 10 November 1968 (DeBlase 1971a); considering the date and circumstances, the record probably also represents a hibernating bat. DeBlase (1980: 297) specified the cave part as follows: "a small, domed room with a temperature of 75°F [= 23.9 °C] and a relative humidity of 91 per cent." and he said about the record (p. 179): "A few *R*[*hinolophus*]. *blasii* and *R. euryale* also in torpor shared this dome, but the *Myotis* hung singly several feet away from them. *Rhinolophus hipposideros* and two species of *Rhinopoma* were found elsewhere in this large and complex cave, but no other *M. capaccinii* were found." (for description of the cave see also under *Rhinopoma microphyllum*; cf. DeBlase 1980: 296–298). Thirteen *M. capaccinii* of both sexes were caught into a net exposed at the entrance to this cave on 7 October 2011, when approaching the cave entrance or flying out of the cave. However, this species was not found to roost inside the cave, where only smaller colonies of *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus blasii*, *Myotis blythii* and a large colony (ca. 1000 bats) of *Miniopterus pallidus* were observed.

Sharifi & Akmali (2006: 14) reported that: "One pregnant female, one non-pregnant female and three males [of *M. capaccinii*] were taken alive by a harp net in Mahidasht cave [Kermanshah] […]." Unfortunately, they did not give a date and other circumstances of their record, e.g. if a colony of *M. capaccinii* was present in the cave or the bats were caught when approaching the cave. However, colonies of other species, namely *Rhinolophus mehelyi*, *Myotis blythii*, and *Miniopterus pallidus*, were found in this cave during various visits (Hemmati 2001, Sharifi et al. 2002, Akmali 2004, Sharifi & Hemmati 2004, Sharifi 2004a, b, Rahimi et al. 2007, Karataş et al. 2008, Vatandoost et al. 2010, Akmali et al. 2011a). This large cave served as a roost of an estimated total population of about 3000 bats, however, it was destroyed due to mining activities (Akmali et al. 2011a).

At a small cave in the rocky massif above the Bisotun village (Kermanshah), in the rock wall where also the ancient monument of Bisotun is present, a subadult female of *M. capaccinii* was netted on 8 October 1998; the bat was caught when approaching the cave, perhaps for a night roost or for a swarming site on this autumn term. During this netting session, *Rhinolophus ferrumequinum*, *Eptesicus anatolicus*, *Miniopterus pallidus*, and *Tadarida teniotis* were recorded.

Only four times in Iran, *M. capaccinii* was recorded when foraging above water bodies, which is typical for this species (Spitzenberger & von Helversen 2001). DeBlase (1971a) reported a collection of three bats at Persepolis (Fars) and later on, DeBlase (1980: 294) specified this record as follows: "at dusk on 3 October 1968 the Street Expedition shot six *P*[*ipistrellus*]. *kuhli* and three *Myotis capaccinii* as they flew over a pond in the garden adjacent to the ruins of Persepolis about 60 km. NE Shiraz." Sharifi & Akmali (2006: 14) briefly described the westernmost record from Iran: "[… a] male *M. capaccinii* was captured using a mist net over a fish pond in Qasre-e Shirin […] in Kermanshah Province."

On 11 October 1998, two adult males were caught into a net installed over a river passing through a dry steppe landscape at Si Mili near Masjed Soleyman (Khuzestan); the bats were captured when foraging above water surface just during the sunset, along with two *Pipistrellus kuhlii*. Foraging individuals of *M. capaccinii* were observed and their calls recorded at a larger pool (fishpond?) in the oasis near Garmab (Zanjan) on 30 September 2011 (Fig. 105). The oasis is surrounded by dry desolate steppe landscape, however, the large karstic Kataleh Khur cave is situated few kilometres west of the oasis; *Pipistrellus pipistrellus* and *P. kuhlii* were also recorded at this site.

Very little data are available about the reproduction of *M. capaccinii* in Iran. Sharifi & Akmali (2006) caught a pregnant female in the Mahidasht cave (see above), however, they did not specify the date or period of the catch. They collected the female alive and kept it in a cage. They observed the parturition and the ontogenesis of the young (Sharifi & Akmali 2006: 16): "The pregnant female *M. capaccinii* gave birth to a male pup. At birth, young *M. capaccinii* was naked with closed eyes and folded pinnate. By the first week of age, the ears became erected and a few spare hairs were present on their bodies. The eyes opened during the first week and the pup began to move. The short and soft hair of the pups [sic] was distinguishable between 6 and 10 days. The young bat ability to flight improved when they were about 30 days old. At this time the pup began independently to bite and lick the mealworms. The mass of the litter reported in present study represents 25 percent of the mothers post-mortem mass. […]. The pattern of growth and development obtained for a single *M. capaccinii* pup is similar to other species of bats in showing linear growth of length of forearm and body mass during the preflight period. Similarly, the epiphyseal gap increases during this period and decreases until the closure of the gap at about 36 days of age. At the end of the second month after parturition the length of the forearm was 90 per cent of the adult length while the mean body mass was 88.75 per cent of adult mass. The young *M. capaccinii* showed a growth rate for body mass and forearm of 0.3 g/d and 1.35 mm/d respectively."

From the same cave, Sharifi et al. (2008a) collected several specimens of *M. capaccinii* and observed annual cycle of genitalia in males and the sperm storage in females. According to their Table 1 (Sharifi et al. 2008a: 66), the observation was conducted from 28 October to 1 March; they described their observations as follows (Sharifi et al. 2008a: 64): "Size of Testes in *Myotis capaccinii* began to increase in early July and before the end of summer testicular size reached to its maximum. This increase in testes mass is mainly due to the development of spermatogenic cells up to the spermatid stage. During this period no spermatozoa were released into epididymis. In late summer the spermatozoa began to move into epididymis. This was clearly illustrated by the decrease in testicular mass and concomitant increase in epididymal mass by the end of summer […]. In contrast with testis mass, epididymal volume peaked in November. Histological examinations of male testes and epididymes were in accordance with the reproductive pattern apparent from macroscopic data. Few spermatozoa were recorded in testes during November, while at the same time considerable volume of sperm existed in the cauda epididymides […]. In autumn the proportion of bats with enlarged testis declined when no males showed signs of testis enlargement. In contrast, male bats began to have enlarged epididymis […]."

At one site of Iran, remains of *M. capaccinii* were recorded in the osteological material from owl pellets (Table 40). Skull fragments and two left mandibles (= remains of two individuals) were found in the pellets of *Bubo bubo* collected in the large cave above the Sasan spring at Bishapur (Fars). This represented 2.29% of all prey items (and 2.81% of mammal items) in the respective sample and 0.025% of all prey items (0.033% of mammal items) in the whole analysed eagle owl diet from Iran (Table 40). Previously, such exceptional evidence of *M. capaccinii* in owl diet in the Middle East was published from Turkey and Syria (Benda & Horáček 1998, Benda et al. 2006).

Material examined. 2 inds. (JOC unnumbered [Sf]), Bishapur (Fars Prov.), 21 April 2000, leg. J. Obuch; – 1 ♀ (NMP 48152 [S+A]), Bisotun (Kermanshah Prov.), 8 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂ (NMP 48158, 48159 [S+A]), Si Mili (Khuzestan Prov.), 11 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 1 ♀ (NMP 93883, 93884 [S+A]), Tadovan cave (Fars Prov.), 7 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Myotis capaccinii* are shown in Table 15. For the material examined see above.

Most frequently, *M. capaccinii* is considered to be a monotypic species, all populations are regarded to belong to the nominotypical form, although some authors formerly excluded west-Asian populations into a separate subspecies, *M. c. bureschi* (Heinrich, 1936); however, this name was shown to be inapplicable for the populations of the Middle East, see the review by Benda et al. (2006). Anyway, several authors mentioned distinctness of these populations. Harrison (1964) found the Levantine samples to differ in their paler colour of pelage from *M. c. capaccinii* (= European bats) and suggested a subspecific status for these populations, a similar opinion was presented also by Atallah (1970). Albayrak & Aşan (2002) compared Turkish populations with other Middle Eastern and with European ones, and found metric differences between

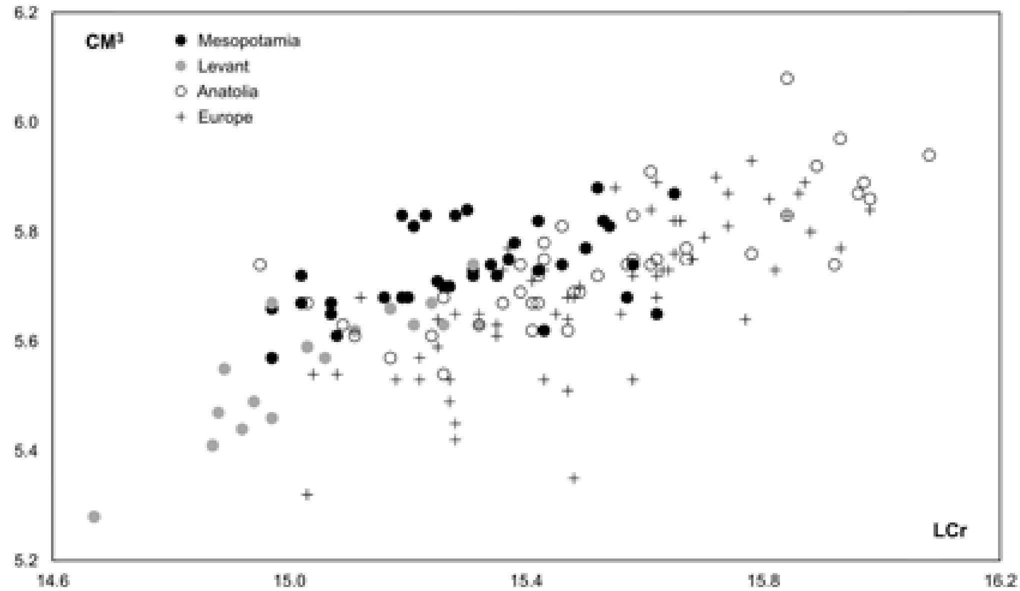


Fig. 106. Bivariate plot of the examined Iranian and comparative samples of *Myotis capaccinii* (Bonaparte, 1837): greatest length of skull (LCr) against the length of upper tooth-row (CM^3).

Table 20. Comparison of biometric data on four sample sets of *Myotis capaccinii* (Bonaparte, 1837) and their statistical evaluation (ANOVA). For abbreviations see p. 171

	n	**M**	min	max	SD	n	**M**	min	max	SD
			Mesopotamia					Levant		
LAt	37	**40.64**	37.9	43.2	1.173	19	**40.87**	39.0	42.7	0.933
LCr	36	**15.31**	14.97	15.65	0.190	17	**15.05**	14.67	15.32	0.183
LCb	36	**14.22**	13.91	14.63	0.185	17	**14.00**	13.32	14.37	0.282
LaZ	25	**9.19**	8.88	9.58	0.208	13	**9.09**	8.48	9.52	0.334
LaI	37	**3.63**	3.41	3.80	0.094	17	**3.65**	3.38	3.84	0.107
LaN	37	**7.80**	7.48	8.17	0.177	16	**7.81**	7.52	8.06	0.158
AN	23	**5.76**	5.58	6.02	0.112	16	**5.69**	5.38	5.96	0.170
CC	24	**3.91**	3.74	4.13	0.090	17	**3.79**	3.47	4.02	0.169
M^3M^3	25	**6.07**	5.83	6.27	0.106	17	**5.79**	5.17	6.16	0.276
CM^3	37	**5.73**	5.57	5.88	0.076	17	**5.56**	5.28	5.74	0.118
LMd	37	**10.65**	10.18	11.02	0.193	17	**10.47**	9.87	10.74	0.219
ACo	25	**2.88**	2.74	3.03	0.091	17	**2.91**	2.74	3.02	0.074
CM_3	37	**6.05**	5.78	6.23	0.110	17	**5.85**	5.64	6.02	0.107
CC/LCr	23	**0.255**	0.248	0.266	0.005	17	**0.252**	0.232	0.266	0.010
CM^3/LCr	36	**0.375**	0.362	0.384	0.005	17	**0.369**	0.360	0.379	0.005
			Anatolia					Europe		
LAt	33	**42.21**	39.8	44.3	1.074	66	**41.62**	39.4	44.0	0.992
LCr	41	**15.53**	14.95	16.08	0.281	57	**15.51**	15.03	15.98	0.240
LCb	40	**14.46**	13.84	15.42	0.334	54	**14.42**	13.95	14.93	0.243
LaZ	33	**9.41**	9.03	9.96	0.242	42	**9.46**	8.88	9.83	0.193
LaI	41	**3.65**	3.43	3.85	0.096	62	**3.63**	3.24	3.83	0.114
LaN	41	**7.86**	7.48	8.28	0.188	62	**7.95**	7.21	8.22	0.169
AN	41	**5.72**	5.43	5.96	0.132	59	**5.74**	5.42	6.12	0.132
CC	40	**3.91**	3.62	4.20	0.119	62	**3.92**	3.48	4.17	0.145
M^3M^3	38	**6.09**	5.84	6.36	0.122	62	**6.08**	5.27	6.47	0.227
CM^3	41	**5.75**	5.54	6.08	0.115	65	**5.68**	5.22	5.93	0.155
LMd	41	**10.86**	10.52	11.18	0.188	61	**10.86**	10.38	11.38	0.242
ACo	41	**2.94**	2.74	3.17	0.119	60	**2.95**	2.68	3.28	0.130
CM_3	41	**6.06**	5.81	6.28	0.121	61	**6.03**	5.69	6.53	0.142
CC/LCr	40	**0.252**	0.235	0.264	0.006	57	**0.252**	0.228	0.268	0.007
CM^3/LCr	41	**0.370**	0.361	0.384	0.005	57	**0.367**	0.346	0.378	0.006

the Levantine and Iranian bats and those from the rest of the distribution range (Europe and Turkey; unfortunately, they compared literature data only). As a result, they suggested a separate subspecific status for bats from the Levant and Iran. Similarly, Topál (1997) found significant craniometrical differences between European and Iraqi samples of *M. capaccinii*, which in his view conformed with subspecific division.

These data suggest that there are more than only one morphotype within the species rank of *M. capaccinii* (contra e.g. Corbet 1978, Horáček et al. 2000, Spitzenberger & von Helversen 2001, Simmons 2005), however, the zone of transition between the possible two morphotypes of *M. capaccinii* lies in the centre of the Middle East rather than in the centre of the Balkans (contra e.g. Harrison 1964, DeBlase 1980, Harrison & Bates 1991, Koopman 1994, Topál 1997, etc.).

Table 20. (continuation)

	df	F	p	df	F	p	df	F	p
	Mesopotamia vs. Levant			Mesopotamia vs. Anatolia			Mesopotamia vs. Europe		
LAt	54	0.527		68	33.518	***	101	20.298	***
LCr	51	21.860	***	75	15.796	***	91	18.881	***
LCb	51	11.976	**	74	14.930	***	88	17.856	***
LaZ	36	1.435		56	13.289	**	65	29.566	***
LaI	52	0.381		76	0.776		97	0.029	
LaN	51	0.063		76	2.280		97	17.271	***
AN	37	2.501		62	1.300		80	0.656	
CC	39	7.858	**	62	0.001		84	0.239	
M^3M^3	40	21.166	***	61	0.251		85	0.017	
CM^3	52	42.694	***	76	0.340		100	3.982	*
LMd	52	9.988	**	76	23.239	**	96	20.256	***
ACo	40	1.128		64	4.416	*	83	6.316	
CM_3	52	38.491	***	76	0.237		96	0.915	
CC/LCr	38	1.879		61	5.377	*	78	2.553	
CM^3/LCr	51	13.347	**	75	15.795	***	91	41.870	***
	Levant vs. Anatolia			Levant vs. Europe			Anatolia vs. Europe		
LAt	50	20.508	***	83	8.777	**	97	7.157	**
LCr	56	41.727	***	72	53.886	***	96	0.080	
LCb	55	25.484	***	69	36.725	***	92	0.481	
LaZ	44	13.562	**	53	26.289	***	73	1.084	
LaI	56	0.002		77	0.486		101	1.109	
LaN	55	0.877		76	8.408	**	101	5.807	*
AN	55	0.659		73	1.358		98	0.198	
CC	55	8.615	**	77	9.925	**	100	0.287	
M^3M^3	53	30.371	***	77	19.170	***	98	0.049	
CM^3	56	31.202	***	80	8.842	**	104	5.724	*
LMd	56	47.981	***	76	37.221	***	100	0.004	
ACo	56	0.934		75	1.735		99	0.270	
CM_3	56	38.971	***	76	21.487	***	100	2.063	
CC/LCr	55	0.022		72	0.073		95	0.415	
CM^3/LCr	56	0.268		72	2.989		96	9.150	*

Besides the observations of pale colouration of *M. capaccinii* pelage reported from the Levant (Harrison 1964, Atallah 1970), Benda et al. (2006) also found the dorsal pelage colouration in Syrian Mesopotamian samples of *M. capaccinii* to be slightly paler than in the Balkan samples. The same is true for the Iranian populations, which also belong to the Mesopotamian extension of the species range; the Iranian bats were referred/observed to be relatively pale in comparison with European samples (DeBlase 1980, Sharifi & Akmali 2006, own observations). However, Benda et al. (2006) interpreted this difference in pelage tinge as an effect of arid conditions of the region – *M. capaccinii* is the only *Myotis* bat occurring in arid steppes of Mesopotamia (see Distribution). So, the applicability of the pelage tinge intensity for intraspecific taxonomy in this bat remains very uncertain.

The comparison of forearm and skull dimensions of four sample sets of *M. capaccinii* from Europe, the eastern Mediterranean (Anatolia, Levant) and Mesopotamia, including the Iranian

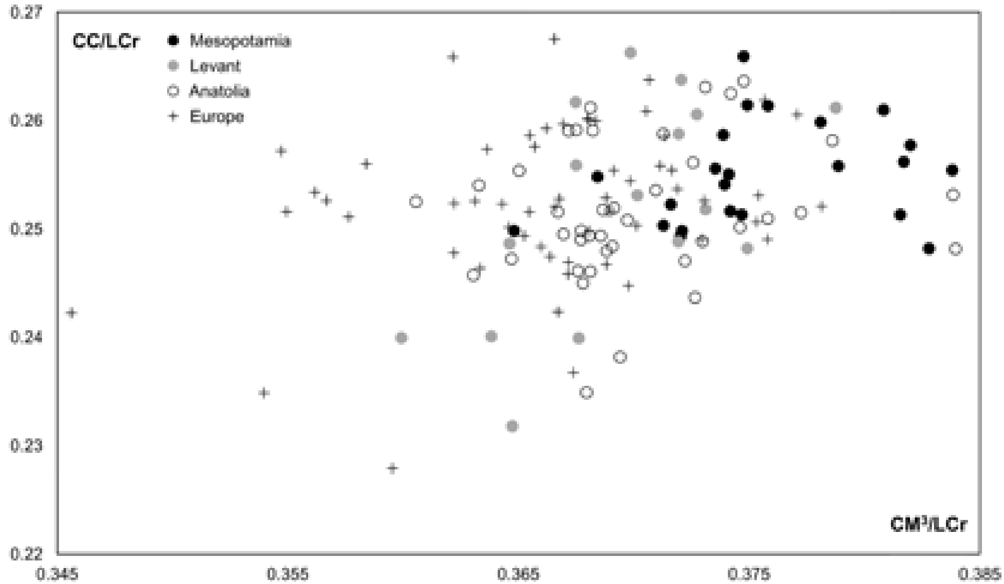


Fig. 107. Bivariate plot of the examined Iranian and comparative samples of *Myotis capaccinii* (Bonaparte, 1837): relative length of rostrum (CM^3/LCr) against the relative width of rostrum (CC/LCr).

ones (Table 20, Fig. 106), showed a certain level of metric variation among them. The Levantine (Lebanese) bats are absolutely the smallest ones, while the Turkish (western Anatolian) and European samples are the largest; the Mesopotamian bats are medium-sized in relation to other sample sets. However, a comparison of the relative rostral length shows a slight difference between the European samples and the Middle Eastern ones (CM^3/LCr; Table 20, Fig. 107; see also Benda et al. 2006: 137, Fig. 82). The bats from Mesopotamia (Iran, Iraq, Syria) and from Turkey have a relatively longer rostrum than the bats from southern Europe and the Levant. A simple statistical comparison of the four sets of samples (ANOVA; Table 20) showed the Mesopotamian bats to be the most distinct among the compared sets, namely from the European (nominotypical) populations, while the Anatolian bats rather fit to the European samples (this conforms to the results by Albayrak & Aşan 2002). These preliminary results are in accordance with the previous reports on intraspecific variation within *M. capaccinii* in the Middle East. Based on this morphometric evidence, the bats from Mesopotamia (including the Iranian populations) and the Levant constitute morphotypes separate from that of southern Europe. On the other hand, it is not clear whether these morphological differences reflect the categorial distinctness between populations, deserving a taxonomic interpretation, or represent an evidence of a clinal shift in morphological parameters between populations in the eastern part of the species distribution range. This question can be perhaps answered only by the results of a molecular genetic analysis based on representative sampling from the maximum of the distribution range of *M. capaccinii* (the results of a preliminary analysis by Bilgin et al. 2008b did not bring a sufficient amount of data for taxonomic interpretation of the intraspecific variation within this species).

Echolocation. *Myotis capaccinii* has downward frequency-modulated calls with a frequency bandwidth from 70–100 kHz up to 35–40 kHz, the peak frequency ranges between 44–67 kHz (Siemers et al. 2001, Russo & Jones 2002, Obrist et al. 2004, Papadatou et al. 2008). In Iran, we recorded numerous calls of *M. capaccinii* individuals foraging above a pool in the oasis near Garmab (Fig. 108), their basic echolocation parameters are given in Table 3. The obtained data are in general concordance with the previously published values, with an exception of the end frequency, which was found remarkably higher in the Iranian bats.

Feeding ecology. *Myotis capaccinii* is a small- to medium-sized bat hunting its prey above water surface or just from the surface (Spitzenberger & von Helversen 2001). *M. capaccinii* feeds mainly on nematoceran Diptera and its diet also contains important proportions of Brachycera, Lepidoptera, Araneae, Trichoptera, and Neuroptera (Almenar et al. 2008), it was also found to consume small fish (Aihartza et al. 2003, Levin et al. 2006).

In the Middle East, the diet of *M. capaccinii* was studied in Turkey, Syria and Israel (Benda et al. 2006, Levin et al. 2006, Whitaker & Karataş 2009). Formicoidea and Lepidoptera were found to be the most important food items complemented by Brachycera and Trichoptera in Syria (Benda et al. 2006). Lepidoptera prevailed in the analysed samples from Turkey (Whitaker & Karataş 2009). In northern Israel, Levin et al. (2006) found the food of *M. capaccinii* to be dominated by chironomid dipterans and corixid heteropterans (together ca. 58–75% of volume), complemented mainly by Hymenopera, Coleoptera, Lepidoptera and Araneae; fish scales (attributed to *Gambusia affinis*) were found in all analysed seasonal sets of faeces.

From Iran, we analysed samples of *M. capaccinii* diet originating from two sites, one digestive tract from Bisotun (Kermanshah) and two digestive tracts from Si Mili (Khuzestan). The digestive tract from Bisotun contained only Lepidoptera, the tracts from Si Mili contained Trichoptera (40% of volume), Auchenorrhyncha (30%), nematoceran Diptera (20%), and Neuroptera (10%). These findings generally correspond well with results of the previous studies of the diet composition in *M. capaccinii* (see above).

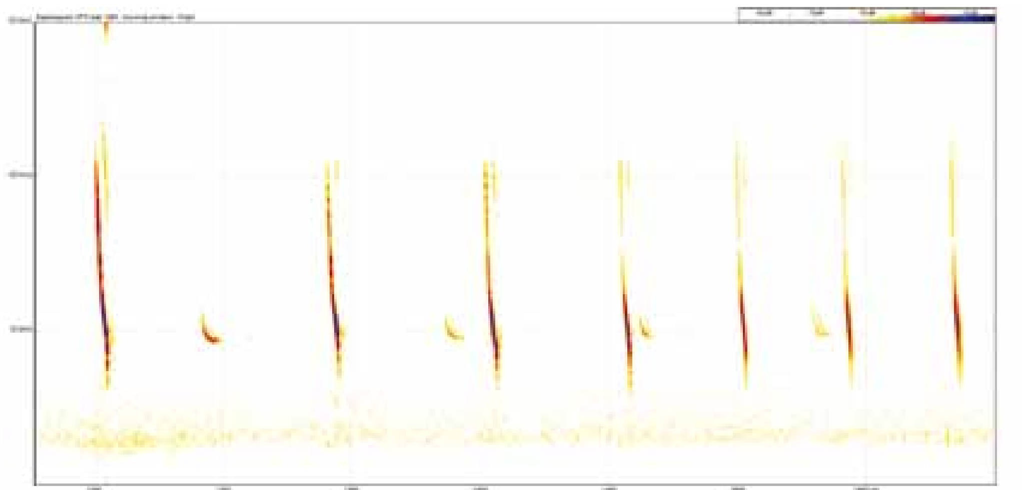


Fig. 108. Spectrogram of echolocation calls of *Myotis capaccinii* (Bonaparte, 1837) and *Pipistrellus pipistrellus* (Schreber, 1774); individuals foraging above a pool in the oasis near Garmab (Zanjan).

Records of ectoparasites. **Original data**: N y c t e r i b i i d a e: *Nycteribia latreillii*: 1 fa (CMŠ [P]) from 1 ma (NMP 93884), Tadovan, Tadovan cave (Fars prov.), 7 October 2011. – *Nycteribia schmidlii*: 2 ma, 1 fa (CMŠ [A]) from 8 inds. (incl. NMP 93883, 93884), Tadovan, Tadovan cave (Fars Prov.), 7 October 2011. – *Penicillidia conspicua*: 1 ma (CMŠ [A]) from 8 inds., Tadovan, Tadovan cave (Fars Prov.), 7 October 2011. – *Penicillidia dufourii*: 4 fa (CMŠ [A]) from 10 inds. (incl. NMP 93883, 93884), Tadovan, Tadovan cave (Fars Prov.), 7 October 2011. – S p i n t u r n i c i d a e: *Spinturnix psi*: 5 fa (CMŠ [P]) from 10 inds. (incl. NMP 93883, 93884), Tadovan, Tadovan cave (Fars Prov.), 7 October 2011.

Comments on ectoparasites. From *Myotis capaccinii* in Iran an enormous variety of bat flies was collected – in total four species, all from eleven bats netted at one site, the Tadovan cave (Fars). *Nycteribia latreillii* (Leach, 1817), *N. schmidlii* Schiner, 1853, *Penicillidia conspicua* Speiser, 1901 (Fig. 109), and *P. dufourii* Westwood, 1834 (Fig. 110) are species parasitic on cave-dwelling bats (Hůrka 1964). Their presence on *M. capaccinii* and occurrence in Iran is not surprising, although *N. latreillii* is here recorded from Iran for the first time. From neighbouring Turkey, also *Nycteribia pedicularia* Latreille, 1805 and *Phthiridium biarticulatum* (Hermann, 1804) were recorded from *M. capaccinii* (Hůrka 1972, Kock 1989), their occurrence in this bat in Iran can thus be expected (the latter species was already documented on *Rhinolophus ferrumequinum*, see above).

From *M. capaccinii* also the mite *Spinturnix psi* (Kolenati, 1856) was recorded, a permanent parasite of bats of the genus *Miniopterus* (Dusbábek 1972). It is here reported from Iran for the first time (see also under *Miniopterus pallidus*). *Spinturnix psi* and/or *S. myoti* (Kolenati, 1856) parasitise *M. capaccinii* usually in cases of shared roosts with *Miniopterus* and *Myotis* bats (Deunff et al. 2004), i.e. just in the case of the Tadovan cave, where both spinturnicid species were documented.

Fig. 109. Dorsal view of a male *Penicillidia conspicua* Speiser, 1901 collected from *Myotis capaccinii* (Bonaparte, 1837) at the Tadovan cave (Fars). Photo by O. Balvín.

Fig. 110. Dorsal view of a female *Penicillidia dufourii* (Westwood, 1835) collected from *Myotis capaccinii* (Bonaparte, 1837) at the Tadovan cave (Fars). Photo by O. Balvín.

Vespertilio murinus Linnaeus, 1758

Records. **Original data**: G o l e s t a n: valley 2 km SSE of Ali Abad [1], beech forest, above a stream, 28 May 2006: net. 1 ma (NMP 90863); – Dach Bourom au N. de Gombad e Qabous, Bord de l'Atrek [= Dashli Burun] [2], 26 October 1956: 1 ma (MNHN 1985-947; leg. F. Petter). – L o r e s t a n: Lenje Abad [3], 6 km SW of Dorud, above a river, 8 October 1998: net. 1 ma (NMP 48156). – Q a z v i n: valley 1 km S of Razjerd [4], 16 km NE of Qazvin, above a stream, 13 May 2006: net. 1 ma (NMP 90766; Fig. 112). – Iran (undef.): Persiâ [= Iran], coll. 1 m (ZIN 6109; leg. Buze). – **Published data**: C h a h â r M a h â l v a B a k h t i â r i: Sar Dasht [5], near [= 13 km S of] Lordegan, over a wide jube, 1 October 1968: shot 1 fa, FMNH (DeBlase 1971a, 1980). – K h o r a s â n - e S h o m â l i: Dasht [6], attic of a house, 3 November 1962: 1 ma, FMNH (Lay 1967, DeBlase 1980). – Q o m: 28 km. S Qum (= Qom) [7], over a stream, 24 April 1969: 1 m, IPHR (DeBlase 1980).

Distribution. *Vespertilio murinus* is a rather rare bat species in Iran, seven record sites are available from the country (Fig. 111). The records come from a crescent-shaped broad belt of mountains surrounding the north-western margin of the basin of the Dasht-e Kavir desert; it stretches from the western parts of the Kopetdagh Mts. over the central Alborz Mts. to the northern and central Zagros Mts. The localities lie in various habitats, from semi-arid areas near Qom, in northern Golestan or western Khorasan, to humid mixed forests on the slopes of the Alborz Mts. in southern Golestan or near Qazvin. Although DeBlase (1980) summarised only three records of *V. murinus* from Iran, these records well demarcated the currently known range of distribution in the country (Fig. 111). *V. murinus* is a Palaearctic bat species widely distributed from western Europe to the Far East of Russia, the southern extension of its occurrence lies in south-western Asia (see Bates

& Harrison 1997, Horáček et al. 2000). Its occurrence in the central Zagros Mts. of western Iran (Chahar Mahal va Bakhtiari province) represents the southernmost margin of the whole distribution range of the species (cf. DeBlase 1980).

Based on the rather unusual pattern of geographical distribution of the records of *V. murinus* in Iran, it is difficult to conclude from which region the Iranian range continues; the species is known to occur in both Transcaucasia and West Turkestan (Kuzâkin 1965). Since the Iranian findings were made only in spring and autumn transition periods (and are dominated by males), one can suppose presence of individuals migrating to or from hibernacula rather than sedentary breeding populations in Iran (cf. Strelkov 1997). The Golestani and Khorasani records of *V. murinus* most probably represent a natural extension from its range in Turkmenistan; however, the west-Iranian records are probably related to individuals migrating from either the Transcaucasian or West Turkestani oriented route and represent an opportunity for members of the two populations to meet.

Field notes. In Iran, mostly foraging individuals of *Vespertilio murinus* were recorded, only one record from a roost is available. *V. murinus* has not been found in the osteological material from owl pellets collected in Iran (Table 40).

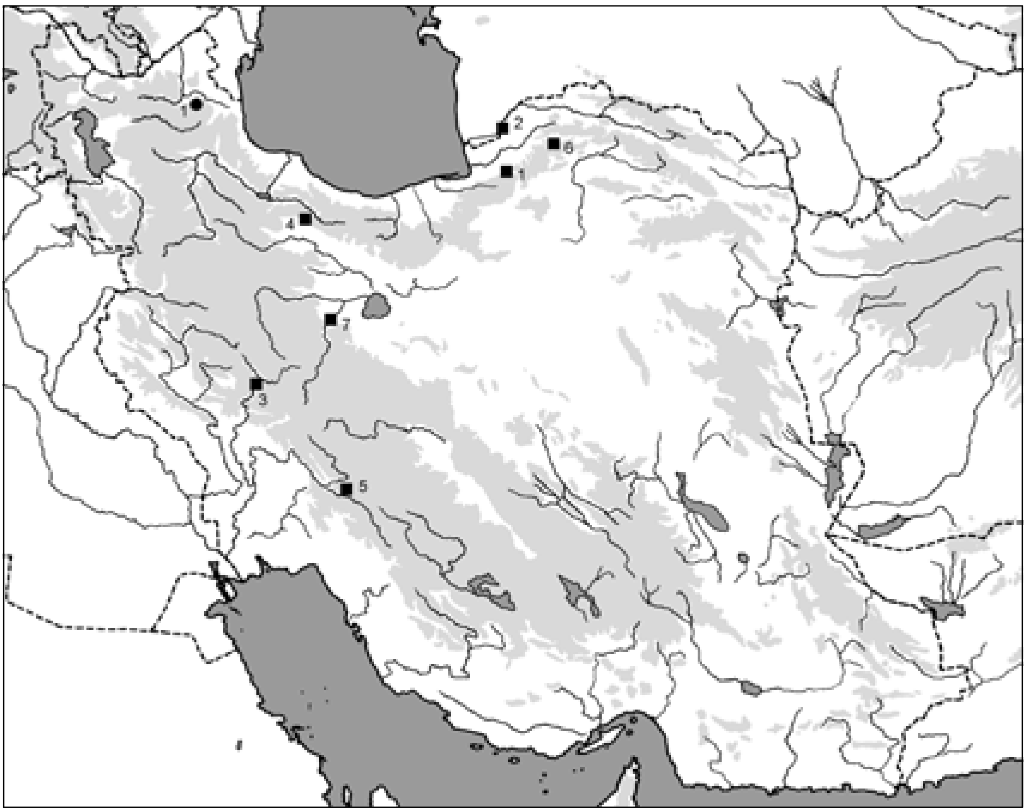


Fig. 111. Records of *Vespertilio murinus* Linnaeus, 1758 (squares) and *Eptesicus bobrinskoi* Kuzâkin, 1935 (circle) in Iran.

Fig. 112. Portrait of *Vespertilio murinus* Linnaeus, 1758 from Razjerd (Qazvin). Photo by A. Reiter.

The only Iranian finding of *V. murinus* in its roost was reported by Lay (1967: 146); an adult male was collected from an artificial shelter in Dasht (Khorasan) on 3 November 1962: "[… it] roosted in the attic of a house and was kept alive for three weeks during which it remained torpid, always hanging from its cage top. When handled, this individual made slow uncoordinated movements and never attempted flight. This bat contained a large quantity of fat." On a different page, Lay (1967: 63) interpreted this finding as an evidence of hibernation in *V. murinus*: "We took a single hibernating *Vespertilio murinus* from its refuge in the attic […]." Perhaps, a better interpretation of this record is a temporary roost in the prehibernation period, which probably ends in November or even later in the conditions of northern Iran. *V. murinus* is known to hibernate mainly in rocky crevices in natural habitats or in fissures between stones or bricks in anthropogenous habitats (Rydell & Baagøe 1994, Baagøe 2001b). However, Lay (1967) did not give any close details describing properly the shelter or the circumstances of collection of the bat.

Most of the findings of *V. murinus* in Iran represent foraging bats; single individuals, mostly males, were netted or shot when flying. The records come from various habitats, from humid forests of northern Iran to semi-arid steppes of central Iran. An adult male was netted above a stream passing through a beech forest in a valley near Ali Abad (Golestan) on 28 May 2006 (Fig. 76). The locality represents an exploited lowland forest, partially used as a recreation area by the locals; besides *V. murinus*, a rich forest bat community was documented there by netting, viz. *Myotis blythii*, *M. bechsteinii*, *M. nattereri*, *M. emarginatus*, *M. hyrcanicus* sp. n., *Eptesicus serotinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri*. A single adult male of *V. murinus* was netted above a stream at Razjerd (Qazvin) on 13 May 2006. The site is located in a valley of a small river with numerous steps, cataracts and pools on the southern slopes of the Alborz Mts. covered by orchards, fields and pastures. Another adult male was caught into a net installed on the bank, above a meander of a large river in the valley at Lenje Abad near Dorud (Lorestan) on 8 October 1998 (Fig. 40). The valley is situated close to the Kuh-e Oshtoran Mts. and slopes of this deep valley are covered by dry and sparse oak forests; *Pipistrellus pipistrellus* and *Miniopterus pallidus* were also netted there. DeBlase (1980) referred on a male netted on 24 April 1969 over a stream near Qom, i.e. in an arid landscape bordering the Dasht-e Kavir desert.

The southernmost record of *V. murinus* from Iran was reported by DeBlase (1971a, 1980) from Sar Dasht near Lordegan (Chahar Mahal va Bakhtiari): "an adult female [was] shot at dusk on the evening of 1 October 1968 as it flew over a wide jube and around an electric light." (DeBlase 1980: 181). The locality is a dry valley of the south-western slope of the Zagros Mts. with sparse tree vegetation (see DeBlase 1980: 290, Fig. 150). DeBlase (1980: 291) described the record as follows: "On 29 September we set two mistnets over a jube […] near the village of Sar Dasht, a few km. SW Lordegan. Although the nets were left up for three nights and numerous bats were seen flying along the jube at dusk, none were collected by mistnet. On 1 October we shot three of the many bats seen flying. These included one each of *Vespertilio murinus*, *P*[*ipistrellus*]. *pipistrellus*, and *P*. [= *Hypsugo*] *savii*."

No data on reproduction of *V. murinus* are available from Iran.

Material examined. 1 ♂ (NMP 90863 [S+A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 1 ♂ (MNHN 1985-947 [S+A]), Dach Bourom au N. de Gombad e Qabous, Bord de l'Atrek [= Dashli Burun, Golestan Prov.], 26 October 1956, leg. F. Petter; – 1 ♂ (NMP 48156 [S+A]), Lenje Abad (Lorestan Prov.), 8 October 1998: leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 90766 [S+A]), Razjerd (Qazvin Prov.), 13 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Vespertilio murinus* are shown in Table 21. For the material examined see above.

Two subspecies of *V. murinus* are recognised within its species range (Wallin 1969, Corbet 1978, Koopman 1994, Rydell & Baagøe 1994, Horáček et al. 2000, Baagøe 2001b, Simmons 2005); viz., *V. m. ussuriensis* Wallin, 1969 in the Far East of Russia (type locality: southern part of Ussuri region, Soviet Union [= Primorskij Prov. and the southern part of the Khabarovsk Prov., Russia]; Wallin 1969: 358) and *V. m. murinus* Linnaeus, 1758 (type locality: Wien [Austria]; Kuhl 1817: 44) in most of the species range, from Central Europe and Scandinavia to Kashmir and Transbaikalia (Rydell & Baagøe 1994, Baagøe 2001b). Populations of Iran as well as of the adjacent countries were also naturally assigned to the latter form (DeBlase 1980, Strelkov et al. 1978, Habilov 1992). Considering the metric characteristics, the Iranian samples of *V. murinus* (Table 21) conform to those from Europe (see e.g. Baagøe 2001b: 478–480).

Echolocation. *Vespertilio murinus* produces combined frequency-modulated (at the beginning) and almost constant-frequency (at the end) calls with the range of frequencies of maximum energy between 23–27 kHz (Rydell & Baagøe 1994, Obrist et al. 2004, Schaub & Schnitzler 2007). Echolocation calls of *V. murinus* have not yet been studied in the Asian part of the species range.

Feeding ecology. *Vespertilio murinus* is a medium-sized bat foraging in open space (Baagøe 2001b). Small nematoceran Diptera, Aphididae, Trichoptera, and Lepidoptera were found to be the most important food items in the European populations of this bat (Bauerová & Ruprecht 1989, Rydell 1992, Beck 1995).

From Iran, we analysed a set of ten faecal pellets collected from one individual of *V. murinus* netted at Ali Abad (Golestan). Its diet was dominated by Coleoptera (42% of volume), namely Carabidae (39%) and Staphilinidae (3%); other important food items were Heteroptera (30%)

Table 21. Basic biometric data on the examined Iranian samples of *Vespertilio murinus* Linnaeus, 1758, *Eptesicus bobrinskoi* Kuzâkin, 1935, and *E. pachyomus* (Tomes, 1857). For abbreviations see p. 171

	Vespertilio murinus					*Eptesicus bobrinskoi*					*Eptesicus pachyomus*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	3	**62.7**	61	64	1.528	–	–	–	–	–	1	73	–	–	–
LCd	3	**45.3**	42	47	2.887	–	–	–	–	–	1	55	–	–	–
LAt	4	**43.63**	42.2	44.5	1.072	9	**35.11**	33.9	36.7	0.799	6	**51.67**	50.2	53.1	1.183
LA	3	**18.13**	17.4	18.8	0.702	–	–	–	–	–	1	21.3	–	–	–
LT	3	**6.13**	5.8	6.6	0.416	–	–	–	–	–	1	7.8	–	–	–
LCr	4	**14.93**	14.67	15.18	0.260	6	**14.92**	14.57	15.24	0.277	6	**20.11**	19.88	20.42	0.199
LCb	4	**14.83**	14.58	14.96	0.177	6	**14.56**	14.28	14.88	0.260	6	**19.17**	18.87	19.58	0.240
LaZ	4	**9.58**	9.36	9.70	0.152	2	**8.97**	8.38	9.56	0.834	6	**14.00**	13.75	14.27	0.210
LaI	4	**4.21**	4.18	4.27	0.042	7	**4.06**	3.92	4.19	0.100	6	**4.04**	3.83	4.32	0.182
LaInf	4	**5.47**	5.22	5.67	0.191	6	**4.46**	4.28	4.86	0.212	6	**6.67**	6.19	7.07	0.345
LaN	4	**7.65**	7.39	8.05	0.286	6	**7.64**	7.16	7.95	0.303	6	**8.90**	8.52	9.38	0.337
LaM	4	**8.77**	8.54	9.18	0.281	6	**7.99**	7.77	8.22	0.164	6	**10.60**	10.44	10.73	0.117
ANc	4	**5.14**	5.09	5.22	0.057	6	**4.49**	4.28	4.74	0.170	6	**6.88**	6.48	7.42	0.324
LBT	3	**3.44**	3.37	3.58	0.118	1	3.03	–	–	–	6	**3.55**	3.31	3.85	0.177
CC	4	**5.16**	5.07	5.28	0.089	6	**3.94**	3.74	4.32	0.208	6	**6.36**	6.17	6.59	0.140
M^3M^3	4	**6.39**	6.22	6.48	0.118	6	**5.81**	5.61	6.04	0.172	6	**8.45**	8.18	8.68	0.166
CM^3	4	**5.34**	5.25	5.48	0.097	7	**5.16**	5.02	5.38	0.134	6	**7.55**	7.38	7.62	0.088
LMd	4	**10.95**	10.66	11.11	0.206	5	**10.40**	10.14	10.75	0.238	6	**15.13**	14.89	15.56	0.242
ACo	4	**3.32**	3.28	3.38	0.042	6	**2.97**	2.81	3.14	0.137	6	**5.74**	5.47	6.04	0.190
CM_3	4	**5.63**	5.56	5.76	0.092	5	**5.56**	5.42	5.67	0.105	6	**8.30**	8.21	8.44	0.092

and Formicoidea (27%). The proportion of Lepidoptera was very small (1%). The recorded diet composition in *V. murinus* in Iran differs remarkably from the results of previous studies from Europe, however, the available sample set is too limited to allow for any general conclusions.

Eptesicus serotinus (Schreber, 1774)

Records. **Original data**: A r d a b i l: Dâshkasan [1], 17 km SE of Meshginshahr, Dâshkahul cave, 29 September 2011: net. 1 ma (NMP 94109; Fig. 114), det. & rec. calls of 1 foraging ind. – F â r s: Bishapur [2], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April 2000: remnant of 1 ind. (right mandible) found in *Strix aluco* pellets (cf. Obuch 2011). – G o l e s t a n: valley 2 km SSE of Ali Abad [3], beech forest, above a stream, 28 May 2006: net. 3 ma (NMP 90864–90866). – K h o r a s â n - e R a z a w i: valley 7 km E of Bazangan [4], 14 km NNW of Mazdavand, 17 May 2006: det. 1+ foraging ind.; – Persiâ, Nusi [= Iran, Nusi] [5], 17 [= 29 NS] April 1896: coll. 1 m, 1 f (ZIN 5429, 5800; leg. N. A. Zarudnyj; see Zarudnyj 1896); – Rubat-e Sharaf caravanserai [6], 54 km SW of Sarakhs, ruins, 18 May 2006: coll./net. 10 ma (NMP 90779–90788; Fig. 115); – valley 3 km SW of Tahir Abad [7], 45 km NE of Mashhad, above a creek, 21 May 2006: net. 9 ma (NMP 90800–90808). – K h o r a s â n - e S h o m â l i: Ghezel Ghan [8], 22 km NNE of Bojnurd, around a street lamp, 24 May 2006: det. 2+ inds. – Y a z d: fortress caravanserai 5 km N of Rubat-e Chah Gonbad [9], 9 May 1997: remnants of 1 ind. in *Athene noctua* pellets (cf. Obuch & Krištín 2004). – **Published data**: A l b o r z: Karaj [10], 1 ind., KAUM (Lay 1967). – A r d a b i l: Guter-Su [= Qutur Su] [11], Sulphur Caves, north of Mt. Sabalan, 21 August 1961: 1 m, BMNH (Harrison 1963), Qutur Su cave, 17 km ESE Meshginshahr, 20 July 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Lâhrud [12], 17 km NE Meshginshahr, ceiling of water channel under road, 20 July 2006: coll. 1 m (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: "seemingly Khwoy" [13] (Vereŝagin 1959, Lay 1967). – F â r s: Shiráz, 4500['], 5 inds. (Blanford 1876 [as *V. Shiraziensis*]), Shiraz, Persia, 1871: 2 inds., IMC (Dobson 1876), Shiraz, 1 fa, BMNH (Dobson 1878), Shiráz, South Persia, 1871: 2 f, 2 inds. IMC (Anderson 1881), Persia, Shiraz (Trouessart 1897), near Shiraz [14], 4,750 feet, 1 f, BMNH (Dobson 1871 [as *Vesperus Shiraziensis*], Gaisler 1970, Benda et al. 2006); – Zurghum [= Zarqan] [15], 2/7 [?] 1920: 1 f, BMNH (Lay 1967, Gaisler 1970, DeBlase 1980, Benda et al. 2006). – G i l â n: Assalem [16], edge of small clearing in forest, 1250 m, 21 July 1968: net. 1 mj, 22 July 1968: net. 1 ma (Steiner & Gaisler 1994). – G o l e s t a n:

foot of the Elburz Mountains., S. E. Caspian [= vicinity of Bandar-e-Gaz] [17], 1 ind., resp. 2 inds., BMNH (Harrison 1963, Benda et al. 2006); – Mohammed Reza Shah National Park [18], over a river, 25 June 1969: 1 m, 1 ind., MMTT (DeBlase 1980); – Pahlavi Dezh [= Aq Qala] [19], 28 October 1962: 12 inds., resp. 1 ms, 2 fa, 3 inds. sad (mummies), FMNH (Lay 1967, DeBlase 1980). – K h o r a s â n - e R a z a w i: Chelmir [20], over a stream, July 1968: net. 1 m, IPHR (Farhang-Azad 1969a), July 1969: 4 inds. (Farhang-Azad 1970a ex DeBlase 1980); – Shahr-Âbâd village 10 kms. east of Mash'had [21], crack in a wall, Summer 1963, resp. 21 August 1962: coll. 1 m, BMNH (Etemâd 1967, 1984, Benda et al. 2006). – M â z a n d a r a n: Cheshmeh Gerduk [22], 4 km S of Nowshar, on Caspian shore, 12 May 1974: 4 f, BMNH (Etemâd 1984, Benda et al. 2006); – Sama [23], over a pond, 17 August 1962: net. 1 m, FMNH (Lay 1967, DeBlase 1980). – Q a z v i n: Kazwin [= Qazvin] [24], MZST (De-Filippi 1863 [as *Vespertilio mirza*]), Kazvin (De Filippi 1865 [as *V. mirza*]). – Z a n j â n: Zendgian [= Zanjân] [25], MZST (De-Filippi 1863 [as *Vespertilio mirza*]), Zendjan [= Zanjân] (De Filippi 1865 [as *V. mirza*]). – Iran (undef.): Perse (Trouessart 1879, 1905), Persia (Trouessart 1897, 1904).

Distribution. Although *Eptesicus serotinus* is not a quite common bat in Iran, it belongs to rather widespread species, 25 record sites are available from the country (Fig. 113). DeBlase (1980) reported only a half of the number of localities (Table 1); however, these records well delineated even the currently known range of distribution in Iran. The records come from two distant regions of the country, situated at least 700 km apart. Majority of the localities (84%) are available from the northernmost part of Iran, an approx. 150 km broad belt of mostly mountainous areas (Alborz,

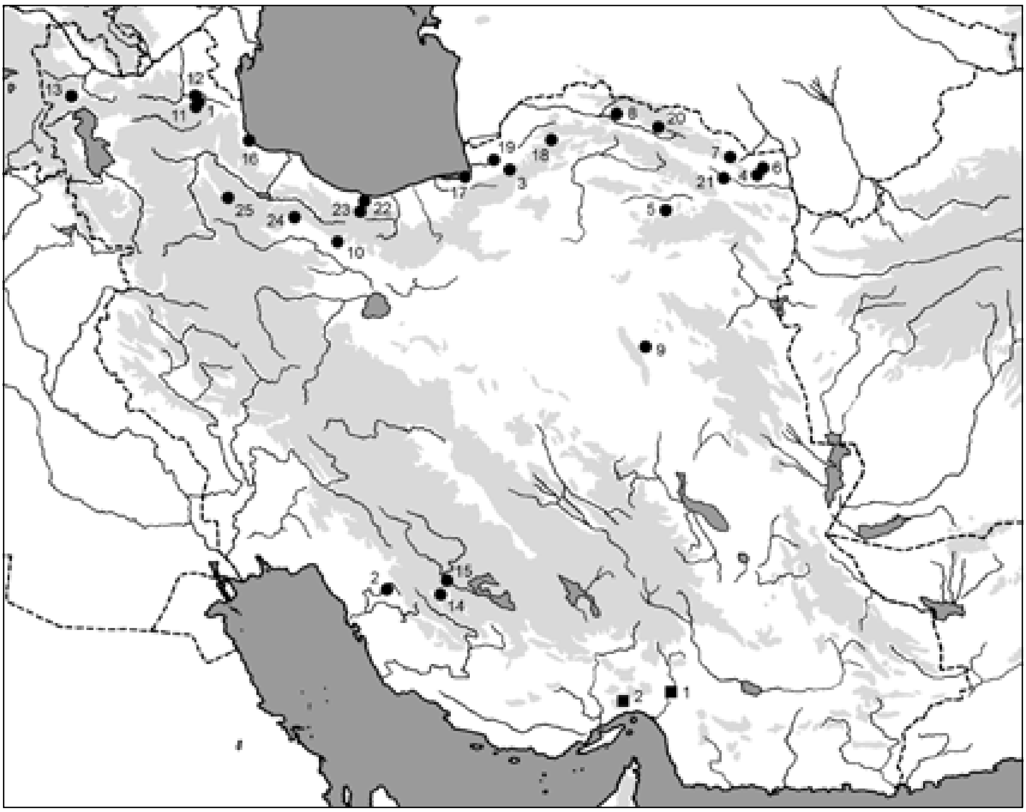


Fig. 113. Records of *Eptesicus serotinus* (Schreber, 1774) (circles) and *E. pachyomus* (Tomes, 1857) (squares) in Iran.

Fig. 114. Portrait of *Eptesicus serotinus* (Schreber, 1774), *serotinus* morphotype, from the Dashkasan cave (Ardabil). Photo by A. Reiter.

Ardabil, Azarbaijan, Gilan, Golestan, Mazandaran, Khorasan, Qazvin, and Zanjan provinces). An island of isolated occurrence is known from the Fars province in southern Iran. The particular records of *E. serotinus*, however, come from several very distinct habitat types; seven records were made in the humid Hyrcanian mixed forests (Gilan, Golestan, Mazandaran); eight records come from Khorasani arid steppes and deserts; seven records were reported from mountain steppes of north-western Iran (Alborz, Ardabil, Azarbaijan, Qazvin, Zanjan); and three records are known from the dry Mediterranean shrublands of the southern Zagros Mts. Considering the apparent ecological valence in *E. serotinus* giving it an ability to inhabit a wide range of environments, the lack of records in large parts of Iran, namely in the western regions with temperate climate, is rather surprising. Thus, it cannot be excluded that the large gap between the known occurrence areas is caused only by unavailability of records rather than actual absence of this bat. On the other hand, the complete absence of *E. serotinus* records at least in the western parts of Iran seems to be rather enigmatic, since in some parts of its range this bat can be regarded a very conspicuous faunal element (typical echolocation call, tendency to synanthropy, noisy colonies, preference of secondary foraging habitats, e.g. pastures) whose existence does not appear completely hidden.

The north-Iranian range of *E. serotinus* continues to the north-west in Turkey and Transcaucasia, in both these regions this species belongs to the most common bats (Benda & Horáček 1998, Buhnikašvili et al. 2004, Rahmatulina 2005). More to the west, the range continues to the Levant and Europe, including some Mediterranean islands (Baagøe 2001c). The Iranian range continues also to the north-east in West Turkestan, in southern and central parts of this region this bat represents a very common faunal element (Strelkov et al. 1978, Strelkov & Šajmardanov 1983, Rybin et al. 1989, Habilov 1992, etc.). The (seeming?) isolate of *E. serotinus* occurrence in southern Iran (south-western Zagros Mts.) represents the southernmost fringe of the whole distribution range of the species (cf. Juste et al. in press).

FIELD NOTES. *Eptesicus serotinus* was recorded in Iran both in its roosts and at its foraging grounds. At two sites, its remains were recorded in the osteological material from owl pellets.

The only finding which may refer to a possible maternity roost, was made by Lay (1967) in the Golestan province. He reported a group of 12 individuals found on 28 October 1962; Lay (1967: 145) specified the circumstances as follows: "These bats roosted in attics beneath tin roofs at Pahlavi Dezh, where we obtained one live individual which subsequently escaped and many mummies. The townsmen stated that during the summer "thousands" occupied the attics which, with the observations we made in October, suggests that these bats either migrate or move to hibernating quarters for the winter." To this record, DeBlase (1980: 207) added: "Lay also reported collecting mummies of *P*[*ipistrellus*]. *pipistrellus* from attics under tin roofs at Pahlavi Dezh but did not say if the two species were found in the same attics."

Etemad (1967) reported a finding of *E. serotinus* at Shahr-Abad near Mashhad (Khorasan), Etemad (1984) specified this record to be made in a wall crack in the summer 1963; however, the date 21 August 1962 is written on the label of the respective BMNH specimen (Benda et al. 2006). A roost of a similar type was discovered by Sheikh-Jabbâri (2008) who found a solitary

Fig. 115. Portrait of *Eptesicus serotinus* (Schreber, 1774), *turcomanus* morphotype, from the Rubat-e Sharaf caravanserai (Khorasan). Photo by A. Reiter.

male in a fissure of the ceiling of a water channel under road at Lahrud near Meshginshahr (Ardabil) on 20 July 2006. One adult male was caught into a net installed at the entrance of the Dashkahul cave at Dashkasan near Meshginshahr (Ardabil) during evening emergence from the roost on 29 September 2011; this small cave is situated on the northern slope of Mount Sabalan at 1920 m a. s. l. (Fig. 200), surrounded by extensively exploited farmland. *Plecotus macrobullaris* and *Miniopterus pallidus* were netted at the Dashkahul cave along with *E. serotinus*.

Ten solitary males of *E. serotinus* were found to roost in the deserted caravanserai of Rubat-e Sharaf near Sarakhs (Khorasan) on 18 May 2006 (Fig. 116). The bats were collected directly from the fissures between bricks in ceilings of corridors in the caravanserai at daytime or netted during the evening emergence on the same day (along with one individual of *Hypsugo savii*). The caravanserai lies on the southern margin of the Karakum desert and at the northern foothill of the Kopetdagh Mts. in a hilly landscape covered by dry steppes to sandy deserts.

Concerning the roost ecology of *E. serotinus* in Iran, DeBlase (1980: 207) noted: "Etemad (1969 […]) said that *E. serotinus* occur in old houses under roofs and between walls in cracks in rocks, and occasionally in caves, but are usually found near human habitation." Here reviewed data fully conform to this conclusion.

A carcass of *E. serotinus* was found twice in the sulphuric caves at Qutur Su (Ardabil), for the first time in 1961 (Harrison 1963), along with five other bat species (Table 24), and for the second time in 2006 (Sheikh-Jabbâri 2008). This site represents an unusually positioned and acting trap for animal life in the Sabalan mountains – the bats and other animals which visit the cave are killed by the sulphuric fumes; see under *Eptesicus bobrinskoi* for more details. The second finding was rather unusual in comparison with other records from these caves; while the other bats were found mostly on the cave floor hidden in fissures or under stones, Sheikh-Jabbâri (2008) found a mummy of the bat hanging from the cave ceiling.

Foraging individuals of *E. serotinus* were recorded at many sites of Iran. Blanford (1876: 21) reported collection of this species at Shiraz (Fars) [most probably in 1870]: "I found this bat abundant close to Shiráz. I shot several [= five individuals] in the evening just outside of the city." Lay (1967: 145) reported the observation of foraging *E. serotinus* from the northern slopes of the Alburz Mts. (Mazandaran) on 17 August 1962: "One was netted at Sama, and other large bats, seemingly serotines, were seen often in our searchlights during night around Sama." (for details of the site see under *Eptesicus nilssonii*; the latter species as well as *Myotis* cf. *mystacinus*, *Pipistrellus pipistrellus* and *Nyctalus leisleri*, were captured there along with *E. serotinus*; see Lay 1967, DeBlase 1980). Farhang-Azad (1969a) caught foraging individuals of *E. serotinus* into a net stretched over a stream at Chelmir (Khorasan) in the Kopetdagh Mts. in July 1968 and July 1969. This species was caught there as a part of an extremelly rich community of bats, composed also of *Rhinolophus ferrumequinum*, *R. blasii*, *Myotis blythii*, *M. emarginatus*, *Eptesicus ognevi*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Nyctalus leisleri*, *Otonycteris leucophaea*, *Miniopterus pallidus*, and *Tadarida teniotis*. DeBlase (1980: 334) reported on the individuals collected in a forest bat community at a river in the Golestan province on 25 June 1969: "Lay and Iran Department of Game and Fish personnel mistnetted bats in Mohammed Reza Shah National Park [= Golestan NP]. They collected one *Myotis bechsteini*, two *E. serotinus*, and one *Barbastella leucomelas* [= *B. barbastellus*]." Steiner & Gaisler (1994) referred to captures of two males of *E. serotinus* in a wooded area west of Assalem (Gilan) on 21 and 22 July 1968; the authors specified: "The locality […] was a clearing close to the forest edge, 1250 m [a. s. l.]. In the course of 14 net-nights, Steiner captured 1 adult and 1 juv. M." (Steiner & Gaisler 1994: 19). During this long netting session, one individual of *Plecotus auritus* was also netted.

Three males of *E. serotinus* were netted above a stream at Ali Abad (Golestan) on 28 May 2006 (Fig. 76); at this locality covered by a dense beech forest also *Myotis blythii*, *M. bechsteinii*, *M.*

nattereri, *M. emarginatus*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Pipistrellus pygmaeus*, and *Nyctalus leisleri* were caught. Nine adult males of *E. serotinus* were caught into a net installed above a creek in a small village lying in a shallow valley covered by agricultural landscape at Tahir Abad near Mashhad (Khorasan) on 21 May 2006 (Fig. 132). Along with *E. serotinus* also *Myotis blythii*, *Eptesicus ognevi*, *Pipistrellus pipistrellus*, and *Tadarida teniotis* were documented on this site. Echolocation calls of foraging individuals of *E. serotinus* were recorded in the valley at Bazangan near Mazdavand (Khorasan) on 17 May 2006; the site lies on the dry northern slope of the Kopetdagh Mts. covered by fields and pastures, with very scarce tree vegetation. Two *Myotis blythii* were netted there and calls of *Pipistrellus pipistrellus* detected. Calls of *E. serotinus* and *P. pipistrellus* foraging around a street lamp at Ghezel Ghan near Bojnurd (Khorasan) were detected on 24 May 2006.

The only evidence of reproduction of *E. serotinus* recorded in Iran is the juvenile male captured at Assalem on 21 July (Steiner & Gaisler 1994). This record conforms to the findings from the Levant, where births are suggested to occur approximately in mid-May, but differs from the reports from Turkey where somewhat later terms were suggested (see Benda et al. 2006 for a review).

Osteological remains of *E. serotinus* were recorded from pellets of two owl species, *Strix aluco* and *Athene noctua* (Table 40). A right mandible was found in the pellets of *Strix aluco* collected in the large cave above the Sasan spring at Bishapur (Fars; Obuch 2011) representing 0.50% of all prey items (and 4.17% of mammal items) in the respective sample and 0.15% of all prey items (0.37% of mammal items) in the whole analysed tawny owl diet from Iran. Remnants of one individual were detected in *Athene noctua* pellets collected in the fortress caravanserai at Rubat-e Chah Gonbad (Yazd), making up 0.60% of all prey items (and 3.57% of mammal items) in the respective sample, but 0.05% of all prey items (0.36% of mammal items) in the whole analysed diet of the spotted owlet from Iran. From the Middle East, evidence of *E. serotinus* in owl diet was previously available from Turkey and Syria (Obuch 1994, Benda et al. 2006).

MATERIAL EXAMINED. 3 ♂♂ (NMP 90864–90866 [S+A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 1 ind. (JOC unnumbered [Sf]), Bishapur (Fars Prov.), 21 April 2000, leg. J. Obuch; – 1 ♂ (NMP 94109 [S+A]), Das-

Fig. 116. Ruins of the Rubat-e Sharaf caravanserai near Shurlaq (Khorasan), a roosting site of *Eptesicus serotinus* and *Hypsugo savii*. Photo by P. Benda.

Table 22. Basic biometric data on the examined Iranian samples of three forms of *Eptesicus serotinus* (Schreber, 1774). For abbreviations see p. 171

	Eptesicus s. serotinus serotinus morphotype					*Eptesicus s. serotinus turcomanus* morphotype					*Eptesicus s. mirza*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	4	**76.5**	70	82	5.000	19	**72.7**	67	77	2.786	–	–	–	–	–
LCd	4	**57.3**	56	60	1.893	19	**56.6**	53	61	2.434	–	–	–	–	–
LAt	5	**52.12**	48.6	53.8	2.121	20	**49.05**	46.8	51.1	1.218	1	54.0	–	–	–
LA	4	**21.85**	21.2	22.5	0.695	19	**22.73**	21.5	24.3	0.688	–	–	–	–	–
LT	4	**8.08**	6.8	9.0	0.929	19	**8.43**	7.4	9.3	0.469	–	–	–	–	–
LCr	7	**20.82**	19.88	21.37	0.476	16	**19.74**	18.77	20.62	0.518	2	**22.16**	22.02	22.30	0.198
LCb	7	**19.95**	19.09	20.58	0.479	16	**19.25**	18.56	19.83	0.388	2	**21.02**	20.55	21.48	0.658
LaZ	5	**13.92**	13.04	14.59	0.706	15	**12.98**	12.63	13.40	0.245	2	**14.98**	14.98	14.98	0.000
LaI	7	**4.29**	4.07	4.53	0.150	16	**4.23**	3.88	4.38	0.120	2	**4.39**	4.38	4.39	0.007
LaInf	7	**6.52**	6.19	6.74	0.181	16	**6.28**	5.82	6.54	0.203	1	6.75	–	–	–
LaN	7	**9.36**	9.04	9.64	0.223	16	**8.97**	8.64	9.34	0.198	2	**9.78**	9.74	9.82	0.057
LaM	7	**10.92**	10.53	11.53	0.386	16	**10.15**	9.23	10.61	0.329	2	**11.59**	11.48	11.69	0.149
ANc	7	**7.02**	6.63	7.17	0.181	16	**6.27**	5.85	6.74	0.236	2	**7.41**	7.14	7.67	0.375
LBT	4	**3.79**	3.62	4.03	0.183	15	**3.91**	3.68	4.13	0.148	–	–	–	–	–
CC	7	**6.55**	6.21	6.97	0.280	16	**6.29**	5.98	6.52	0.175	1	7.31	–	–	–
M^3M^3	7	**8.51**	7.88	8.92	0.331	16	**8.10**	7.63	8.32	0.168	1	9.02	–	–	–
CM^3	7	**7.76**	7.54	8.16	0.200	16	**7.48**	7.11	7.73	0.152	2	**8.50**	8.43	8.56	0.092
LMd	7	**15.30**	14.38	15.92	0.464	15	**14.39**	14.07	15.00	0.261	2	**16.75**	16.52	16.97	0.318
ACo	7	**5.78**	5.23	6.18	0.323	15	**5.17**	4.77	5.39	0.157	2	**6.38**	6.38	6.38	0.000
CM_3	7	**8.52**	8.15	8.91	0.225	15	**8.11**	7.69	8.36	0.188	2	**9.38**	9.37	9.38	0.007

hkahul cave, Dashkasan (Ardabil Prov.), 29 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ind. (BMNH 10.8.12.1 [S]), Foot of Elborz, N. side, Demavend, date unlisted, leg. G. Barrett-Hamilton; – 1 ind. (BMNH 63.1185 [S+A]), Guter-Su, N. of Mount Sabalan, 38° 10' N, 47° 40' E [Ardabil Prov.], 21 August 1961, leg. Aberystwyth University Expedition; – 1 ♀ (BMNH 77.840 [S+B]), 4 km S Noushar, on Caspian shore [Mazandaran Prov.], 12 May 1974, leg. E. Etemad; – 10 ♂♂ (NMP 90779–90786 [S+A], 90787, 90788 [A]), Rubat-e Sharaf caravanserai (Khorasan-e Razawi Prov.), 18 May 2006, leg. P. Benda & A. Reiter; – 1 ♂ (BMNH 77.841 [S+B]), Shehr Abad, 10 km N of Mashad [Khorasan-e Razawi Prov.], 21 August 1962, leg. E. Etemad; – 1 ♀ (BMNH 74.11.21.31 [S], holotype of *Vesperus Shiraziensis* Dobson, 1871), Shiraz [Fars Prov.], leg. W. I. Blanford; – 9 ♂♂ (NMP 90800–90806 [S+A], NMP 90807, 90808 [A]), Tahir Abad (Khorasan-e Razawi Prov.), 21 May 2006, leg. P. Benda & A. Reiter; – 1 ♀ (BMNH 25.10.4.10 [S+B]), Zarghun [Fars Prov.], 52° 44' E, 29° 45' N, 5150 ft, 2 July 1920, collector unlisted.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Eptesicus serotinus* are shown in Table 22. For the material examined see above.

E. serotinus was for a long time considered a polytypic species with a number of subspecies distributed throughout the temperate zone of Eurasia (see the review by Benda et al. 2006). Populations from the Middle East and the Caucasus region were assigned to 2–7 forms by various authors, viz. *E. s. serotinus* (Schreber, 1774), *E. s. isabellinus* (Temminck, 1840), *E. s. turcomanus* (Eversmann, 1840), *E. s. pachyomus* (Tomes, 1857), *E. s. mirza* (de-Filippi, 1863), *E. s. shiraziensis* (Dobson, 1871), and *E. s. intermedius* Ognev, 1927.

Gaisler (1970) was the first to analyse the populations of *E. serotinus* in almost its whole distribution range, including the Middle East. In this region he recognised two subspecies, based mainly on the pelage and skin colouration; *E. s. serotinus* (incl. *intermedius*) in Asia Minor, the Levant, and in the Caucasus region, but with the 'eastern limit unknown', extralimitally also in the European range; *E. s. turcomanus* (incl. *shiraziensis*) in 'whole Iran and, very likely, northern

Iraq' and extralimitally in Central Asia and northern Afghanistan. Besides these two forms, Gaisler (1970) distinguished 5–6 additional subspecies of *E. serotinus* in the rest of its range.

DeBlase (1980) mostly accepted Gaisler's (1970) opinion but regarded the form *shiraziensis* as a separate subspecies, being much larger than *E. s. turcomanus*, however, of a similar but not identical colouration. Moreover, he pointed out that only two specimens of *E. s. shiraziensis* were known, as the other Gaisler's individuals of '*shiraziensis*' were in fact *E. anatolicus* (see below). According to DeBlase (1980), three forms occur in Iran, the medium-sized dark-brown coloured *E. s. serotinus* in the Talysh and Elborz Mts. (type locality: France; Miller 1912: 226), the small-sized pale coloured *E. s. turcomanus* in the north-eastern part of the country (type locality: meždu Aral'skim i Kaspijskim morâmi [between the Aral and Caspian Seas, Uzbekistan/Kazakhstan]; Ognev 1928: 537; Čelkar, Aktûbinskaâ obl., Kazahstan [= Shalkar, Aqtöbe Prov., Kazakhstan]; Pavlinov & Rossolimo 1987: 44), and the large-sized pale coloured *E. s. shiraziensis* at two sites of the Fars province, southern Zagros Mts. (type locality: near Shiraz, 4750 feet [Fars, Iran]; Dobson 1871: 459). Spitzenberger (1994) distinguished two morphotypes of *E. serotinus* in two separate ranges in the north-western part of the Middle East (Turkey); the nominotypical form occurring in northern Anatolia, where its western part of distribution in the Balkans is connected with the eastern part in the Caucasus and northern Iran, and a population distinct in large size and pale colouration, similar in size to *E. s. shiraziensis*, in southern Anatolia (she did not name this form). These opinions indicated altogether up to five morphotypes to be present in the Middle East; (1) the small-sized form with pale coloured pelage, face, and wings that inhabits the north-eastern part of the region and continues in distribution to West Turkestan, identified as *E. s. turcomanus*; (2) the medium-sized form with rather dark-brown coloured pelage and dark brown

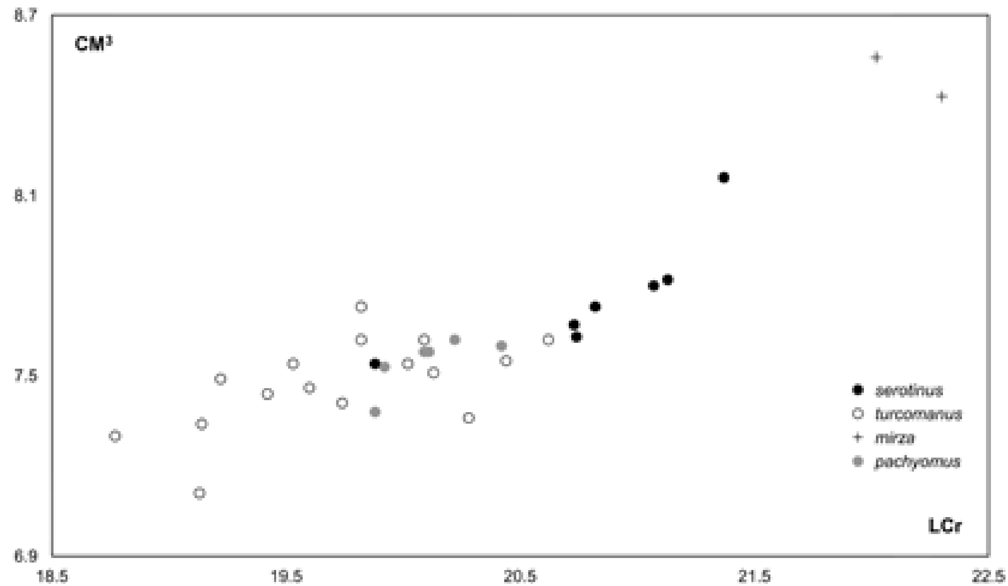


Fig. 117. Bivariate plot of the examined Iranian samples of *Eptesicus serotinus* (Schreber, 1774) and *E. pachyomus* (Tomes, 1857): greatest length of skull (LCr) against the length of upper tooth-row (CM^3). Particular symbols denote affiliation to the particular morphotype/taxon.

to blackish naked parts that occurs in the northern part of the Middle East and in the Caucasus region, co-identified with *E. s. serotinus* of Europe; (3) the dark-coloured form reported from the Levant that was also assigned to the nominotypical subspecies (see also Benda et al. 2006); (4) the large-sized form with pale pelage and pale coloured naked parts occurring in south-western Iran including the type locality of *E. s. shiraziensis*, to which the form was assigned (DeBlase 1980); and (5) the large-sized form with pale fur but with blackish naked parts living in south-western Anatolia (a not formally described taxon, see Spitzenberger 1994). Three of these forms were reported from the territory of Iran.

Benda et al. (2006) performed a detailed morphological and morphometric revision of the *E. serotinus* complex in the western Palaearctic, based on analyses of external and skull dimensions and colouration characters of more than 260 specimens. Although the respective populations broadly overlap in their characters throughout the range, the authors suggested to split the populations of the species inhabiting the Middle East into three taxa and provided their tentative names; (1) *E. s. serotinus*: medium-sized form, skull with a relatively long and medium-wide rostrum, with pale brown to dark-brown coloured pelage and dark brown to black naked parts, distributed in the northern parts of the Middle East from Pontus to the Kopetdagh Mts. (also in Europe and the Caucasus); (2) *E. s. turcomanus*: small-sized form, skull relatively narrow with a relatively short rostrum, with buffy to beige coloured pelage and pale brown naked parts, distributed in West Turkestan, with extensions to the easternmost parts of Europe, north-eastern Iran, northern Afghanistan, western East Turkestan, and southern Mongolia; and (3) *E. s. shiraziensis*: large- to very large-sized form, skull with a relatively long rostrum, beige to pale-brown coloured pelage, pale brown to black naked parts, distributed in the southern parts of the Near East, from south--western Anatolia and the Levant to south-western Iran. (They recognised also one extralimital form concerning the Middle East, *E. s. isabellinus*, distributed from the Canary Islands and western Morocco to Tripolitania, Libya.) According to the distribution descriptions given, the allopatric ranges of all three Middle Eastern forms were found in the territory of Iran.

After publication of the revision by Benda et al. (2006), several papers appeared that suggested separate species positions of the forms that had been included into the rank of *E. serotinus*, namely *isabellinus* and *turcomanus*, based on analyses of mitochondrial DNA markers (Ibáñez et al. 2006, Mayer et al. 2007, García-Mudarra et al. 2009, Juste et al. 2010); therefore, Benda et al. (2011c) listed the latter form as a full species. However, the most recent revision of the west-Palaearctic *Eptesicus* bats by Juste et al. (in press) that combined results of analyses of both nuclear and mitochondrial markers, confirmed the species status only for *E. isabellinus* from North Africa and southern Iberia and also for *E. pachyomus* from the Oriental region (from southern Iran to China, see below), considering the former rank of *E. serotinus* s.l. The form *turcomanus*, well defined in its morphological traits (size, colouration, skull shape; see above and also Table 22 for comparison of dimensions of both morphotypes from Iran), has been shown to be a part of the nominotypical form of *E. serotinus*. Concerning the genetic traits, no sign of clustering of haplotypes according to the *serotinus* and *turcomanus* morphotypes were found and similar results were presented also by Artyushin et al. (2012a). Therefore, the *turcomanus* morphotype is here treated as an ecological and geographical morph of the subspecies *E. s. serotinus*. On the other hand, the third morphotype reported from Iran by DeBlase (1980) and Benda et al. (2006) and named *E. s. shiraziensis*, was confirmed as a subspecies in an almost identical geographical extent as suggested by Benda et al. (2006), covering south-western Anatolia, Levant incl. Cyprus, and also the Van region of eastern Turkey (the samples from Iran were not available for genetic sampling). Since eastern Turkey is adjacent to the north-western part of Iran, from where also the description of the name *Vespertilio mirza* De-Filippi, 1863 is available (type locality: Zendgian ed Kazwin [= Zanjan and Qazvin, Iran]; De-Filippi 1863: 378), Juste et al. (in press) named this well substantiated form *E. s. mirza*. However, also a sample of true *E. s. serotinus* (sensu Juste et al. in press), the *serotinus* morphotype, is available from north-western Iran, from the Dashkahul cave (Ardabil). Therefore, a possibility still remains that the name *mirza* is a junior synonym of *serotinus* (cf. DeBlase 1980) and not a senior synonym of *shiraziensis* (cf. Juste et al. in press). To be able to answer this question responsibly, the topotype material of both names needs to be examined by molecular genetic methods.

In summary, two separate subspecies in three distinct morphotypes of *E. serotinus* live in Iran. The nominotypical subspecies in a belt along the northern border of the country, represented with the *serotinus* morphotype in the western part of this belt (Ardabil, Gilan, Mazandaran, Golestan) and the *turcomanus* morphotype in the eastern part of the belt (Khorasan); the subspecies *E. s. mirza* lives presumably in the areas southwards of the Talysh and Alborz Mts. to the southern Zagros Mts. The skull size relations among the respective morphotypes in the Iranian specimens of the *E. serotinus* complex (including *E. pachyomus*) are presented in Fig. 117.

Echolocation. *Eptesicus serotinus* has long (up to 23 ms) frequency-modulated calls with a quasi-constant-frequency pattern at the end of the call. The interpulse intervals are usually long (up to ca. 290 ms), the frequency of maximum energy obtained from European populations falls to the range between 24–40 kHz (Vaughan et al. 1997, Jensen & Miller 1999, Russo & Jones 2002, Obrist et al. 2004, Preatoni et al. 2005, Papadatou et al. 2008, etc.). We measured parameters of one echolocation sequence of *E. serotinus* in Iran, from a bat flying near the entrance of the Dashkahul cave (Fig. 118). Basic values of echolocation characteristics are given in Table 3; these values fall to the respective ranges obtained from the European populations. No other data on echolocation of *E. serotinus* are available from the Asian part of the species range.

Feeding ecology. *Eptesicus serotinus* is a larger bat that hunts its prey in a slow flight mainly in open spaces, but some prey is probably picked up from surfaces or hunted from a perch (Norberg & Rayner 1987, Catto et al. 1996, Baagøe 2001c). In Europe, *E. serotinus* was found to feed mostly

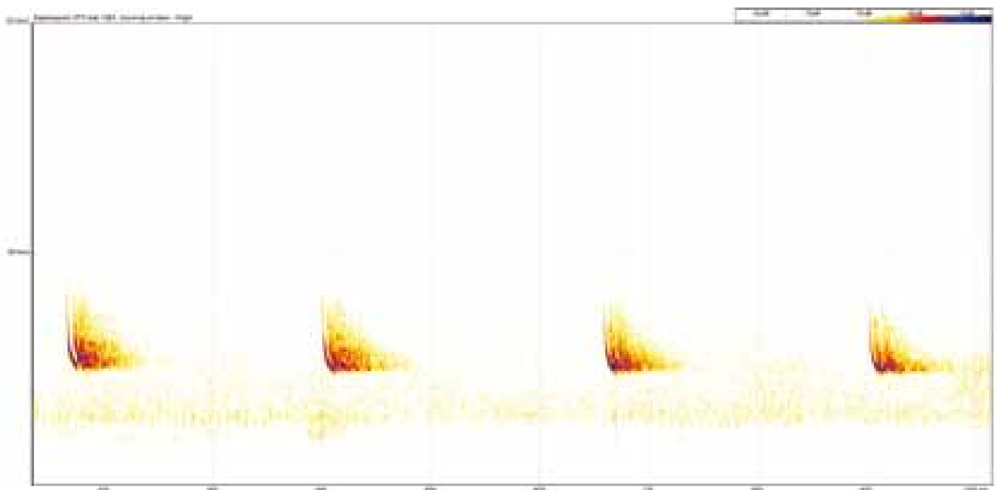


Fig. 118. Spectrogram of echolocation calls of *Eptesicus serotinus* (Schreber, 1774); an individual foraging near the Dashkasan cave (Ardabil).

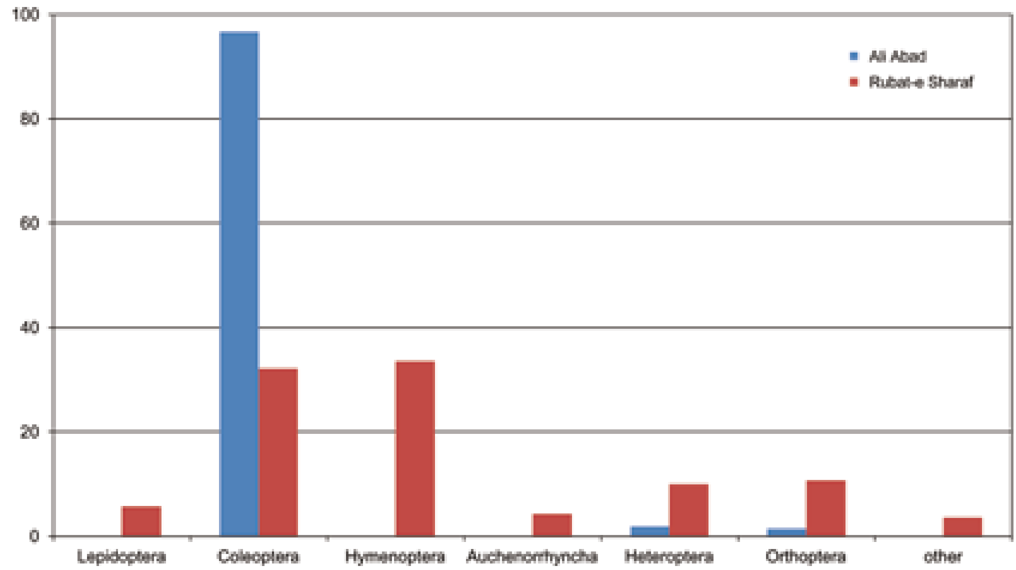


Fig. 119. Percentage volume of particular food items in the diet of *Eptesicus serotinus* (Schreber, 1774) in Iran. Material analysed: Ali Abad [*serotinus* morphotype] (21 faecal pellets from three bats), Rubat-e Sharaf caravanserai [*turcomanus* morphotype] (30 pellets from nine bats).

on Coleoptera, nematoceran Diptera and Lepidoptera (Catto et al. 1994, Beck 1995, Gajdošík & Gaisler 2004, Baagøe 2001c).

In the Middle East, the diet composition of *E. serotinus* was studied relatively widely. The majority of scarabaeid beetles and also a large proportion of gryllid orthopterans and a small proportion of Araneae were documented in the diet of this bat in Turkey (Whitaker & Karataş 2009). Mostly Coleoptera, Lepidoptera and brachyceran Diptera were recorded in Azerbaijan (Rahmatulina 2005). Scarabaeid beetles as the most important diet item complemented by Heteroptera was found in Syria (Benda et al. 2006). Samples from Cyprus, Crete and Lebanon contained an overwhelming majority of beetles (own unpubl. data).

From Iran, we analysed diet material of *E. serotinus* collected from two sites, altogether 51 faecal pellets from twelve bats (Fig. 119). Faeces from three bats of the *serotinus* morphotype collected at Ali Abad (Golestan) contained mainly Coleoptera, especially Scarabaeidae, but Carabidae were also recorded; other food items were Heteroptera and Ortoptera. The diet of nine bats of the *turcomanus* morphotype collected in the Rubat-e Sharaf caravanserai (Khorasan) was dominated by ants (Formicoidea) and beetles (mainly Scarabaeidae, much less Carabidae and Elateridae); Heteroptera belonged to family Tingidae. Our data correspond well with the results of previous studies and also indicate a higher importance of ants in the diet of *E. serotinus* in more arid habitats.

Eptesicus pachyomus (Tomes, 1857)

Records. **Original data**: H o r m o z g â n: Chahâr Dahaneh [1], 12 km ENE Dehbârez, above a pool, 17 April 2000: net. 1 fG (NMP 48436; cf. Benda et al. 2006 [as *E. serotinus*]); – Isin [2], 15 km N of Bandar Abbâs, 30 April 1977: net. 1 ma (NMP 48466), 2 May 1977: net. 2 ma, 2 fa (NMP 48467–48470; cf. Benda et al. 2006 [as *E. serotinus*]).

Distribution. *Eptesicus pachyomus* is a very rare bat species in Iran, only two sites of records are available from the southern part of the country, the Hormozgan province (Fig. 113). This bat, whose separate species position has been suggested very recently (Juste et al. in press), is an Oriental biogeographical element within the Iranian fauna. It occurs in the north of the Indian subcontinent and in south-eastern Asia from northern Indochina to Korea and Japan (Corbet & Hill 1992, Bates & Harrison 1997). The rather surprising evidence of *E. pachyomus* in Hormozgan represents the first record of this species in Iran and the western Palaearctic as well, and also proves a prolongation of the species distribution range by some 1500 km to the south-west from the southern slopes of the Hindu Kush range in eastern Afghanistan and northern Pakistan. The record localities lie in one of the most arid parts of Iran, which continues in the east to Baluchestan (both of Iran and Pakistan); where other records of *E. pachyomus* can be expected, filling the gap between the known occurrence spots in Iran and Afghanistan/Pakistan.

Field notes. Only foraging individuals of *Eptesicus pachyomus* were recorded in Iran. An adult female of *E. pachyomus* was netted above a pool in an artificial hole in a river bed next to a small village of Chahar Dahaneh near Dehbarez (Hormozgan) on 17 April 2000. This small pool in a tributary of the Rudan river served as a reservoir of water for the village and although in the middle of the river bed a very small stream of permanent water was still running, the pool represented the only quiet surface of water, suitable for bats to drink. The river valley is surrounded by almost sterile rocky deserts without any significant traces of vegetation. Besides *E. pachyomus*, individuals of *Rhyneptesicus nasutus* and *Otonycteris hemprichii* were also netted at this site.

Five individuals of *E. pachyomus*, three males and two females, were netted at Isin near Bandar Abbas (Hormozgan) on 30 April and 2 May 1977. The landscape surrounding Isin is very similar to that around Dehbarez, being only one hundred kilometres away; Isin is a palm oasis surrounded by arid rocky steppe-desert with very sparse vegetation. Along with *E. pachyomus*, also *Rousettus aegyptiacus* and *Myotis emarginatus* were recorded at Isin.

Figs. 120, 121. *Eptesicus pachyomus* (Tomes, 1857) from Chahar Dahaneh (Hormozgan) (NMP 48436). Photo by A. Reiter.

Despite the small number of records, a direct evidence of reproduction of *E. pachyomus* is available from Iran; the female collected at Chahar Dahaneh on 17 April contained two foeti of the crown-rump length of 26.0 mm and two females collected on 2 May were lactating. Gaisler (1970: 35) reported 35 females of *E. pachyomus* collected in Jalalabad, Afghanistan (as *E. serotinus pashtonus*), in the period 8–26 April, "all showing initial stages of pregnancy". These data suggest the parturition terms in the westernmost populations of the species distribution range to occur in the second half of April to first half of May.

Material examined. 1 ♀ (NMP 48436 [S+A]), Chahar Dahaneh (Hormozgan Prov.), 17 April 2000, leg. P. Benda & A. Reiter; – 1 ♂ (NMP 48466 [S+A]), Isin (Hormozgan Prov.), 30 April 1977, leg. B. Pražan; – 2 ♂♂, 2 ♀♀ (NMP 48467–48470 [S+A]), Isin (Hormozgan Prov.), 2 May 1977, leg. B. Pražan.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Eptesicus pachyomus* are shown in Table 21. For the material examined see above. *E. pachyomus* is most typical by its colouration (Figs. 120, 121); the dorsal pelage is dark greyish-brown with very pale hair tips (i.e. of similar appearance as in *Vespertilio murinus*, *Eptesicus nilssonii* and/or *Barbastella barbastellus*), ears are pale brown and face is brown. In body and skull dimensions, *E. pachyomus* is similar to *E. serotinus* (see Tables 21, 22, and Fig. 117).

E. pachyomus has been recognised as a full species separated from the species rank of *E. serotinus* only recently (Juste et al. in press), its geographic variation could be only estimated from the former opinions concerning *E. serotinus* sensu lato (see above). Within the distribution range of the newly elevated species (see Distribution), Corbet (1978), Koopman (1994), and Simmons (2005) agree in enumeration of five subspecies; viz. *E. p. pachyomus* (Tomes, 1857) in Pakistan and north-western India, *E. p. andersoni* (Dobson, 1871) in southern mainland China, *E. p. pallens* Miller, 1911 in Korea and northern China, *E. p. horikawai* Kishida, 1924 in Taiwan, and *E. p. pashtonus* Gaisler, 1970 in eastern Afghanistan. The revision by Juste et al. (in press) validated three of them as relevant taxa within the species, *pachyomus*, *anderseni* and *pallens*, while samples of the others (*horikawai* and *pashtonus*) were not included in the analysis.

However, the dimensions of the Iranian samples of *E. pachyomus* (Table 21) as well as their colouration (Figs. 120, 121) clearly indicate the nominotypical form to inhabit southern Iran (type locality: India; Tomes 1857: 51; Rajputana [= Rajasthan, India]; Wroughton 1918: 585). The forearm length (LAt) and skull dimensions of the Iranian bats correspond with those given for the subspecies *E.* (*serotinus*) *pachyomus* from Kashmir by Gaisler (1970) and Chakraborty (1983) and from India and Pakistan by Bates & Harrison (1997); only one of the LAt values given by Chakraborty (1983) markedly exceeds those in Iranian bats (58.0 mm). Tomes (1857: 51) described the pelage colouration of the type of *Scotophilus pachyomus* (= *E. pachyomus*) from Rajasthan, India as follows: "The fur is markedly and singularly bicoloured, very much resembling that of *S. discolor* [= *Vespertilio murinus*]. That of the upper parts is of a dark brown, conspicuously tipped with whitish brown. Beneath, it is brown at its base, with the terminal half yellowish brown." A similar description was given by Chakraborty (1983: 34) for the Kashmiri specimens of *E. pachyomus*: "Dorsum seal brown with pale tips to hairs, venter broccoli brown." Both descriptions conform to the appearance of the Iranian representatives (Fig. 121).

Echolocation. No data on echolocation of *Eptesicus pachyomus* are available.

Feeding ecology. *Eptesicus pachyomus* is a medium- to large-sized bat, perhaps foraging in a similar way as *E. serotinus* (cf. Bates & Harrison 1997). No data concerning feeding ecology of this species are available.

From Iran, we analysed the content of a digestive tract from one specimen collected at Chahar Dahaneh (Hormozgan). It contained medium-sized Carabidae (40% of volume), Curculionidae

(20%), Heteroptera (20%) and Blattodea (20%). The large proportion of beetles complemented by Heteroptera resembles the diet of *E. serotinus* from other parts of the Middle East (e.g. Benda et al. 2006).

Eptesicus nilssonii (Keyserling et Blasius, 1839)

Records. **Original data**: M â z a n d a r a n: alpine meadow 3 km E of Ilka [1], 34 km W of Baladeh, at a small lake, 2920 m a. s. l., 31 May 2006: det. & obs. 1 foraging ind. of *E.* cf. *nilssonii*. – **Published data**: M â z a n d a r a n: Sama [2], over a grassy bluff near a stream, 17 August 1962: net. 1 ma, FMNH (Lay 1967, DeBlase 1980).

Distribution. *Eptesicus nilssonii* is a very rare bat species in Iran, only two sites of records are known from the northern part of the country (Fig. 103). Lay (1967) reported a netting of a single individual at a stream on the northern slope of the Alborz Mts. in Mazandaran at ca. 1100 m a. s. l. (and observation of another possible individual in a roost, see below). This record represents the only yet known specimen of this species from Iran. Another bat was recorded near the top of the Alborz range at 2920 m a. s. l., where a foraging idividual was observed and its calls were detected.

The Iranian extension of the distribution range of *E. nilssonii* is the southernmost spot of the species occurrence (Hanák & Horáček 1986, Strelkov 1986). (The more southward lying record from Baghdad reported by Hatt 1959 was rejected by a revision of the respective specimen by Harrison

Fig. 122. Lakes in an alpine meadow at Ilka (Mazandaran), a foraging habitat of *Eptesicus* cf. *nilssonii* and *Tadarida teniotis*. Photo by A. Reiter.

1972: 627.) The distribution in the Iranian Alborz Mts. continues in Transcaucasia, where at least two records are available (Buhnikašvili et al. 2004, Rahmatulina 2005, see also Benda & Reiter 2006). The record of *E. nilssonii* in the Lənkəran area of Azerbaijan (Satunin 1910) represents the closest locality to those in the central Alborz Mts. in Iran (ca. 450 km apart), suggesting possible occurrence of the species in the Iranian part of the Talysh Mts. (cf. DeBlase 1980).

Field notes. Both records of *Eptesicus nilssonii* from Iran represent foraging bats. The record from Sama (Mazandaran), an adult male caught on 17 August 1962, was described by Lay (1967: 145–146) by the following words: "We netted it over a grassy bluff about 4 m. above the level of the mountain stream flowing beside it. A bat of similar appearance, which we failed to collect, roosted in the shelter formed by a fallen boulder at the base of a cliff in second growth forest about 3 km. upstream from where our specimen was caught. *Myotis* [cf.] *mystacinus* and *Eptesicus serotinus* were netted in this same place." The area of the record locality, lying at the altitude of ca. 1100 m a. s. l., were characterised by Lay (1967: 96–97) as follows: "The forest community, most extensive and characteristic of this area, occurs between 950 and 2440 m. Thick forest composed mainly of beech, *Fagus*; elm, *Ulmus*; and oak, *Quercus*, in that order of abundance, grew over the higher, less accessible, mountain reaches. […] Low plants, 10–15 cm. high, dead leaves, and occasional rotting logs formed the floor cover in this park-like forest. Ferns, mosses, blackberry vines, and grass grew luxuriantly along water courses through the forest. Thickets of beech saplings and blackberry vines bearing many ripe berries flourished in openings created by cutting of the forest to produce charcoal. Streamlets produced by springs have cut deep ravines in the sides of the mountains here. Springs that have not emitted enough water to produce streams have created bogs. Grass and herbaceous plants dominated and grew luxuriantly in these places, […]."

Another record was made at a small lake near the top of the Alborz Mts. at Ilka near Baladeh (Mazandaran) at 2920 m a. s. l. on 31 May 2006. A foraging individual was observed and its calls were recorded by a bat detector during and shortly after sunset. The identification was made by visual observation of the flying bat and mainly by elimination of other possible candidates with similar call characteristics recorded using the heterodyne mode of the detector. Along with one individual of *E.* cf. *nilssonii* also three *Tadarida teniotis* were observed in this way. The site represents a primary alpine meadow with two springs filling small lakes (Fig. 122) above which the bats foraged for a short time, since the temperature dropped very quickly after the sunset and the activity of insects finished soon.

Variation. We did not examine any museum material of *Eptesicus nilssonii* from Iran. The only available specimen was examined by DeBlase (1980), who reported it to be identical in colouration with a FMNH series of *E. nilssonii gobiensis* from Mongolia, and therefore, he assigned the specimen to *E. n. gobiensis* Bobrinskoj, 1926 (type locality: Burhastej-tala, (vost. okonečnost' Gobijskogo Altaâ) [south-western Mongolia]; Bobrinskij 1926: 96). However, the latter form was found by Strelkov (1986) to represent a separate species, *E. gobiensis*, distributed in the mountains of Turkestan (Tajikistan, Kirghizstan, East Turkestan), eastern Afghanistan, eastern Kazakhstan, Tuva, Mongolia, Tibet, and Kashmir (Strelkov 1986, Bates & Harrison 1997). In that case, the specimen from Iran thus represents the westernmost and completely isolated record situated more than 1500 km from the nearest site in western Tajikistan (Strelkov 1986).

On the other hand, the values of metric data on the respective Iranian specimen given by DeBlase (1980) conform rather to the dimensions of *E. nilssonii* s.str. than to those of *E. gobiensis*, according to the data given by Strelkov (1986), see Table 23. The identification of the specimen to the former species is supported also by biogeographical and ecological data; the Hyrcanian forests of northern Iran are a direct continuation of the Caucasian forest zone (see Distribution)

Table 23. Comparison of biometric data on *Eptesicus nilssonii* (Keyserling et Blasius, 1839) from Iran (after DeBlase 1980) with the data on *E. nilssonii* and *E. gobiensis* Bobrinskoj, 1926 (after Strelkov 1986). For abbreviations see p. 171

	Eptesicus nilssonii				*Eptesicus gobiensis*				Iran
	n	**M**	min	max	n	**M**	min	max	
LAt	24	**39.6**	37.5	41.0	33	**39.5**	38.5	43.0	37.7
LCr	21	**15.0**	14.0	15.4	14	**15.7**	15.1	16.4	15.9
LCb	21	**14.8**	14.1	15.4	17	**15.4**	15.0	16.0	15.5
LaZ	14	**9.4**	8.7	9.7	14	**10.2**	9.8	10.6	9.5
LaI	–	–	–	–	–	–	–	–	4.1
LaN	19	**7.6**	7.3	7.8	16	**7.9**	7.7	8.2	7.6
AN	14	**6.5**	6.2	6.7	11	**6.4**	6.2	6.7	–
CM^3	27	**5.3**	5.1	5.6	25	**5.6**	5.0	5.8	5.3
LMd	24	**10.7**	10.5	11.1	21	**11.2**	10.8	11.5	10.8
CM_3	26	**5.8**	5.6	6.1	21	**6.0**	5.6	6.4	5.7

and the bat was caught in a forest habitat, while *E. gobiensis* occurs in open areas of mountain plateaus (Strelkov 1986).

The intraspecific variation in *E. nissonii* s.str. is rather poorly known; most authors (Wallin 1969, Hanák & Horáček 1986, Yoshiyuki 1989, Koopman 1994, Horáček et al. 2000, Simmons 2005) suggested existence of the subspecies *E. n. parvus* Kishida, 1932 in the Far East (Sakhalin and Hokkaido islands, Russian Far East, northern Korea), while Rydell (1993a) and Tiunov (1997) regarded it as a monotypic taxon (in its current sense). Based on the molecular genetic comparison, Dolch et al. (2007) suggested to recognise only one taxon within the species rank of *E. nilssonii*, as the documented divergences did not exceed 2.4% of distance in sequences of the mitochondrial gene ND1 among samples from Europe, Mongolia and Japan (similar results were reported also by Meyer et al. 2007).

Anyway, the Caucasian populations (to which the Iranian part of the range should belong) have been assigned solely to the nominotypical form, *E. n. nilssonii* (Keyserling et Blasius, 1839) living in the forest zones of Eurasia from Central Europe and Scandinavia to the Caucasus and Siberia or even to the Far East (type locality: Torpe, Hallingdalen, Norway; Ryberg 1947: 89). On the other hand, the Caucasian range of *E. nilssonii* distribution represents a spot of occurrence isolated from the continuous Eurasian range of this bat, which could perhaps be phylogenetically separated from each other. However, such a hypothesis still needs to be tested.

Echolocation. *Eptesicus nilssonii* produces frequency-modulated calls with a quasi-constant-frequency final part. The frequencies of maximum energy were reported between 26–30 kHz from the European populations (Rydell 1993a, b, Obrist et al. 2004, Dietz et al. 2009) and slightly higher (28–31 kHz) from the populations of the easternmost part of the species range (Hokkaido, Japan; Fukui et al. 2004). In northern Iran at the elevation of almost 3000 m, using a heterodyne bat-detector we recorded echolocation calls, which according to their frequencies at ca. 30 kHz and the foraging habitat (alpine meadow) were attributed to this species. No further data on echolocation parameters of *E. nilssonii* are available from the Middle East.

Feeding ecology. *Eptesicus nilssonii* is a medium-sized bat hunting its prey in a rapid and agile flight, along vegetation edges, in open areas, and at streetlamps (Rydell 1986, Gerell & Rydell 2001). Nematoceran Diptera usually prevail in its diet, complemented by beetles, moths and heteropterans (Rydell 1986, Gajdošík & Gaisler 2004). The diet of *E. nilssonii* in Iran has not yet been studied.

Eptesicus bobrinskoi Kuzâkin, 1935

Records. **Original data**: A r d a b i l: Qutur Su, 17 km SE of Meshginshahr, sulphuric caves, 5 June 2006: carcasses of 1 ma, 1 fs, 1 ind. (NMP 90890–90892; cf. Benda & Reiter 2006) found in the cave. – **Published data**: A r d a b i l: Guter--Su, Sulphur Caves, north of Mt. Sabalan, 21 August 1961: 4 m, 3 f, BMNH (Harrison 1963, Hill & Harrison 1987).

Distribution. *Eptesicus bobrinskoi* is one of rarest bat species in Iran, only one site of occurrence has been recorded from the country so far (Fig. 111). At two occasions (1961, 2006), semi--mummified carcasses of altogether 10 individuals were collected from the sulphuric caves on the northern slope of Mount Sabalan near the thermal spa resort of Qutur Su (Benda & Reiter 2006). These caves act as a natural trap for many insects and small vertebrates (along with at least seven species of bats, also insectivores, small rodents, and birds were found dead in the cave); *E. bobrinskoi* was thus recorded in Iran solely with the help of this "trap".

The Iranian locality lies completely out of the regular range of the species, both geographically and ecologically. *E. bobrinskoi* occurs in the Karakum desert and steppes of Kazakhstan, in the belt stretching from the eastern and north-eastern shores of the Caspian Sea to central Kazakhstan (Butovskij et al. 1985), its type locality is the Tûlek wells in the Aral Karakum desert, 65 km east of Aralsk, Kazakhstan (kolodec Tûlek v Aral'skih Kara-Kumah (v 65 km k Vostoku ot g. Aral'skoe more); Kuzâkin 1935: 435). The Iranian caves lie ca. 1800 km south-west (or ca. 1300 km of aerial distance, over the Caspian Sea) of the closest locality of the more or less continuous range in West Turkestan. The site of the records in Iran (at the cave entrances) is localised at the altitude of 2585 m a. s. l., surrounded by alpine meadows (Figs. 123, 124; see also Benda & Reiter 2006:

Fig. 123. The northern slope of Mount Sabalan, area of the famous locality of Qutur Su (for details see text). Photo by A. Reiter.

26, Figs. 1, 2), while the regular Turkestani range stretches over the lowland Karakum deserts at the altitudes below 200 m a. s. l. Perhaps only the supposed continental climate of both these parts of the range, the Karakum desert vs. the alpine location on Mt. Sabalan, could be found as a similarity between the two types of habitats, which otherwise differ completely in their environmental characteristics. The Iranian occurrence thus represents the largest biogeographic enigma within the Iranian bat fauna (see also discussion by Benda & Reiter 2006).

Field notes. As stressed above, the only evidence of the species in Iran is available from the sulphuric caves at Qutur Su situated in the montane zone of alpine meadows of Mount Sabalan. *E. bobrinskoi* was recorded there for the first time in August 1961 (Harrison 1963), when seven mummified individuals were found along with 15 specimens of five other bat species (Table 24). Other three dead individuals were found in these caves in June 2006, along with one specimen of *P. macrobullaris*.

Fig. 124. Position of the entrance to sulphuric caves at Qutur Su (Ardabil). Photo by M. Andreas.

Fig. 125. Small mammals and birds found on the bottom in one of the sulphuric caves at Qutur Su (Ardabil) during the visit on 29 September 2011. All these animals were killed and mummified by the sulphur fumes in the cave. Photo by A. Reiter.

This site represents an unusually positioned and acting trap for the animal life living in the Sabalan mountains (Figs. 123, 124). Benda & Reiter (2006: 25) described the site as follows: "The site is situated on the northern slope of the main peak of the Sabalan Range which rises to the altitude of 4811 m from the flat steppe plateau of about 1100 m a. s. l. The village and mines lie in the zone of alpine meadows at the altitude of about 2500 m […]. In these small artificial rocky caverns, which act as a natural trap being filled by an unbreathable atmosphere, the bat cadavers were found under smaller stones covering the mine floor."

During a subsequent visit of this site in September 2011, no specimen of *E. bobrinskoi* was found, however, there were four bats (two *Myotis schaubi*, one *M. emarginatus*, and one *M. mystacinus*), six carcasses of small mammals, 53 dead small birds (Fig. 125), and countless

Table 24. Review of bat records in the sulphuric caves at Qutur Su (Ardabil); based on the data by Harrison (1963), Sheikh-Jabbâri (2008) and own data

species	1961	2006	2010	2011
Myotis blythii	1	–	–	–
Myotis schaubi	2	–	–	2
Myotis emarginatus	–	–	–	1
Myotis mystacinus morpho-group	3	–	1	1
Eptesicus serotinus	1	1	–	–
Eptesicus bobrinskoi	7	3	–	–
Plecotus macrobullaris	3	1	–	–
total	17	4	1	4

dead insects in a huge heap on the cave floor along a line of the entrance zone. While the birds and insects were freely lying on the floor, mammals including bats were hidden behind or under stones covering the floor, namely along the walls. It suggests that the mammals were affected by the sulphuric fumes less acutely than the other animals found and they tried to escape to some shelter like under stones.

Material examined. 4 ♂♂, 3 ♀♀ (BMNH 63.1184, 63.1186, 63.1189, 63.1190 [S], 63.1188, 63.1189, 63.1192 [Sf]), Guter--Su, N. of Mount Sabalan, 38° 10' N, 47° 40' E [Ardabil Prov.], 21 August 1961, leg. Aberystwyth University Expedition; – 1 ♂, 1 ♀, 1 ind. (NMP 90890–90892 [S+A]), Qutur Su (Ardabil Prov.), 5 June 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Eptesicus bobrinskoi* are shown in Table 21. For the material examined see above. Benda & Reiter (2006: 30) presented additional metric data on these bats.

The first record of *E. bobrinskoi* in the Middle East (and outside Kazakhstan, see the review by Benda & Reiter 2006) was published by Harrison (1963) from Guter-Su [Qutur Su], north-western Iran (see Records and Field notes). Harrison (1963) supported this species identification by his observation of the typical morphological characters of this bat according to Kuzâkin (1950), and also by a comparison with the collection material of *Eptesicus nilssonii* and *Rhyneptesicus nasutus*, both of which markedly differed from the Qutur Su specimens in body size and in all important cranial traits. Harrison's (1963) identification was supported also by results of the *Eptesicus* revision carried out by Hanák & Gaisler (1971). *E. bobrinskoi* was for a long time considered

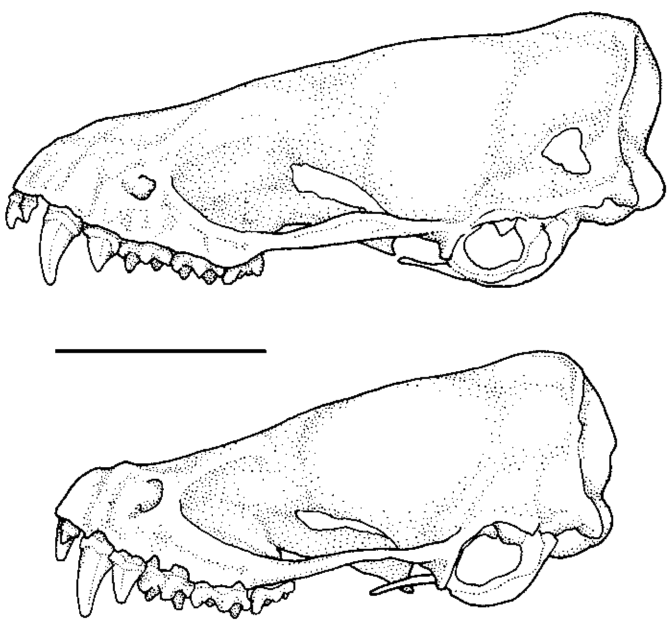


Fig. 126. Skulls of *Eptesicus bobrinskoi* Kuzâkin, 1935 and *Rhyneptesicus nasutus* (Dobson, 1877) from Iran (after Benda & Reiter 2006); a – *E. bobrinskoi*, NMP 90890, Qutur Su (Ardabil); b – *R. nasutus*, NMP 48404, Pir Sohrab (Baluchestan). Scale bar – 5 mm.

to be a part of the Iranian fauna (Lay 1967, Etemad 1969, Hanák & Gaisler 1971, Corbet 1978, DeBlase 1980, Butovskij et al. 1985, Sharifi et al. 2000, etc.).

Hanák & Horáček (1986) examined the BMNH series of the Qutur Su skulls and concluded: "(a) Alle untersuchten Stücke einschließlich der größten (Nr. 63 1189) sind diesjährige Jungen mit auffallend niedrigeren Werten der Schädelbreite, mit einer unvollendeten Ossifikation der Terminalränder des Processus coronoideus und mit einer unvollendeten Eruption der Zähne, u. ä. (b) Die metrischen Werte und Proportionen des Rostrums, welche eher der Art *E. bobrinskoi* entsprechen, sind aus den oben angeführten Gründen wenig nachweisbar; nach wichtigsten anderen Merkmalen (Anwesenheit der Foramina cavernosa, Fellfärbung) entspricht das Material vielmehr der Art *E. nilssoni*. (c) Aus den angeführten Tatsachen ergibt sich, daß dieses Material offensichtlich juvenile Stücke der zentralasiatischen Population *E. nilssoni* darstelt. […] (d) Die angeführte Interpretation des Fundes aus Guter-Su steht im Einklang mit der bisherigen Ansicht über die zoogeographischen Bewertung von *E. bobrinskoi*." According to this revision, *E. bobrinskoi* has been no longer regarded as a member of the bat fauna of Iran (although not absolutely), and the Harrison's (1963) record has been considered to belong to *E. nilssonii gobiensis* Bobrinskoj, 1926 (Koopman 1993, 1994, Borisenko & Pavlinov 1995, Horáček et al. 2000, Simmons 2005, cf. Rybin et al. 1989, Rydell 1993a, Benda & Horáček 1998, Albayrak 2003).

Benda & Reiter (2006) reported on the second finding of these bats at Qutur Su (see Records and Field notes) and used this opportunity to re-examine the BMNH specimens reported by Harrison (1963) along with the newly collected bats. They compared the series of altogether ten Qutur Su specimens with representative sample sets of similar taxa from the western Palaearctic (*E. bobrinskoi*, *E. nilssonii*, *E. gobiensis*, and *R. nasutus*). Their morphometric comparison showed the Qutur Su bats to be very similar in their body and skull size and skull characters to the samples of *E. bobrinskoi* from central Kazakhstan, and clearly distinguished them from all other comparative samples of *Eptesicus* bats from the western Palaearctic. Benda & Reiter (2006: 35–36) recorded: "Besides the distinctions in [body and skull] dimensions […], the particulars in the shapes of braincase and rostrum in the Qutur Su bats and *E. bobrinskoi* (an extremely low braincase, a distinct areal ratio between frontal and parietal parts of the braincase, a relatively small external auditory orifice, flattened frontal bones, narrow zygomatic arches, relative slender teeth, a flattened facial part of the skull, a relatively very narrow mesial part of the rostrum, shapes of supraorbital ridges, shapes of orbital processes of the zygomata) clearly differ from other compared bats. *E.* [= *Rhyneptesicus*] *nasutus* is most distinct, in comparison with the previous morphotype it has relatively much wider zygomatic arches but a much narrower braincase with smaller frontal and larger parietal bones, much narrower zygomata, a more massive lambda, more massive teeth (and of course, a unicuspidal first upper incisor) and a very short and high anteorbital part of the rostrum with distinct supracanine swellings. […] The skulls of two very similar morphotypes, *E. nilssonii* and *E. gobiensis*, differ from the Qutur Su bats and *E. bobrinskoi* mainly in the relatively and absolutely much higher braincase and rostrum, distinct frontal concavities, a relatively large external auditory orifice, relatively wider mesial parts of the rostrum, more developed orbital processes of the zygomata and more massive teeth […]." (see also Fig. 126). The bacula of the Qutur Su bats corresponded in their shape and size to the baculum of *E. bobrinskoi* from central Kazakhstan (Strelkov 1986, 1989) and these bacula resembled in their shape (but not in size) also those of *E. gobiensis* (Strelkov 1986, 1989). On the other hand, the bacula of *E. nilssonii* and *R. nasutus* completely differed from those of the above taxa, both in their size and shape.

Concerning all these findings, Benda & Reiter (2006: 37) concluded: "It seems to be clear from the above gathered arguments that the series of the Qutur Su bats, both that published by Harrison (1963) and that newly collected by us, belong to the only morphotype. Moreover, this morphotype was found to be identical in many aspects with that of the samples of *E. bobrinskoi* from central

Kazakhstan. The original identification of the Qutur Su bats as *E. bobrinskoi* by Harrison (1963) appears to be proved as well as the occurrence of this species in the Middle East."*

The geographic variation in *E. bobrinskoi* is poorly documented, the species is traditionally considered a monotypic form. However, it cannot be excluded that the Iranian populations, on account of their geographical and ecological exclusivity (see Distribution), represent a distinct taxon.

Eptesicus anatolicus Felten, 1971

Records. **Original data**: F â r s: Bishapur [1], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April 2000: remnants of 2 inds. (2 right and 1 left mandibles) found in *Strix aluco* pellets (cf. Obuch 2011 [as *E. bottae*]); – Tâdovân [2], 44 km NW of Jahrom, Tâdovân cave, above a pool in wadi below the cave, 7 October 2011: net. 1 ma (NMP 93885; Fig. 128), det. & rec. calls of 1 ind. – K e r m â n: small cave 5 km NNE of Deh Bakri [3], 40 km W of Bam, 8 April 2000: net. 1 fa (NMP 48363; cf. Benda et al. 2006), remnants of 1 ind. (pair of mandibles) found in *Bubo bubo* pellets. – K e r m â n s h a h: Bisotun [4], 28 km E of Kermanshah, small cave, 8 October 1998: net. 1 ma (NMP 48153; cf. Benda et al. 2006); – Qasr-e Shirin [5], caravanserai ruins, 17 October 1998: coll. 1 fa (NMP 48193; cf. Benda et al. 2006). – L o r e s t a n: valley 4 km SE of Bavineh [6], 42 km WNW of Kuhdasht, above a river, 16 October 1998: net. 1 fs (NMP 48192; cf. Benda et al. 2006). – **Published data**: F â r s: 11 km NW Darab [7], 1 fs, USNM (DeBlase 1980 [as *E. bottae*]). – K h u z e s t â n: Mala-i-Mir [= Izeh] [8], 70 mi. N.E. of Ahwaz, 4,300', 10 April 1905: 1 f, BMNH (Thomas 1905 [as *Vespertilio* sp.], Cheesman 1921 [as *E. mirza*], Gaisler 1970 [as *E. serotinus*], DeBlase 1980 [as *E. bottae*], Benda et al. 2006); – near Telespid [9], Shulistan, 3,200', 13 June 1902: 1 f, BMNH (Thomas 1905 [as *Vespertilio* sp.], Cheesman 1921 [as *E. mirza*], Gaisler 1970 [as *E. serotinus*], DeBlase 1980 [as *E. bottae*], Benda et al. 2006). – K o h g i l u y e v a B o y e r A h m a d: Basht [10], Shulistan, alt. 4,000', 1 f, BMNH (Cheesman 1921 [as *E. mirza*], Gaisler 1970 [as *E. serotinus*], DeBlase 1980 [as *E. bottae*], Benda et al. 2006).

Distribution. *Eptesicus anatolicus* is a rather infrequent bat species in Iran, ten localities are known from the country (Fig. 127). It is an endemic of the Middle East and its Iranian range represents the easternmost and southernmost marginal area of the species distribution (see Benda et al. 2006). DeBlase (1980) reported four localities of this bat from three provinces of south-western Iran, the newly documented six records enlarged the known range in the country extensively; by ca. 500 km to the northwest and ca. 350 km to the east. The range of *E. anatolicus* in Iran now comprises a belt of mainly western and southern slopes of the Zagros Mts. in its whole extent from the Kermanshah to the Fars provinces; one additional record was made at the easternmost reach of this mountain chain on the southern margin of the basin of the Dasht-e Lut desert, at Deh Bakri in the Kerman province. The latter locality represents the easternmost documented point of the species occurrence.

With respect to its general distribution pattern (see Benda et al. 2006), *E. anatolicus* represents a rather Mediterranean element among its congeners of the *bottae* group (cf. Juste et al. in press) in Iran; the other two species are generally desert and semi-desert dwellers (see under *E. bottae* and *E. ognevi*). In the western part of the Middle East (Dodecanese, S Anatolia, Cyprus, W Levant), which also delineates the western margin of the distribution range of *E. anatolicus*, this bat is an exclusive inhabitant of the Mediterranean habitats (Benda & Horáček 1998, von Helversen 1998, Benda et al. 2006, 2007, Horáček et al. 2008). In the eastern part of the range,

* note added in proof: Based on molecular genetic and morphological data, Artyushin et al. (2012b) suggested to consider *Eptesicus bobrinskoi* s.str. from Kazakhstani lowland deserts a subspecies (and a junior synonym) of the larger montane form, *E. gobiensis* Bobrinskoj, 1926. In that case, the presence of *E. g. bobrinskoi* in mountains of north-western Iran is better understandable. Thus, a profound examination of the FMNH specimen of *E. nilssonii* from the Alborz Mts. (see above) and its comparisons with specimens of *E. nilssonii* s.str. from boreal habitats of the Palaearctic as well as with *E. gobiensis* (incl. *E. g. bobrinskoi*) from Kazakhstan are urgently needed. A possibility that the Qutur Su bats (referred to *E. bobrinskoi*) and the respective FMNH specimen (referred to *E. nilssonii*) belong to identical taxon (*E. gobiensis*) cannot be excluded (as well as that one of them or both these bats represent a completely distinct taxon). The same is true also for some specimens from Transcaucasia originally assigned to *E. nilssonii* s.l. (see also Artyushin et al. 2012b).

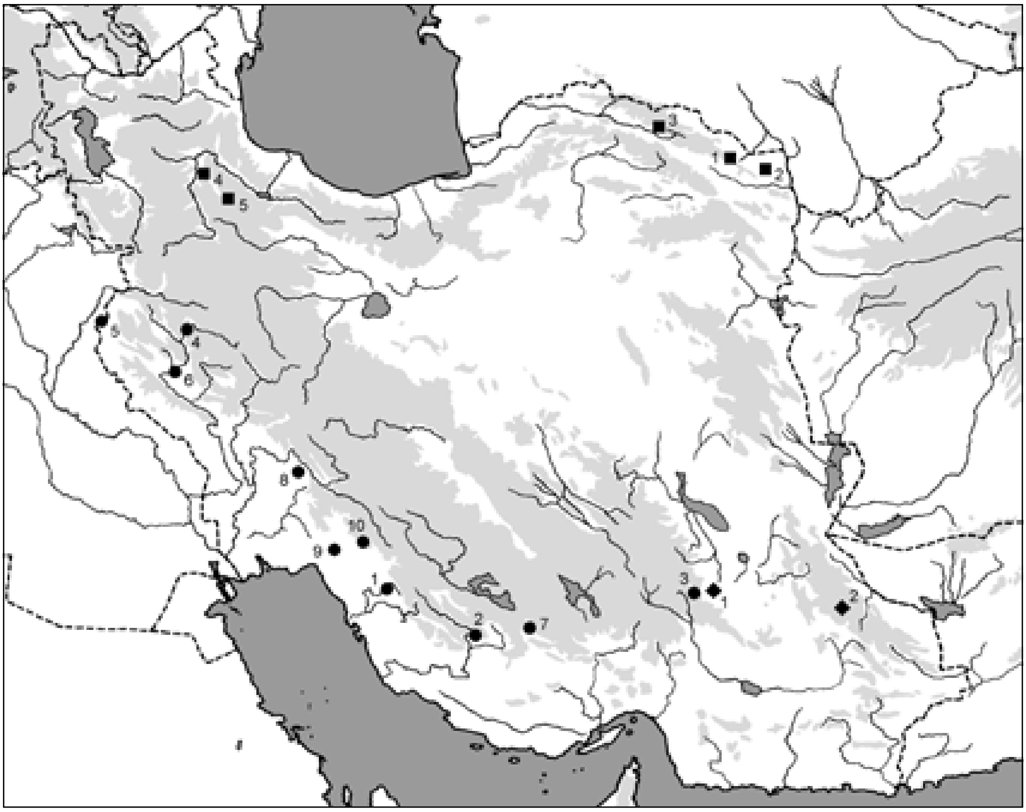


Fig. 127. Records of *Eptesicus anatolicus* Felten, 1971 (circles), *E. bottae* (Peters, 1869) (diamonds), and *E. ognevi* Bobrinskoj, 1918 (squares) in Iran.

i.e. in northern Iraq (cf. Harrison 1956a) and in Iran, this species occurs in localities lying in the areas below 1500 m a. s. l. (with an exception of the Deh Bakri record), with a rather semi-arid climate and vegetation.

FIELD NOTES. *Eptesicus anatolicus* was found in Iran mainly at its foraging grounds, only one record represents a finding in a roost. At two sites, remains of *E. anatolicus* were recorded in the osteological material from owl pellets.

A lethargic female was found during day in a fissure between bricks in a ceiling vault of a ruined caravanserai in the town centre of Qasr-e Shirin (Kermanshah) on 17 October 1998. The fissure was exposed to external climatic conditions except for rains and only slightly hidden from direct winds.

At two sites individuals of *E. anatolicus* were netted at cave entrances. These records could be considered as possible evidences at roosts, although in the latter case swarming behaviour cannot be excluded (considering the autumn date of the catch). An adult male of *E. anatolicus* was netted at the entrance to a small cave in the rocky massif above the Bisotun village (Kermanshah) on 8 October 1998; at this netting session, also *Rhinolophus ferrumequinum*, *Myotis* *capaccinii*, *Miniopterus pallidus*, and *Tadarida teniotis* were recorded. An adult female with no signs of pregnancy was caught in a net installed at the entrance to a small cave at Deh Bakri near Bam (Kerman) on 8 April 2000; the cave is situated in the shrubland mountain ridge above a wide valley in the easternmost extent of the Zagros Mts. (Fig. 129); at the same place, also *Rhinolophus ferrumequinum* and *Myotis blythii* were netted.

Cheesman (1921: 574) reported notes written by the collector on the labels attached to two BMNH specimens of *E. anatolicus*; these notes show the respective collections as records of foraging bats. A female was "shot flying about at sunset in rocky places with trees" at Basht (Koh-giluye va Boyer Ahmad), date was not specified. Another female was "shot among oak trees on hill-side" at Izeh (Khuzestan) at the altitude of 1310 m a. s. l. on 10 April 1905; on this label it was also noted "They hang up during the day in the old trees" (Cheesman 1921: 574). However, a question remains, if the latter note is based on direct field observation or only an assumption resulting from the observation of foraging bats among trees in the evening.

Foraging individuals of *E. anatolicus* were twice netted above water bodies. An adult male was captured into a net installed above a pool of still water of the mostly dried Qarah Agaj river, in the river bed below the entrace to the Tadovan cave at Tadovan near Jahrom (Fars) on 7 October 2011 (Figs. 43, 44). The canyon-like valley of the Qarah Agaj river at Tadovan lies in an arid country of dry steppes with sparse shrubs and trees. Besides bats of the cave community emerging from the Tadovan cave (see details under *Rhinopoma microphyllum*), calls of foraging *Tadarida teni-otis* were recorded at the site. A subadult female was netted above running water in the valley at

Fig. 128. Portrait of *Eptesicus anatolicus* Felten, 1971 from Tadovan (Fars). Photo by A. Reiter.

Fig. 129. Deh Bakri (Kerman), a foraging habitat of *Rhinolophus ferrumequinum*, *Myotis blythii*, and *Eptesicus anatolicus*. Photo by A. Reiter.

Bavineh near Kuhdasht (Lorestan) on 16 October 1998; the site is covered by a sparse oak forest extensively used as a pasture.

No data on reproduction of *E. anatolicus* are available from Iran. Osteological remains of *E. anatolicus* were recorded in pellets of two owl species coming from two sites of Iran (Table 40). Remains of one individual were documented from *Bubo bubo* pellets collected in the small cave at Deh Bakri (Kerman) representing 0.49% of all prey items (and 0.77% of mammal items) in the respective samples and 0.013% of all prey items (and 0.017% of mammal items) in the whole analysed eagle owl diet from Iran. Remains of two individuals of *E. anatolicus* were discovered in *Strix aluco* pellets collected at Bishapur (Fars; Obuch 2011). This record made up 1.01% of all prey items (and 8.33% of mammal items) in the respective sample and 0.30% of all prey items (and 0.75% of mammal items) in the whole analysed tawny owl diet from Iran. In the Middle East, remains of *E. anatolicus* were also found in the owl diet in Turkey (Obuch 1994, Benda & Horáček 1998).

Material examined. 1 ♀ (BMNH 2.10.1.1 [S+B]), Basht, 4000 ft [Khuzestan Prov.], 10 June 1902, leg. H. F. Witherby; – 1 ♀ (NMP 48192 [S+A]), Bavineh (Lorestan Prov.), 16 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 inds. (JOC unnumbered [Sf]), Bishapur (Fars Prov.), 21 April 2000, leg. J. Obuch; – 1 ♂ (NMP 48153 [S+A]), Bisotun (Kermanshah Prov.), 8 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 48363 [S+A]), Deh Bakri (Kerman Prov.), 8 April 2000, leg. P. Benda & A. Reiter; – 1 ind. (JOC unnumbered [Sf]), Deh Bakri (Kerman Prov.), 7 April 2000, leg. J. Obuch; – 1 ♀ (BMNH 5.10.4.1 [S+B]), Mala-i-Mir, 70 mi NW Ahwaz, 4300 ft [Khuzestan Prov.], 10 April 1905, leg. R. B. Woosnam; – 1 ♀ (NMP 48193 [S+A]), Qasr-e Shirin (Kermanshah Prov.), 17 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93885 [S+A]), Tadovan cave (Fars Prov.), 7 October

Table 25. Basic biometric data on the examined Iranian samples of *Eptesicus anatolicus* Felten, 1971, *E. bottae* (Peters, 1869), and *E. ognevi* Bobrinskoj, 1918. For abbreviations see p. 171

	Eptesicus anatolicus					*Eptesicus bottae*					*Eptesicus ognevi*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	5	**67.4**	66	72	2.608	7	**63.1**	56	67	3.671	3	**63.7**	62	65	1.528
LCd	5	**52.8**	51	57	2.490	7	**48.3**	44	54	3.251	3	**49.3**	45	52	3.786
LAt	8	**48.01**	46.4	50.4	1.644	13	**43.31**	41.2	46.4	1.595	3	**43.57**	42.5	44.6	1.050
LA	5	**18.94**	18.4	20.0	0.639	7	**16.86**	15.6	17.7	0.645	3	**19.03**	17.9	20.0	1.060
LT	5	**7.00**	5.8	8.3	0.957	7	**7.21**	6.5	7.9	0.534	3	**8.07**	7.7	8.5	0.404
LCr	8	**17.70**	17.02	18.37	0.455	13	**16.41**	15.67	17.29	0.466	3	**16.50**	16.35	16.63	0.142
LCb	8	**17.38**	16.75	17.90	0.428	13	**16.07**	15.46	16.83	0.448	3	**16.40**	16.28	16.53	0.126
LaZ	8	**12.62**	12.27	13.09	0.296	10	**10.82**	10.47	11.18	0.214	3	**10.94**	10.63	11.27	0.320
LaI	8	**3.92**	3.74	4.13	0.119	13	**3.72**	3.57	3.92	0.109	3	**3.62**	3.54	3.67	0.072
LaInf	8	**5.89**	5.75	6.12	0.133	13	**5.14**	4.68	5.42	0.213	3	**5.14**	4.97	5.28	0.156
LaN	8	**8.43**	8.02	8.62	0.190	13	**7.73**	7.50	8.18	0.195	3	**7.90**	7.81	8.08	0.153
LaM	8	**9.95**	9.75	10.12	0.124	13	**8.73**	8.28	9.07	0.227	3	**8.94**	8.84	9.09	0.134
ANc	7	**6.46**	6.21	6.65	0.167	13	**5.68**	5.38	6.02	0.199	3	**5.59**	5.51	5.74	0.127
LBT	4	**3.78**	3.64	3.97	0.138	12	**3.62**	3.38	3.88	0.140	3	**3.60**	3.52	3.67	0.076
CC	7	**5.81**	5.52	6.11	0.237	13	**5.09**	4.82	5.30	0.162	3	**5.35**	5.27	5.48	0.116
M^3M^3	8	**7.82**	7.53	8.17	0.199	13	**6.99**	6.54	7.26	0.247	3	**7.13**	6.98	7.32	0.172
CM^3	7	**6.68**	6.47	6.85	0.157	13	**6.00**	5.77	6.28	0.149	3	**6.28**	6.09	6.53	0.226
LMd	10	**13.22**	12.83	13.59	0.301	13	**11.86**	11.47	12.33	0.261	3	**11.96**	11.90	12.00	0.053
ACo	11	**4.85**	4.63	5.14	0.160	13	**4.13**	3.90	4.38	0.144	3	**4.23**	4.08	4.42	0.172
CM_3	8	**7.29**	7.03	7.55	0.174	13	**6.55**	6.33	6.82	0.135	3	**6.66**	6.47	6.76	0.165

2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ♀ (BMNH 2.10.1.2 [S+B]), Telespid [Khuzestan Prov.], 13 June 1902, leg. H. F. Withersby.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Eptesicus anatolicus* are shown in Table 25. For the material examined see above.

E. anatolicus was described by Felten (1971), originally as a separate species of the genus *Eptesicus* (type locality: Alanya, Küste von S-Anatolien, Prov. Antalya, Türkei; Felten 1971: 371). Although Felten (1971) gave a good description and differential diagnosis based on a very comprehensive comparison with many taxa, Harrison (1976: 417) concluded that *E. anatolicus* "seems from its description to represent a larger race of *E. bottae*". Albeit this statement had only a tentative validity, being based on examination of very limited comparative samples, it was completely accepted by subsequent authors (Corbet 1978, DeBlase 1980, Nader & Kock 1983a, 1990, Harrison & Bates 1991, Koopman 1993, 1994, Spitzenberger 1994, Benda & Horáček 1998, Horáček et al. 2000, etc.).

Benda et al. (2006) suggested to raise *E. anatolicus* to the species level on the basis of two types of differences from other forms of *E. bottae* s.str. (then including *E. ognevi*), biogeographical and morphological. While almost all then recognised subspecies of *E. bottae* s.str. are inhabitants of arid habitats (deserts or steppes), the form *anatolicus* is the only inhabitant of the Mediterranean arboreal zone. However, the most marked differences between *E. anatolicus* and *E. bottae* s.str. were found in morphological characters, i.e. body and skull size, skull shape, baculum shape, and the skin and pelage colouration.

E. anatolicus is markedly larger than *E. bottae* s.str., see also Table 25. While in skull length dimensions, the samples of *E. anatolicus* showed slight overlaps in marginal values with *E. bottae* s.str., in skull width and height dimensions they differed completely, without any overlaps. Hence, *E. anatolicus* has a relatively broader and more robust skull and a more massive braincase than *E. bottae* s.str. Bacula of *E. anatolicus* were relatively large and massive bones (length 0.97–1.22 mm, width of proximal epiphysis 0.63–0.72 mm) of the converted Y-shape (see Benda et al. 2006: 166, Fig. 99). In *E. bottae* s.str., the bacula were smaller (length 0.80–0.91 mm, width of proximal epiphysis 0.46–0.65 mm) and of simple triangular shapes. The tinge of dorsal pelage colouration in *E. anatolicus* is rusty brown to brownish-grey, ventral side is whitish-beige; naked parts are dark brown to blackish-brown. In *E. bottae* s.str., the tinge of dorsal pelage is greyish-beige to rusty brown, ventral side is creamy to greyish-beige; naked parts are pale greyish-brown to dark brown. All this morphological evidence presented by Benda et al. (2006) gave a good support for recognition of *E. anatolicus* as a separate species different from all other populations then associated with *E. bottae*.

Another support for the separation of *E. anatolicus* from *E. bottae* s.str. was documented by differences in their echolocation calls, the peak frequency above 30 kHz in the latter form (Holderied et al. 2005, Benda et al. 2008, 2010) against ca. 28 kHz in *E. anatolicus* (von Helversen 1998). However, a more substantial evidence for this division was demonstrated by results of molecular genetic analyses. Mayer et al. (2007) found very deep divergences between *E. anatolicus* from Rhodes (Greece) and *E. bottae* from Egypt and Israel (= *E. b. innesi*) in two mitochondrial genes, 9.7% (ND1 gene) and ca. 3.5% (16S gene) of uncorrected *p* distances. Similarly, a broader genetic comparison of sequences from mitochondrial and nuclear genes (Juste et al. in press), covering samples of *E. anatolicus* from Iran, Syria and Turkey and of *E. bottae* from Iran, Syria and Jordan, revealed a divergence of 5.57–7.44% of uncorrected *p* distance between these populations in the cyt *b* gene. So, this evidence undoubtedly validates the opinions presented by Felten (1971) and Benda et al. (2006), and clearly indicates the full species position of *E. anatolicus*.

Neither morphological nor genetic data support existence of remarkable geographic variation within *E. anatolicus* and therefore, we consider this species monotypic.

Echolocation. Published data on parameters of echolocation signals of *Eptesicus anatolicus* are limited to values recorded in the Rhodes island (Greece; von Helversen 1998). The species produces frequency-modulated calls with an almost constant-frequency end part. The start frequency of searching signals is ca. 29–32 kHz, which drops to ca. 27–28 kHz at the end of the signal. In Iran, we recorded only a single sequence of echolocation calls of a searching *E. anatolicus* near the Tadovan cave (Fars). Due to a low quality of the recording, we measured only values of the peak frequency, which was on average at 29 kHz (Table 3). These data are similar to those obtained in Lebanon, where the range of frequency of maximum energy was ca. 27–30 kHz (own unpubl. data).

Feeding ecology. *Eptesicus anatolicus* is a medium-sized bat foraging in open areas, around streetlamps and in the semi-open area along cliffs and vegetation (Dietz et al. 2007). The diet of the species was studied in Syria (Benda et al. 2006) and the results of these analyses were contradictory – two sample sets contained an overwhelming majority of ants (Hymenoptera, Formicoidea), the other two sets contained a majority of brachyceran Diptera complemented by Heteroptera. Whitaker & Karataş (2009) found the diet of *E. anatolicus* from Turkey to be dominated by beetles (Carabidae prevailing). One sample analysed from Rhodes, Greece, was dominated by Hymenoptera and a sample from Lebanon contained mostly Coleoptera, Hymenoptera and Heteroptera (own unpubl. results).

From Iran, four sample sets of the diet of *E. anatolicus* were analysed; two faecal pellets from one bat netted at the Tadovan cave (Fars) and three digestive tracts from three sites (i.e. one tract per site), Bisotun and Qasr-e Shirin (Kermanshah) and Bavineh (Lorestan). The digestive tracts from Bisotun and Qasr-e Shirin contained only Orthoptera, in the tract from Bavineh we identified Coleoptera (40% of volume), Orthoptera (25%), Lepidoptera (20%), Neuroptera (10%), and Aphididae (5%). The pellets from Tadovan contained Odonata (60%) and ants (Hymenoptera, Formicoidea) (40%). According to the available data on the diet composition, *E. anatolicus* seems to be remarkably flexible in its hunting behaviour.

Eptesicus bottae (Peters, 1869)

Records. **Original data**: K e r m â n: Arg-e Bam [1], Bam, ruined fortress town, 4 May 1997: coll. 2 ma (NMP 48114, 48115; cf. Benda et al. 2006), 8 April 2000: coll. 4 ma, 1 fG (NMP 48364–48368; cf. Benda et al. 2006). – **Published data**: S i s t â n v a B a l u c h e s t â n: Kusheh [2], western slope of the Kuh-e Taftan Mt., 2250 m, 14 June 1975: 1 ms, 4 fa, 1 fs, MHNG (de Roguin 1988, Benda et al. 2006).

Distribution. *Eptesicus bottae* is a very rare bat species in Iran, only two sites of records are available from the south-eastern part of the country (Fig. 127). The first Iranian record of this bat was reported from northern Baluchestan (de Roguin 1988); due to the marked separation of the locality from ranges of other populations of the species, the Baluchestani bats were described as a separate subspecies *E. b. taftanimontis* (see below). This subspecies remains the only documented population of *E. bottae* s.str. from Iran, its range was later prolonged to the Kerman province, some 250 km to the west (Benda et al. 2006). The subspecies remains known only from the above two sites, both representing continental desert habitats adjacent to the Dasht-e Lut basin.

Fig. 130. Ruined fortress town of Arg-e Bam (Kerman), an area of numerous roosts of *Rousettus aegyptiacus*, *Eptesicus bottae*, and *Pipistrellus kuhlii*. Photo by A. Reiter.

The occurrence in south-eastern Iran is the easternmost extension of the whole distribution range of *E. bottae* (Nader & Kock 1990). The records closest to the east-Iranian range are known from north-eastern Oman, some 600 km to the south over the Strait of Hormuz, and at Basra in southern Iraq, more than 1000 km to the west (Harrison & Bates 1991, own unpubl. data). However, *E. bottae* is widely distributed in the Mesopotamian arid lowlands of Syria and Iraq (see Benda et al. 2006: 156, Fig. 92) and therefore it is well possible that the local form of *E. bottae* from Mesopotamia – belonging to a different subspecies than the Baluchestani population – occurs also in the low arid plains of the Khuzestan and Ilam provinces of western Iran (cf. DeBlase 1980). The real distribution pattern of *E. bottae* in Iran thus may resemble that of e.g. *Rhyneptesicus nasutus* (see Fig. 134).

Field notes. *Eptesicus bottae* was found at two sites in Iran, in a roost and at a foraging ground.

A dispersed community of *E. bottae* was repeatedly found in the ruined fortress town of Arg-e Bam (Kerman; Fig. 130); two adult males were discovered there on 4 May 1997 and four adult males and one adult female (along with at least two other individuals observed) on 8 April 2000. Solitary bats occupied various fissures and holes in walls and ceilings (if present) of soil-constructed houses and their ruins in the town fortress complex and the fortress itself. Since the males dominated the record on both occasions, the community perhaps did not represent a dispersed nursery colony; on the other hand, the discovery of a pregnant female indicates existence of maternity colony in the close surroundings. Along with *E. bottae*, the total of seven individuals of *Pipistrellus kuhlii* were collected from the ruins on the two occasions and a mummy of a juvenile *Rousettus aegyptiacus* was discovered there in 2000.

De Roguin (1988: 598) reported on six *E. bottae* from Kusheh (Baluchestan) at the altitude of 2250 m a. l. that were collected on 14 June 1975: “au filet, au-dessus d’un ruisseau”, so the record certainly represents foraging individuals. The site was briefly described by de Roguin (1988: 597) as follows: “en bas, zone de production agricole des nomades baloutches (céréales, abricotiers), très empierrée; en haut, entrée d’une gorge sans rivière, au-dessus des derniers campements nomades.” Besides *E. bottae*, also *Rhinolophus blasii*, *Hypsugo savii*, and *Tadarida teniotis* were collected there.

Limited information is available on reproduction of *E. bottae* from Iran. A pregnant female was collected in the ruined fortress town of Bam on 8 April; it contained two foeti of the crown-rump length 5.7 mm. This suggests the parturition terms in the populations of south-eastern Iran to occur around mid-April. It conforms to the more complex data on reproduction of *E. bottae* from various parts of Arabia, where the births occur from late April to early June (see Harrison 1964, Al-Robaae 1966, Mendelssohn & Yom-Tov 1999, Nader & Kock 1990, Benda et al. 2006, 2010).

Material examined. 2 ♂♂ (NMP 48114, 48115 [S+A]), Arg-e Bam (Kerman Prov.), 4 May 1997, leg. P. Benda; – 4 ♂♂, 1 ♀ (NMP 48364–48368 [S+A]), Arg-e Bam (Kerman Prov.), 8 April 2000, leg. P. Benda & A. Reiter; – 4 ♀♀ (MNHG 1703.96–1703.99 [S+A]), Kusheh, Kuh-e Taftan Mt. [Sistan va Baluchestan Prov.], 14 June 1975, leg. M. Desfayes & J.-C. Praz; – 1 ♂, 1 ♀ (MNHG 1703.95 [S+B], 1703.100 [S+A], including the holotype of *Eptesicus bottae taftanimontis* de Roguin, 1987), Varaj [= Kusheh], Kuh-e Taftan Mt. [Sistan va Baluchestan Prov.], 13 June 1975, leg. M. Desfayes & J.-C. Praz.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Eptesicus bottae* are shown in Table 25. For the material examined see above.

E. bottae is considered a polymorphic species being comprised of a series of forms (Harrison 1964, 1976, Corbet 1978, DeBlase 1980, Strelkov 1981a, Nader & Kock 1983a, 1990, Qumsiyeh 1985, Harrison & Bates 1991, Koopman 1994, Borisenko & Pavlinov 1995, Pavlinov & Rossolimo 1998, Horáček et al. 2000, Simmons 2005, Benda et al. 2006, etc.). In its traditional sense (Nader & Kock 1990, Simmons 2005), this species has been divided into seven subspecies. However, this number included also *E. b. anatolicus* and *E. b. ognevi*, which have been recently recognised as two separate species (Juste et al. in press).

All five currently acknowledged subspecies of *E. bottae* meet in the Middle East, although in geographically separated ranges (Harrison 1976, Nader & Kock 1990, Harrison & Bates 1991, Benda et al. 2006); viz. *E. b. bottae* (Peters, 1869) occurring in western Yemen and south-western Saudi Arabia (type locality: south-western Yemen, between Al Hudaydah, Ta'izz and Al Mukha; Nader & Kock 1990: 2); *E. b. innesi* (Lataste, 1887) in Israel, Jordan, Sinai, and the Cairo region (type locality: Caire, Égypte; Lataste 1887: 628); *E. b. hingstoni* Thomas, 1919 in Syria and Iraq (type locality: Baghdad, Mesopotamia [Iraq]; Thomas 1919: 745); *E. b. omanensis* Harrison, 1976 in north-eastern Oman (type locality: Masjid Ma'illah, Jebel Al Akhdar, [Sultanate of] Oman; Harrison 1976: 415); and *E. b. taftanimontis* de Roguin, 1988 in south-eastern Iran (type locality: Kusheh, versant ouest du Kuh-e Taftan, prov. Sistan et Baluchestan, Iran; de Roguin 1988: 598). Among them, only the form *taftanimontis* has been documented to occur in Iran, although the form *hingstoni* is awaited in Iranian Mesopotamia (see Distribution).

Nader & Kock (1990) and Benda et al. (2006) revised morphological characters of the particular subspecies of *E. bottae*. With the exception of *E. b. omanensis*, which is smaller in body and skull size (LAt 38.1–42.1 mm, LCr 14.3–15.5 mm; n=20), all subspecies are more or less equally-sized (LAt 40.3–47.0 mm, LCr 15.3–17.6 mm; n=75) (Benda et al. 2006, 2010, own unpubl. data). However, in the relative skull dimensions, *E. b. omanensis* showed similar values as all other *E. bottae* samples. The only remaining differential trait among the particular populations is pelage colouration and the most distinct populations in this respect are those from south-eastern Iran, belonging to *E. b. taftanimontis*, being darker in their dorsal tinge than all other populations (Nader & Kock 1990, Benda et al. 2006). After examination of the series of *E. b. taftanimontis* from Bam (Kerman), Benda et al. (2006: 172) stated as follows: "the tinge of dorsal pelage is rusty brown, ventral side is greyish-beige; naked parts are dark brown; basal parts of the dorsal hairs (ca. $^1/_2$) are brown, medial parts (ca. $^1/_5$–$^1/_4$) are beige and distal parts (ca. $^1/_3$) are rusty brown; basal parts of the ventral hairs (ca. $^1/_2$) are brown, distal parts greyish-white to creamy." In other examined subspecies (*innesi*, *hingstoni*), the tinge of dorsal pelage was paler (beige) and that of the ventral side was creamy, naked parts were pale brown. Dorsal hairs were tri-coloured and ventral hairs bi-coloured in all compared populations of *E. bottae* including *E. b. taftanimontis* (contra de Roguin 1988).

These rather minute differences in colouration among the particular populations of *E. bottae* (besides the metric differences in the samples from Oman) could be considered insignificant for the division into a series of different taxa. Such a separation has not been supported even by results of the recent molecular genetic analysis by Juste et al. (in press). The Iranian form *taftanimontis* was found the most divergent, being distant in the cyt *b* gene only at 1.46–1.77% of uncorrected *p* distance from three other subspecies of *E. bottae* (except *E. b. bottae* from south-western Arabia, which had not been available for sequencing), which further diverged only at 0.45–1.02% from each other. These shallow divergences did not give a remarkable support for subspecific division in *E. bottae* and suggest rather the isolation-by-distance model among the separate patches of occurrence of the particular populations and their relatively recent dispersion. The hypothesis by Benda et al. (2006) that the populations from north-eastern Oman, described as *E. b. omanensis*, could represent a separate species due to their significant differences in body and skull size from other *bottae* forms, should thus be rejected.

Echolocation. *Eptesicus bottae* produces frequency-modulated calls with an almost constant-frequency end part. The populations in the Sinai, Israel and Jordan have the start frequency at ca. 41–53 kHz, which drops to ca. 23–34 kHz (Holderied et al. 2005, Benda et al. 2008, 2010), their peak frequency values are between 29–39 kHz (see also Mendelssohn & Yom-Tov 1999, Shalmon et al. 1993). In Iran, we did not record echolocation sequencies of this species, values of maximum frequency obtained in Oman (own unpubl. data) were between 31–40 kHz, which conforms to other data on this species.

Feeding ecology. *Eptesicus bottae* ranks among small- to medium-sized bats hunting its prey mostly in a slow hawking flight (Norberg & Rayner 1987, Korine & Pinshow 2004). Its diet composition was studied in several countries of the Middle East (Feldman et al. 2000, Benda et al. 2006, 2010, own unpubl. data). The diet analysis from the Dead Sea area of Israel showed Hymenoptera, Lepidoptera and Coleoptera to be the most important prey items (Feldman et al. 2000). On the other hand, in Syrian Mesopotamia, Benda et al. (2006) found Coleoptera to prevail in the diet of this species, followed by Heteroptera and Auchenorrhyncha, while Hymenoptera and Lepidoptera were much less consumed. The diet samples of *E. bottae* collected in the Rum desert in southern Jordan were found to be dominated by Auchenorrhycha, Coleoptera, and Lepidoptera, however, diet samples containing a majority of ants or heteropterans were collected in other sites of Jordan (Benda et al. 2010). Analyses of eleven sets of faeces from Oman showed three taxa to dominate the diet of *E. bottae* – Coleoptera, Hymenoptera (Formicoidea) and Heteroptera, while Lepidoptera prevailed only in one sample set (own unpubl. data)

From Iran, we analysed a set of 30 faecal pellets from five *E. bottae* found in the ancient city of Bam (Kerman). Hymenoptera (Formicoidea) (89% volume) and Coleoptera (Scarabaeidae) were the most important food items. The high local variation in the diet indicates that *E. bottae* is a flexible species feeding opportunistically especially on ants and beetles.

Eptesicus ognevi Bobrinskoj, 1918

Records. **Original data**: K h o r a s â n - e R a z a w i: valley 3 km SW of Tahir Abad [1], 45 km NE of Mashhad, above a creek, 21 May 2006: net. 2 ma (NMP 90809, 90810); – Shurlaq [2], 53 km WSW of Sarakhs, above a stream, 18 May 2006: net. 1 fG (NMP 90789; Fig. 131). – **Published data**: K h o r a s â n - e R a z a w i: Chelmir [3], over a stream, July 1968: 5 m, IPHR (Farhang-Azad 1969a, DeBlase 1980 [as *Eptesicus bottae*]), 27 km W of Derregaz [= Dargaz] town, 12–17 July 1969 (Filippova et al. 1976 [as *Eptesicus* sp.]), nad ruč'em v gornom ušelie Čempir, 27 km zapadnee Derregaza [= above a stream in the mountain canyon of Chelmir, 27 km W of Dargaz], 16 July 1969: net. (Kudrâšova et al. 1978, Kudrâšova 1992, 2004). – Z a n j â n: Sartschem [= Sar Cham] [4], MZST (De Filippi 1865 [as *Vespertilio turcomanus*], DeBlase 1980 [as *Eptesicus bottae*]); – Zendjan [= Zanjân] [5], MZST (De Filippi 1865 [as *Vespertilio turcomanus*], DeBlase 1980 [as *Eptesicus bottae*]).

Distribution. *Eptesicus ognevi* is a rare bat in Iran, only five record sites are known from the northern part of the country (Fig. 127). This bat, whose separate species position has been suggested very recently (Juste et al. in press), is a Turanic element in Iranian fauna. It is distributed principally in the southern part of West Turkestan, with minor range extensions into adjacent areas; eastern Transcaucasia, northern Iran, Kashmir and south-western Mongolia (Nader & Kock 1990, Benda et al. 2006). *E. ognevi* was found to inhabit two separate regions of Iran and this pattern conforms to that presented by DeBlase (1980); three records are available from north-eastern Khorasan, two from the Zanjan province (Fig. 127). The Khorasani localities lie on rather arid northern slopes of the Kopetdagh Mts. adjacent to the Karakum desert (Tahir Abad, Chelmir) or even in the desert lowland (Shurlaq) and represent a direct promontory of the wide range in Turkmenistani deserts (see Strelkov et al. 1978).

The Zanjani records are rather isolated from the continuous range of the species in Transcaucasian and Turkestani deserts (see Benda et al. 2006: 156, Fig. 92). The localities of *E. ognevi* closest to the Zanjani sites lie in eastern Azerbaijan (Gobustan, Sabirabad; Rahmatulina 2005), some 700 km to the north. Moreover, these two parts of the distribution range are widely isolated from each other by humid mountainous areas, which obviously do not provide suitable habitats for the species demanding desert or semi-desert conditions as it is the case with *E. ognevi* – therefore, width of the gap between these range parts should be considered larger than is the mere aerial distance. Both Zanjani findings were made during De Filippi's trip to Persia in 1862 (see De-Filippi 1863) and since that no records have been made in the respective area, although it belongs to the best studied concerning the bat fauna of Iran. These records thus represent a certain enigma which could be elucidated only by a very thorough field work in the valleys of north-western Iran.

FIELD NOTES. Of the five records of *Eptesicus ognevi* known from Iran, the circumstances are available only in three of them; these all represent nettings of foraging bats. *E. ognevi* has not been found in the osteological material from owl pellets collected in Iran (Table 40).

Farhang-Azad (1969a) reported a netting of five males above a stream at Chelmir (Khorasan) in July 1968; during this research campaign an extremely rich bat community was documented, together with *E. ognevi* also *Rhinolophus ferrumequinum*, *Myotis blythii*, *M. emarginatus*, *Eptesicus serotinus*, *Hypsugo savii*, *Otonycteris leucophaea*, *Miniopterus pallidus*, and *Tadarida teniotis*, were netted (Farhang-Azad 1969a, DeBlase 1980).

An adult female of *E. ognevi* was netted above a stream at Shurlaq near Sarakhs (Khorasan) on 18 May 2006. This site lies at the northern foothill of the Kopetdagh Mts. and on the southern

Fig. 131. *Eptesicus ognevi* Bobrinskoj, 1918 from Shurlaq (Khorasan). Photo by A. Reiter.

Fig. 132. Valley near Tahir Abad, Kopetdagh Mts. (Khorassan), a foraging habitat of *Myotis blythii*, *Eptesicus serotinus*, *E. ognevi*, *Pipistrellus pipistrellus*, and *Tadarida teniotis*. Photo by P. Benda.

border of the Karakum desert, it is a very arid place covered by dry steppe (Fig. 189). Besides *E. ognevi* also *Pipistrellus pipistrellus*, *P. kuhlii*, *Otonycteris leucophaea*, and *Tadarida teniotis* were netted at Shurlaq. Two adult males were caught into a net installed over a creek in a small village lying in a shallow valley covered by farmland at Tahir Abad near Mashhad (Khorasan) on 21 May 2006 (Fig. 132). Along with *E. ognevi* also *Myotis blythii*, *Eptesicus serotinus*, *Pipistrellus pipistrellus*, and *Tadarida teniotis* were documented at this site.

The female *E. ognevi* collected at Shurlaq on 18 May was pregnant, it contained two very large foeti of the crown-rump length 19.2 mm. This record, suggesting the occurrence of parturitions in Iranian populations in the second half of May or at the break of May/June, is the only evidence of reproduction in *E. bottae* from the country. Strelkov et al. (1978) reported births to occur in Turkmenistan from mid-May to the beginning of June and Butovskij et al. (1985) reported findings of pregnant females in south-eastern Kazakhstan on 2 May and 25 May (they contained two foeti each, of the length 5 mm and 11–13 mm, respectively). These data conform well to those available from Iran. In Azerbaijan, pregnancy and parturitions occur some weeks later – Rahmatulina (2005) referred to records of pregnant females from mid-May to 22 June.

Material examined. 1 ♀ (NMP 90789 [S+A]), Shurlaq (Khorasan-e Razawi Prov.), 18 May 2006, leg. P. Benda & A. Reiter; – 2 ♂♂ (NMP 90809, 90810 [S+A]), Tahir Abad (Khorasan-e Razawi Prov.), 21 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Eptesicus ognevi* are shown in Table 25. For the material examined see above.

E. ognevi was primarily described as a separate species from western Tajikistan (type locality: Sohta-Činar, Gissarskoe Bekstvo, Buhara [= Činor, Vahdat Dist., Tajikistan]; Bobrinskoj 1918: 12). However, soon after its description it was synonymised with the name *Vespertilio sodalis* Barrett-Hamilton, 1910 (Bobrinskoj 1925, 1926, 1929, Ognev 1927, 1928, Bobrinskoi 1931, Ellerman & Morrison-Scott 1951, Aellen 1959a), a form currently considered a synonym of *E. serotinus* (Hanák & Gaisler 1971, Harrison 1976, Corbet 1978, Koopman 1993, Borisenko

& Pavlinov 1995, Simmons 2005, etc.). On the other hand, several authors (Kuzâkin 1944, 1950, 1965, Strelkov 1963) kept the original rank of the species *E. ognevi*.

Based on a morphological comparison, Hanák & Gaisler (1971) suggested *E. ognevi* to be a subspecies of *E. bottae*, being very similar to *E. b. hingstoni*. The resulting conception, considering one polymorphic species *E. bottae* instead of a group of geographically limited similar species, suggested by Harrison (1964) and complemented by Hanák & Gaisler (1971), has been broadly accepted (e.g., Gaisler 1970, Harrison 1976, Corbet 1978, Strelkov 1981a, DeBlase 1980, Nader & Kock 1983a, 1990, Strelkov & Šajmardanov 1983, Butovskij et al. 1985, Qumsiyeh 1985, Harrison & Bates 1991, Koopman 1993, 1994, Borisenko & Pavlinov 1995, Pavlinov & Rossolimo 1998, Horáček et al. 2000, Simmons 2005, Benda et al. 2006, 2011c, Artyushin et al. 2009, etc.).

However, the recent profound molecular genetic revision of the west-Palaearctic populations of the genus *Eptesicus* (Juste et al. in press) has demonstrated a separate phylogenetic position of the Central Asian populations that were assigned to *E. bottae*, deserving the full species level. The divergence in a mitochondrial gene (cyt *b*) was relatively deep, represented by 5.80–7.35% of uncorrected *p* distance between the *ognevi* and other *bottae* lineages (without *anatolicus*, which diverged even deeper from *ognevi*, 9.79%). In the nuclear gene (RAG2, BGN) analyses, the *ognevi* lineage was in sister position to the *bottae* s.str., *anatolicus* and *hottentotus* lineages within the common clade (*bottae* group).

On the other hand, the elevation of *E. ognevi* to the species level is really surprising from the traditional point of view, since the morphological similarity between the Central Asian medium-sized desert populations of *Eptesicus* and those from Mesopotamia, Egypt, Holy Land, south-western Arabia and south-eastern Iran is very extensive; Benda et al. (2006) found good congruence in both body and skull dimensions. In the colouration of pelage and naked parts, high similarity

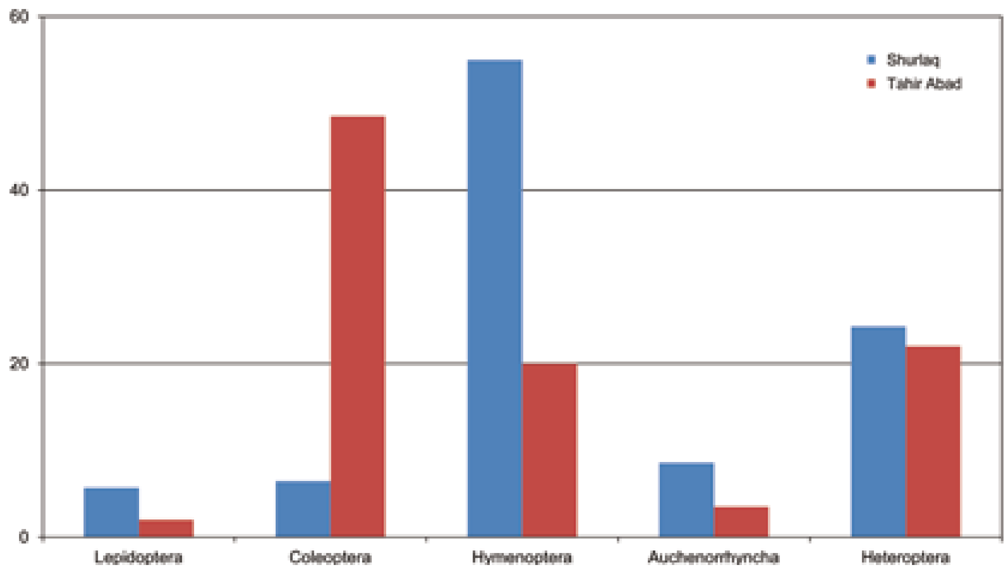


Fig. 133. Percentage volume of particular food items in the diet of *Eptesicus ognevi* Bobrinskoj, 1818 in Iran. Material analysed: Shurlaq (seven faecal pellets from one bat), Tahir Abad (ten pellets from two bats).

was found between *E. ognevi* and *E. b. innesi* and *E. b. hingstoni* (see also Nader & Kock 1990). Benda et al. (2006) found rather slight differences in the skull shape between *E. ognevi* and other large-sized populations of *E. bottae*, the samples of *E. ognevi* showed a relatively longer and narrower rostral part of the skull and a relatively narrower rostrum both in its mesial and distal parts than found in the comparative *bottae* samples.

The species level of *E. ognevi* seems to be more plausible from the biogeographical point of view. The bat fauna of Central Asian deserts exhibits a certain level of endemism, some bat species are centred by their distribution ranges to West Turkestan with minor extensions to adjacent areas, e.g. *Rhinolophus bocharicus*, *Myotis bucharensis* Kuzâkin, 1950, *Eptesicus bobrinskoi*, *Otonycteris leucophaea*, and/or *Plecotus turkmenicus* Strelkov, 1988. *E. ognevi* is another species in this series, although its morphological difference from its sister taxon, *E. bottae*, is much less pronounced than in the other respective species groups.

According to the data by Benda et al. (2006, 2011c), no remarkable geographic variation in metric traits was detected within the rank of *E. ognevi*.

Echolocation. No data on echolocation of *Eptesicus ognevi* are available.

Feeding ecology. *Eptesicus ognevi* is a bat very similar to *E. bottae* and also belongs to small- to medium-sized hawking bats (see above). The feeding ecology of this species is poorly known.

From Iran, we analysed two sets of faeces of *E. ognevi*, 17 pellets from two closely localised sites in Khorasan (Fig. 133). This species was found to feed especially on Coleoptera (Carabidae: Harpalini; Elateridae), Hymenoptera (mainly Formicoidea, also Ichneumonoidea) and Heteroptera; Neuroptera were represented by Hemerobiidae and Chrysopidae. However, the available samples are too limited to be able to draw any general conclusions concerning the feeding ecology of *E. bottae*.

Records of ectoparasites. **Published data**: I x o d i d a e: *Haemaphysalis sulcata*: 2 larvae from 2 inds., 27 km W of Derregaz [= Dargaz] town [Khorasan-e Razawi Prov.], 12–17 July 1969 (Filippova et al. 1976). – T r o m b i c u l i d a e: *Willmanium cavum*: 2 larvae from unknown number of inds., v gornom uŝelie Čempir, 27 km zapadnee Derregaza [= in the mountain canyon of Chelmir, 27 km W of Dargaz, Khorasan-e Razawi Prov.], 16 July 1969 (Kudrâšova et al. 1978 [as *Chiroptella aelleni*], Kudrâšova 1992, 1998, 2004).

Comments on ectoparasites. Adult individuals of the tick *Haemaphysalis sulcata* Canestrini et Fanzago, 1878 are parasitic mainly on the wild and domestic sheep and goats, and also on other ungulates in a variety of arid habitats. Subadult stages of this tick are parasitic on reptiles and only exceptionally on birds and mammals. This species occurs from southern Europe and North Africa to south-western and central Asia (Hoogstraal & Valdez 1980), from Iran it was reported also from *Otonycteris leucophaea* by Filippova et al. (1976). Considering the above noted host preference, these findings from bats should be regarded as exceptional.

One chigger mite species, *Willmanium cavum* Kudrâšova, 1992, has been reported from Iran to parasitise *E. ognevi*. This record was originally, by Kudrâšova et al. (1978), referred to *Chiroptella aelleni* (Vercammen-Grandjean, 1963) described from Afghanistan. Later on, Kudrâšova (1992) described the respective series of parasites as an endemic form, *W. c. iraniensis* Kudrâšova, 1992. From *E. ognevi*, Rybin (1992) reported also the mesostigmatic mite *Steatonyssus desertorus* Rybin, 1992 collected in Kirghizstan.

Rhyneptesicus nasutus (Dobson, 1877)

Records. **Original data**: H o r m o z g â n: Chahâr Dahaneh [1], 12 km ENE Dehbârez, above a pool, 17 April 2000: net. 1 ma, 2 fL (NMP 48437–48439; cf. Benda & Reiter 2006); – valley of the Radul river [2], 5 km SW of Kuchandar, 11 October 2011: det. & rec. calls of several foraging inds.; – Zangârd [3], 25 km E of Bastak, at a reservoir in the village and in palm oasis, 9 October 2011: det. calls of several foraging inds. – K h u z e s t â n: Zap. Persiâ, Arabistan, okr. Nasriè i Ahvaza [= western Iran, Khuzestân, vicinity of Nasrieh and Ahwaz] [4], 22 February [= 7 March NS] 1904: coll. 1 m, 3 f (ZIN 8090–8093; leg. N. A. Zarudnyj; see Zarudnyj 1905). – S i s t â n v a B a l u c h e s t â n: Pir Sohrab [5], 54 km NE of Chabahar, above a pool, 12 April 2000: net. 1 ma, 1 fa, 3 fG (NMP 48404–48408; cf. Benda & Reiter 2006). – Iran (undef.): Vost. Persiâ [= eastern Iran], 1898 [= between 14 March (= 27 March NS) and 15 November (= 28 November NS) 1898, see Zarudnyj 1898]: coll. 1 fa (ZIN 9437; leg. N. A. Zarudnyj; according to Zarudnyj 1898, the specimen should originate from the teritorry of north-eastern or south-eastern Khorasân [provinces of Khorasân-e Razawi and Khorasân-e Janubi] or the Sistân va Baluchestân province). – **Published data**: H o r m o z g â n: Minab [6], over the Dozdan River, 30 November 1968: shot 1 fa, FMNH (DeBlase 1971a). – K h u z e s t â n: Ahwaz [4], Karun R., S.W. Persia, 220', 28 March 1905: shot 5 m, resp. 11 m, BMNH, "common in the town" (Thomas 1905 [as *Vespertilio matschiei*], Gaisler 1970, Benda & Reiter 2006); – Choqa Zambil (Ziggurat) [7], near Shush, 21 February 1975: 1 ind., HZM (DeBlase 1980); – Meshrageh on the Jahari River [8], about 85 km. S Ahvaz, at the river, 17–21 October 1968: shot 3 ma, 3 ms, 2 fa, 2 fs, FMNH (DeBlase 1971a, 1980); – a village 6 km north of Bandar Mahshahr, resp. Olbuhardân [9], N Bandar-e Mâhshahr, 27 March 1972: coll. 2 fa (Etemad 1973 [as *E. walli*], 1984).

Distribution. *Rhyneptesicus nasutus* is an infrequent bat species in Iran, nine record sites are available from the southern and south-western parts of the country (Fig. 134). This species is an endemic of the Middle East and adjacent eastern areas and its Iranian occurrence represents

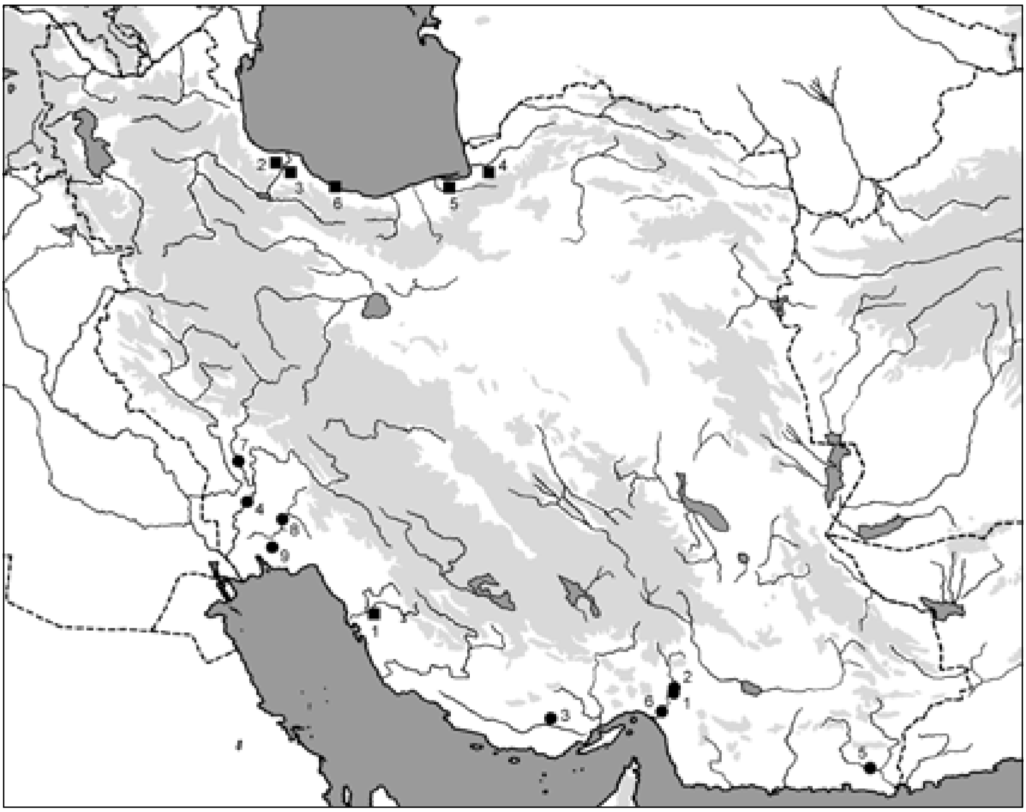


Fig. 134. Records of *Rhyneptesicus nasutus* (Dobson, 1877) (circles) and *Nyctalus noctula* (Schreber, 1774) (squares) in Iran.

Figs. 135, 136. *Rhyneptesicus nasutus* (Dobson, 1877) from Pir Sohrab (Baluchestan) (left) and from Chahar Dahaneh (Hormozgan) (right). Photos by A. Reiter.

a centre of its whole distribution range, stretching from south-western Arabia through Oman, Iraq and Iran to southern Pakistan and Afghanistan (Horáček et al. 2000).

DeBlase (1980) reported five localities of *R. nasutus* from two separate desert areas of southern Iran, Mesopotamian lowlands (Khuzestan) and lowlands at the Strait of Hormuz (Hormozgan); new records confirmed separation of these two areas of occurrence and added one site in a third area, southern Baluchestan. These three regions are inhabited by two subspecies of *R. nasutus* (see below); *pellucens*, present in Iraqi and Iranian Mesopotamia, and *nasutus*, occurring from southern Iran (Hormozgan) to southern Pakistan and Afghanistan (DeBlase 1980, Harrison & Bates 1991, Bates & Harrison 1997). While the occurrence in Khuzestan represents the easternmost part of the distribution range of the *pellucens* subspecies, the occurrence in Hormozgan creates the western margin of the distribution range of the nominotypical subspecies. The new evidence from Baluchestan documents connection between the Hormozgani and Pakistani parts of the range of the latter form (see Mahmood-ul-Hassan et al. 2009). In the south of Iran, over the Strait of Hormuz, the distribution of *R. nasutus* continues to Oman, where another subspecies (*batinensis*) occurs though.

Field notes. In all cases – where proper information is available – the records of *Rhyneptesicus nasutus* in Iran represent bats caught at their foraging grounds. No roost of *R. nasustus* is known from Iran and no osteological remains are available.

Perhaps an indirect indication of finding from a roost is represented by the report by Etemad (1973) from Olbuhardan near Bandar Mahshahr (Khuzestan), where two adult females were presented to him by villagers on 27 March; most probably, the local people collected these bats from a roost (in the village?) rather than during their foraging.

At three sites, foraging individuals of *R. nasutus* were shot. The first of these records was reported by Thomas (1905), five males were caught in Ahwaz (Khuzestan) on 28 March 1905; DeBlase (1980: 188) added the following information concerning the respective BMNH specimens: "The tags on all of these specimens say "common in town" and on the tag of one of the specimen is the note, "Shot in the town where they were common. 11 shot one evening all ♂."

DeBlase (1971a) reported on two records of *R. nasutus*, when the bats were shot during their foraging activity; these findings were specified in details by DeBlase (1980: 188). One record was made in the Khuzestan province, when "Ten *E. nasustus* were shot […] as they flew along

Table 26. Basic biometric data on the examined Iranian samples of *Rhyneptesicus nasutus* (Dobson, 1877) and *Hypsugo savii* (Bonaparte, 1837). For abbreviations see p. 171

	Rhyneptesicus n. nasutus					*Rhyneptesicus n. pellucens*					*Hypsugo savii*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	8	**51.3**	47	56	3.196	–	–	–	–	–	4	**49.8**	45	55	4.272
LCd	8	**46.0**	43	49	1.852	–	–	–	–	–	4	**40.0**	37	43	2.582
LAt	8	**38.39**	37.2	39.9	0.861	3	**36.27**	35.5	37.2	0.862	11	**34.61**	32.9	36.7	1.161
LA	8	**14.03**	13.7	14.4	0.276	–	–	–	–	–	4	**14.20**	12.2	15.2	1.354
LT	8	**5.90**	5.1	6.4	0.407	–	–	–	–	–	4	**5.50**	5.4	5.7	0.141
LCr	7	**13.10**	12.81	13.39	0.215	3	**13.14**	12.93	13.38	0.227	6	**13.13**	12.83	13.62	0.325
LCb	7	**12.77**	12.45	13.18	0.287	3	**12.78**	12.48	13.22	0.389	7	**12.68**	12.26	13.23	0.342
LaZ	6	**8.79**	8.53	8.98	0.151	3	**8.65**	8.39	8.82	0.229	6	**8.59**	8.43	8.72	0.114
LaI	7	**3.00**	2.75	3.13	0.131	3	**2.81**	2.69	2.88	0.102	7	**3.36**	3.16	3.53	0.116
LaInf	7	**4.34**	4.27	4.43	0.067	3	**4.28**	4.02	4.48	0.235	7	**4.35**	4.23	4.52	0.106
LaN	7	**6.31**	6.17	6.42	0.077	3	**6.35**	6.19	6.58	0.204	7	**6.61**	6.46	6.81	0.144
LaM	7	**6.90**	6.82	7.11	0.110	3	**7.04**	6.91	7.13	0.114	7	**7.30**	7.08	7.62	0.182
ANc	7	**4.54**	4.42	4.75	0.134	3	**4.52**	4.34	4.64	0.161	6	**4.49**	4.36	4.74	0.148
LBT	7	**2.96**	2.78	3.16	0.135	–	–	–	–	–	7	**3.23**	2.96	3.42	0.164
CC	7	**4.28**	4.11	4.40	0.131	3	**4.25**	4.04	4.39	0.187	7	**4.15**	3.98	4.39	0.160
M^3M^3	7	**5.93**	5.68	6.17	0.163	3	**5.90**	5.68	6.02	0.193	7	**5.61**	5.42	5.91	0.183
CM^3	7	**4.95**	4.72	5.13	0.141	3	**4.77**	4.65	4.92	0.137	7	**4.45**	4.28	4.61	0.134
LMd	7	**9.41**	9.24	9.59	0.135	3	**9.27**	9.11	9.41	0.151	7	**9.16**	8.83	9.71	0.324
ACo	7	**3.22**	3.12	3.37	0.091	3	**3.25**	3.18	3.35	0.089	7	**2.78**	2.64	2.93	0.089
CM_3	7	**5.20**	4.88	5.40	0.171	3	**5.01**	4.82	5.24	0.214	7	**4.76**	4.58	4.89	0.116
CM^3/LCb	7	**0.407**	0.392	0.420	0.010	3	**0.392**	0.381	0.397	0.009					
LMd/LCb	7	**0.737**	0.716	0.755	0.014	3	**0.726**	0.712	0.744	0.017					
CC/CM^3	7	**0.865**	0.842	0.890	0.017	3	**0.891**	0.851	0.931	0.040					

the Jahari River near Meshrageh [Khuzestan] between 17 and 21 October [1968]. This sample included three adult males, two adult females, and three males and two females that, by epiphysial ossification, appear to be young of the year. These bats began flying while it was still light. They flew low and erratically, often dipping down to almost ground level, and flew earlier, lower, and more slowly than the three species of *Rhinopoma* collected at the same locality." Four other bat species were shot at this place along with *R. nasutus*, one *Rhinopoma microphyllum*, two *R. muscatellum*, nine *R. hardwickii*, and one *Pipistrellus kuhlii*. Another record of *R. nasutus* was made at Minab in the Hormozgan province, when "an adult female [was] shot as it flew low over the Dozdan River at dusk on 30 November 1968." (DeBlase 1980: 188). *Taphozous perforatus* and *Tadarida teniotis* were shot at the latter place together with *R. nasutus*.

Five individuals of *R. nasutus* were netted above a pool of remaining water in the dry bed of the Kaju river at Pir Sohrab near Chabahar (Baluchestan) on 12 April 2000 (Fig. 148). The species was recorded there along with five other species of bats, see under *Hypsugo arabicus*, also for details concerning the site description. Three individuals of *R. nasutus* were netted above a pool in an artificial hole in a river bed next to a small village of Chahar Dahaneh near Dehbarez (Hormozgan) on 17 April 2000. Besides *R. nasutus*, individuals of *Otonycteris hemprichii* and *Eptesicus pachyomus* were also netted at this site, see under the latter species for description of the site.

At two sites, echolocation calls of *R. nasutus* were detected and recorded. On 9 October 2011, calls of several foraging individuals were recorded at a water reservoir in the village of Zangard near Bastak (Hormozgan) and in a small palm oasis ca. 2 km east of the village. The village and the oasis were situated in an open area of stone desert at the foothills of an arid rocky range (in the oasis, also individuals of *Rousettus aegyptiacus* were netted and foraging calls of *Asellia tridens* and *Pipistrellus kuhlii* were detected). Calls of several foraging *R. nasutus* were recorded in the valley of the Radul river near Kuchandar (Hormozgan) on 11 October 2011. The bats foraged above the riparian vegetation along the river during sunset and several tens of minutes after it. Calls of *Pipistrellus kuhlii* were detected at the same site.

Evidence of reproduction of *R. nasutus* is available from two sites in Iran. Three pregnant females were caught at Pir Sohrab on 12 April, two contained one foetus each and one female two foeti of the crown-rump lengths 7.7–13.7 mm (mean 10.4 mm). Two lactating females were collected at Chahar Dahaneh on 17 April. These records indicate the occurrence of parturitions in populations of (at least) south-eastern Iran in mid-April. This roughly concurs with the limited evidence from Arabia (Harrison & Bates 1991), a female in an early stage of pregnancy was found in north-eastern Oman in the late March.

Material examined. 3 ♂♂ (BMNH 5.10.4.2, 5.10.4.4, 5.10.4.6 [S+B], type series of *Vespertilio matschiei pellucens* Thomas, 1905), Ahwaz, Karun River, Arabistan, 220 ft. [Khuzestan Prov.], 28 March 1905, leg. R. Woosnam; – 1 ♂, 2 ♀♀ (NMP 48437, 48438 [S+A], 48439 [A]), Chahar Dahaneh (Hormozgan Prov.), 17 April 2000, leg. P. Benda & A. Reiter; – 1 ♂, 4 ♀♀ (NMP 48404–48408 [S+A]), Pir Sohrab (Sistan va Baluchestan Prov.), 12 April 2000, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Rhyneptesicus nasutus* are shown in Table 26. For the material examined see above.

R. nasutus is a polytypic species, it includes four subspecies in geographically separated ranges that all meet in the Middle East (Corbet 1978, Koopman 1994, Horáček et al. 2000, Simmons 2005, Juste et al. in press); *R. n. nasutus* (Dobson, 1877) living in south-western Pakistan, eastern Afghanistan, and south-eastern Iran, *R. n. matschiei* (Thomas, 1905) from south-western Arabia, *R. n. pellucens* (Thomas, 1905) occurring in Iranian and Iraqi Mesopotamia, and *R. n. batinensis* (Harrison, 1968) in eastern Arabia.

Two of these forms occur in three separate regions of Iran (see Distribution), the nominotypical subspecies in Hormozgan and south-eastern Baluchestan (type locality: little east of Rohri, Upper Sind [Pakistan]; Blanford 1888: 304), and *R. n. pellucens* in Khuzestan (type locality: Ahwaz, Karun R., S.W. Persia [Khuzestan, Iran]; Thomas 1905: 520). These two subspecies conform in most of their dimensions to each other, although the type series of *R. n. pellucens* showed a relatively shorter and broader rostrum than the Iranian specimens of *R. n. nasutus* (Table 26). However, their main difference remains in the colouration of wing membranes; in *R. n. nasutus* it is dark greyish-brown and only slightly paler at distal margins of the membrane, in *R. n. pellucens* it is very pale and translucent, although very dark just along the wing bones (see DeBlase 1980: 153, Fig. 98). The newly collected bats from Hormozgan and Baluchestan conform in size and colouration (Figs. 135, 136) to descriptions of the previously collected *R. n. nasutus* from Hormozgan (DeBlase 1980) as well as of the samples of this form from Pakistan (Dobson 1877, Bates & Harrison 1997, Roberts 1997) and Afghanistan (Gaisler 1970).

The molecular genetic analysis using both mitochondrial and nuclear markers carried out by Juste et al. in (press) confirmed the subspecific division of *R. nasutus* as justified; they validated three subspecies (*nasutus*, *matschiei*, *batinensis*) which were well separated by genetic traits, the fourth subspecies (*pellucens*) was not available for sampling. The divergences between subspecies were relatively deep, they ranged between 3.24–6.12% of the uncorrected *p* distances (3.24% *nasutus* : *matschiei*; 6.12% *nasutus* : *batinensis*; 4.86% *matschiei* : *batinensis*; Juste et al. in press).

Echolocation. *Rhyneptesicus nasutus* produces frequency-modulated calls combined with an almost constant-frequency end part. In Iran, we recorded three call sequences of *R. nasutus* at one

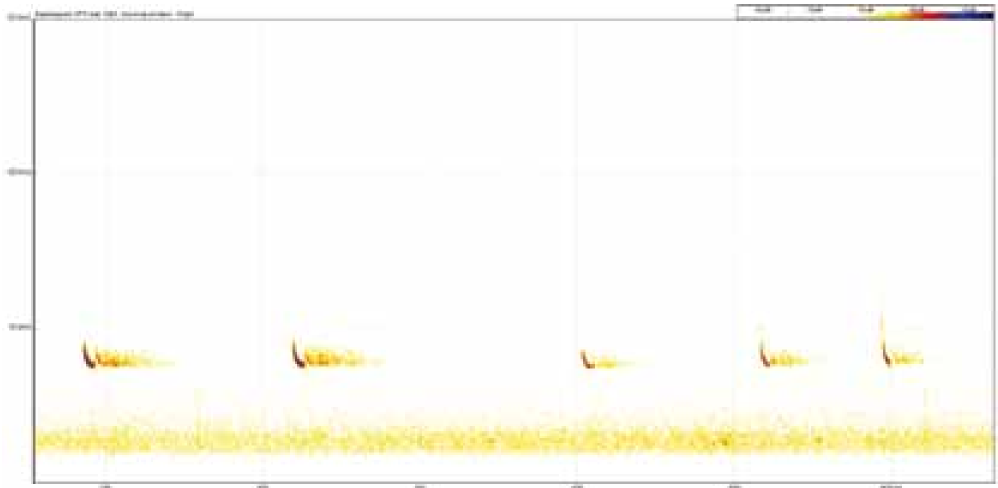


Fig. 137. Spectrogram of echolocation calls of *Rhyneptesicus nasutus* (Dobson, 1877); an individual foraging in the Radul river valley at Kuchandar (Hormozgan).

site (Fig. 137); the values of basic echolocation parameters are given in Table 3. They show the start frequencies at ca. 40–58 kHz and the end frequencies at ca. 36–38 kHz, respectively. These values are very similar to those obtained from *R. nasutus* in Oman (own unpubl. data). The frequencies of maximum energy obtained from Iranian and Omani bats were between 37–40 kHz.

Feeding ecology. *Rhyneptesicus nasutus* is a small-sized bat of the most arid areas of the Middle East and the western part of the Indian subcontinent, no data on its diet composition and foraging strategy are available. Four samples of diet from Oman and Yemen were dominated by Coleoptera (66–95% of volume; own unpubl. data).

From Iran, we analysed the content of seven digestive tracts collected at two sites. Five digestive tracts from specimens collected at Pir Sohrab (Baluchestan) were dominated by Coleoptera (60% of volume), especially Scarabaeidae (25%) and Carabidae (25%); other identified Coleoptera families were Ipidae (5%) and Tenebrionidae (5%). The remaining diet items were Heteroptera (13%), Blattodea (9%), Auchenorrhyncha (8%), Hymenoptera (5%) and Lepidoptera (5%). Two digestive tracts collected at Chahar Dahaneh (Hormozgan) contained mostly ants (95% and 100% vol, respectively) and brachyceran Diptera (5% and 0% vol, respectively). The available data on the diet of *R. nasutus* indicate preference of beetles and also an opportunistic exploitation of swarming ants.

Hypsugo savii (Bonaparte, 1837)

Records. **Original data**: A r d a b i l: Arbab Kandi [1], 33 km ENE of Meshginshahr, at the Qarah Su river, 5 June 2006: det. calls of 1 ind. – Â z a r b â i j a n - e G h a r b i: rocky valley 7 km SE of Chuplu [2], 10 km NW of Takab, 18 October 2011: det. & rec. calls of 1 foraging ind. – F â r s: valley 10 km NW of Hesar [3], 66 km NW of Marv Dasht, above a stream, 5 October 2011: net. 4 ma, 1 fa, coll. 1 m (NMP 93867; Fig. 139). – G i l â n: rocky valley 3 km SSE of Ziaz [4], 32 km S of Rudsar, 2 June 2006: obs. & det. min. 1 ind. – K h o r a s â n - e R a z a w i: valley 5 km W of Chenarbu [5], 13 km SE of Qalandar Abad, 17 May 2006: det. min. 1 ind.; – valley 5 km S of Mina, 20 km SW of Dargaz [6], 22 May 2006: net. 1 ma (NMP 90824; Fig. 140; cf. Benda et al. 2006); – Rubat-e Sharaf caravanserai [7], 54 km SW of Sarakhs, ruins, 18 May 2006: net. 1 ma (NMP 90790; Fig. 141; cf. Benda et al. 2006). – K h o r a s â n - e S h o m â l i: valley 8 km

N of Eshq Abad [8], 22 km N of Ashkhaneh, bridge crevice, 12 May 1997: coll. 1 ma (NMP 48118; cf. Benda et al. 2006); – valley 7 km W of Kalatah Chenar [9], 27 km N of Ashkaneh, 25 May 2006: obs. & det. 5+ inds. – M â z a n d a r a n: rocky valley 3 km NW of Nach [10], 18 km E of Baladeh, 30 May 2006: obs. & det. min. 1 ind.; – Reineh, near Mt. Damâvand [11], crevice in a boulder, 23 December 2011: obs. & exam. 1 ind. (Fig. 142). – Y a z d: Kharanaq [12], caravanserai, June 2005: obs. & photo 1 ind. – **Published data**: A r d a b i l: Qarah Âqâj, 35 km W Germi [13], ceiling of water channel under road, 13 November 2006: coll. 1 f (Sheikh-Jabbâri 2008); – Tâzeh Kand-e Angut [14], 28 km W Germi, ceiling of water channel under road, 13 November 2006: coll. 2 f (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: 1.6 km SE of Maku [15], a cave about 1 km. SE of the town, resp. Zangamar River Cave, 28 July 1968: net. 1 fa, FMNH (DeBlase 1971a, 1980). – Â z a r b â i j a n - e S h a r q i: Jazireh-ye-Quyun [= Kabudan] [16], an island in Lake Rezaiyeh [= Oromiyeh], 11 November 1969: net. 1 fa, UMM (Neuhauser & DeBlase 1974, DeBlase 1980). – C h a h â r M a h â l v a B a k h t i â r i: Sar Dasht, near Lordegan [17], mountain valley, over a small jube, 1 October 1968: shot 1 ms, FMNH (DeBlase 1971a, 1980). – K h o r a s â n - e R a z a w i: Chelmir [18], over a stream, July 1968: net. 2 m, 5 f, IPHR (Farhang-Azad 1969a), 1969: 5 m, 10 f, 13 inds., IPHR (Farhang-Azad 1970a ex DeBlase 1980). – S i s t â n v a B a l u c h e s t â n: Kusheh [19], western slope of the Kuh-e Taftan Mt., 2250–2600 m, 13 June 1975: 1 ma, 2 fa, MHNG (de Roguin 1988).

Distribution. *Hypsugo savii* ranks among a moderately frequent bats in Iran, 19 record sites are available from different parts of the country (Fig. 138). DeBlase (1980) reported only four records of this bat in Iran, however, these very few sites roughly delineated the species distribution range

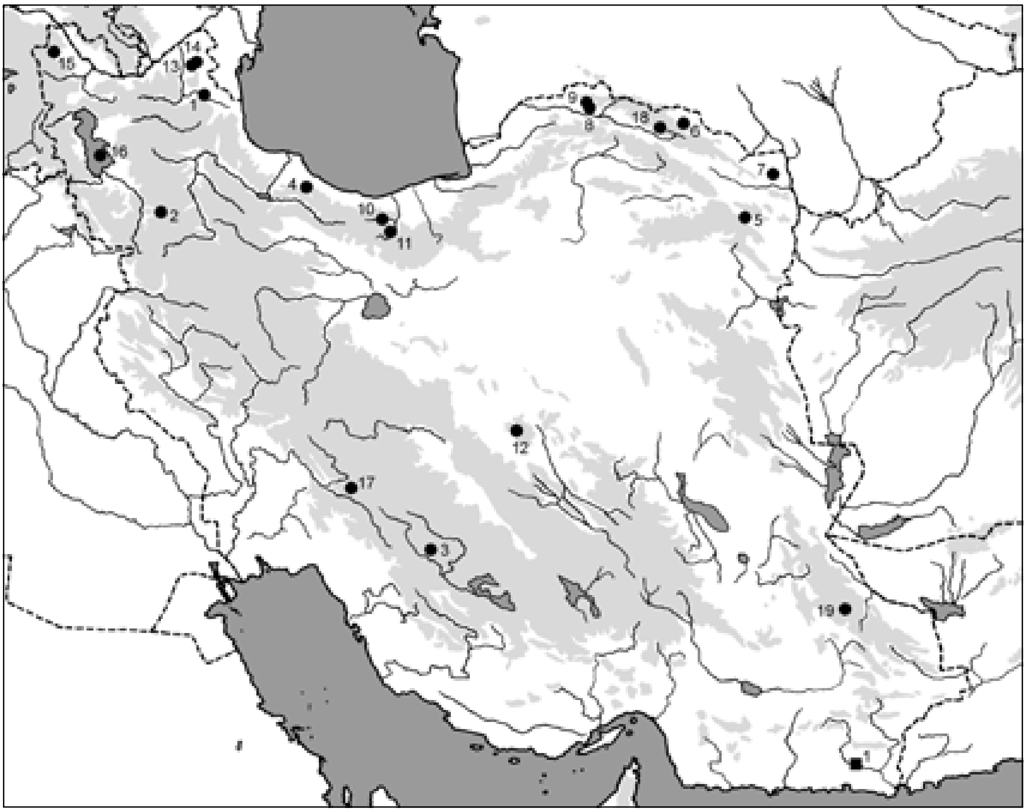


Fig. 138. Records of *Hypsugo savii* (Bonaparte, 1837) (circles) and *H. arabicus* (Harrison, 1979) (square) in Iran.

in the country reviewed here. Most of the records of *H. savii* in Iran (79%) are concentrated to a belt of north-Iranian mountains in the provinces of Azarbaijan, Ardabil, Gilan, Mazanadaran and Khorasan. Only four localities are known from the southern part of Iran: two from the central Zagros Mts. (Sar Dasht, Hesar), one from the Dasht-e Kavir desert and one from Baluchestan (Kusheh) (Fig. 138). With an exception of the latter two localities, all record sites of *H. savii* in Iran lie in the Mediterranean climatic zone or in close adjacent areas. However, although the Baluchestani site is situated in a rather arid region, it lies in a quite elevated position of over 2200 m a. s. l. (de Roguin 1988). Generally, *H. savii* is an apparent inhabitant of upland areas in Iran, with a relatively mild climate, similarly as in other parts of the Middle East (see Harrison & Bates 1991).

The Iranian area of *H. savii* occurrence lies in the centre of the Asian part of the species distribution range (Horáček et al. 2000). In the north-east, this range continues to West Turkestan and Afghanistan (Neuhauser & DeBlase 1974, Strelkov et al. 1978, Bates & Harrison 1997); in the north-west, it continues to Transcaucasia and eastern Turkey (Benda & Horáček 1998, Rahmatulina 2005). However, in all these adjacent regions *H. savii* belongs to uncommon bats. This species still remains unknown from Iraq and Pakistan (see Benda et al. 2006, Mahmood-ul-Hassan et al. 2009), although some of its Iranian localities lie in close proximity to the territories of these countries (Fig. 138). The Iranian locality at Kuh-e Taftan Mt. in Baluchestan (de Roguin 1988) represents the southernmost record within the whole distribution range of the species.

Field notes. *Hypsugo savii* was recorded in Iran mostly at its foraging grounds, only few records from its roosts are available. No osteological remains were found.

Only solitarily roosting individuals of *H. savii* were found in Iran, no records of colonies were made. Sheikh-Jabbâri (2008) reported two findings of solitary bats in ceiling fissures of water channels under the road near Germi (Ardabil). Both closely positioned records – some 7 km apart – were made on 13 November 2006, one female was present in the channel at Qarah Aqaj and two females in the channel at Tazeh Kand-e Angut. No other bat species was recorded in these shelters. One adult male was found in a crevice under a bridge over a valley at Eshq Abad near Ashkhaneh in the Kopetdagh Mts. (Khorasan) on 12 May 1997. An individual of *H. savii* was found roosting in a caravanserai at Kharanaq (Yazd) in June 2005. Another individual was observed in a crevice in a boulder at Reineh near Mt. Damâvand in the Alborz Mts. (Mazandaran) on 23 December 2011 (Fig. 142). The latter record is perhaps related to a hibernating bat.

Two other records of *H. savii* represent undirect indications of its roosts in Iran. DeBlase (1971a) reported on netting of a bat at a cave 1.6 km south-east of Maku (Azarbaijan) on 28 July 1968; DeBlase (1980: 230–231) added the following details: "The Maku specimen is an adult female, mistnetted at 10:00 p.m. on 28 July 1968 as it flew out of a cave near the Zangamar River about 1.6 km. E of town. It hung quietly in the net and did not move or make a sound." However, at another site, DeBlase (1980: 341–342) wrote: "On the evening of 28 July I set a mistnet at the entrance to this cave [= Zangamar River Cave]. I saw a few *M*[*yotis*]. *blythi* fly out of the cave. Most avoided the net, but one was captured. The net also captured a *Pipistrellus* [= *Hypsugo*] *savii* that was flying into the cave." Anyway, whether the bat flew out of the cave or into the cave, the habitat most probably represents a roost of *H. savii*. In 1962, Lay (1967) collected also *Rhinolophus euryale*, *R. mehelyi*, and *Miniopterus pallidus* from this cave. An adult male of *H. savii* was caught into a net installed to the inner yard of the Rubat-e Sharaf caravanserai near Sarakhs (Khorasan) on 18 May 2006 (Fig. 116). Almost certainly, the bat roosted in a fissure between bricks of this historical monument and fell into the net when leaving its roosting place through a corridor of the caravanserai during evening emergence. Besides this bat, ten individuals of *Eptesicus serotinus* were also collected from the monument.




Figs. 139–142. Portraits of *Hypsugo savii* (Bonaparte, 1837) from Iran. Photos by A. Reiter and K. Faizolahi. 139 (top left) – Hesar (Fars). 140 (top right) – Mina (Khorasan). 141 (bottom left) – Rubat-e Sharaf caravanserai (Khorasan). 142 (bottom right) – Reineh (Mazandaran).

At six sites, *H. savii* was netted during its foraging activity, and at six other sites, the typical echolocation calls of this bat were detected. The first such records were published by Farhang--Azad (1969a, 1970a), who caught seven individuals into a net installed over a stream at Chelmir in the Kopetdagh Mts. (Khorasan) in July 1968, and 28 individuals in 1969. DeBlase (1971a) reported on shooting of one individual at Sar Dasht near Lordegan in the south-western Zagros Mts. (Chahar Mahal va Bakhtiari); DeBlase (1980: 231) specified this record as follows: "The Sar Dasht specimen is a male (perhaps a young of the year) shot on the evening of 1 October 1968 as it flew over a small jube in the mountain valley near the village." An adult female *H. savii* was netted on the Kabudan island in Lake Oromiyeh (Azarbaijan) on 11 November 1969 (Neuhauser & DeBlase 1974). De Roguin (1988) reported (possible) netting of three individuals of *H. savii*, made at Kusheh on the western slope of the Kuh-e Taftan Mt. (Baluchestan) on 13 June 1975, at the altitude between 2250–2600 m a. s. l. (see under *Rhinolophus blasii* for a brief description of this unusual locality). An adult male was netted above a pool at a thermal spring situated in a small valley some 5 km south of Mina on the northern slope of the Kopetdagh Mts. near Dargaz

(Khorasan) on 22 May 2006; the site was surrounded by dry steppes and pastures. Five *H. savii* were caught into a net installed above a small stream in a pasture valley near Hesar (Fars) on 5 October 2011 (Fig. 143).

Echolocation calls of *H. savii* were detected in the mountain steppe valley at Chenarbu near Qalandar Abad (Khorassan) on 17 May 2006 (Fig. 72), in the valley at Kalatah Chenar near Ashkaneh in the Kopetdagh Mts. (Khorasan) on 25 May 2006, in the rocky valley at Nach near Baladeh in the Alborz Mts. (Mazandaran) on 30 May 2006, in the rocky valley at Ziaz near Rudsar (Gilan) on 2 June 2006, above the Qarah Su river at Arbab Kandi near Meshginshahr (Ardabil) on 5 June 2006, and in the rocky valley at Chuplu near Takab (Azarbaijan) on 18 October 2011.

In most of these sites, *H. savii* was documented to forage along with other bat species. During two resaearch seasons at Chelmir, Fahrang-Azad (1969a, 1970a) netted also *Rhinolophus ferrumequinum*, *R. blasii*, *Myotis blythii*, *M. emarginatus*, *Eptesicus serotinus*, *E. ognevi*, *Pipistrellus pipistrellus*, *Nyctalus leisleri*, *Otonycteris leucophaea*, *Miniopterus pallidus*, and *Tadarida teniotis*. *Vespertilio murinus* and *Pipistrellus pipistrellus* were also shot at Sar Dasht (DeBlase 1980). On the Kabudan island, *Pipistrellus kuhlii* and *Miniopterus pallidus* were also documented. De Roguin (1988) reported collection of *Rhinolophus blasii*, *Eptesicus bottae*, and *Tadarida teniotis* along with *H. savii* at Kusheh. *Myotis blythii* and *Miniopterus pallidus* were also netted at Mina. Near Hesar, *Myotis blythii*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis* were also netted. *Myotis blythii* and *Pipistrellus pipistrellus* were netted at Chenarbu, where calls of *H. savii* were detected. Calls of *Pipistrellus pipistrellus* and *Tadarida teniotis* were detected together with calls of *H. savii* at Kalatah Chenar. Calls of *Tadarida teniotis* were also detected at Nach near Baladeh and those of *Pipistrellus pipistrellus* at Arbab Kandi. At Chuplu, where calls of *H. savii* were detected in 2011, individuals of *Rhinolophus ferrumequinum*, *R. hipposideros*,

Fig. 143. Dry pastures with scattered oaks in the valley near Hesar (Fars); a foraging habitat of *Myotis blythii*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis*. Photo by A. Reiter.

Myotis schaubi, and *Plecotus macrobullaris* were recorded in 1998. Hence, in Iran *H. savii* was documented to occur syntopically with a high number of 19 bat species, most frequently it was found together with *Pipistrellus pipistrellus*, and very frequently also with *Myotis blythii*, *Miniopterus pallidus*, and *Tadarida teniotis*.

No data on reproduction of *H. savii* are available from Iran.

Material examined. 1 ♂ (NMP 48118 [S+A]), Eshq Abad (Khorasan-e Shomali Prov.), 12 May 1997, leg. P. Benda; – 1 ♂ (NMP 93867 [S+A]), Hesar (Fars Prov.), 5 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 2 ♀♀ (MNHG 1703.92–1703.94 [S+A]), Kusheh, Kuh-e Taftan Mt. [Sistan va Baluchestan Prov.], 13 June 1975, leg. M. Desfayes & J.-C. Praz; – 1 ♂ (NMP 90824 [S+A]), Mina (Khorasan-e Razawi Prov.), 22 May 2006, leg. P. Benda & A. Reiter; – 1 ♂ (NMP 90790 [S+A]), Rubat-e Sharaf caravanserai (Khorasan-e Razawi Prov.), 18 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Hypsugo savii* are shown in Table 26. For the material examined see above.

Traditionally, *H. savii* has been considered a rather polytypic species and the populations of the Middle East, Crimea, Caucasus region, and West Turkestan have been traditionally assigned to the form *H. s. caucasicus* (Satunin, 1902) (type locality: Tiflis [= Tbilisi, Georgia]; Satunin 1902: 462) by most authors (see the reviews by Horáček & Benda 2004 and Benda et al. 2006); naturally, this is also true for bats of the Iranian populations (Neuhauser & DeBlase 1974, DeBlase 1980, de Roguin 1988). The main differences between this form and the nominotypical subspecies from Europe were supposed to include paler pelage colouration and the tendency to lack the small upper premolar, P^3 (Kuzâkin 1950, 1965, Harrison 1961). However, both these characters are very variable even within the nominotypical populations (Kahmann 1958, Harrison 1961, Dulic 1978, Dulić & Mrakovčić 1984, Arlettaz et al. 1993, Horáček & Benda 2004). Anyway, Benda et al. (2006) showed these two characters to be invalid for differentiation of *savii* s.str. from *caucasicus*, since in ca. two-thirds of the European specimens the dorsal pelage colouration was yellowish to pale brown (dorsal hairs dark brown to blackish at their bases, with yellowish, sandy and/or golden hair tips) and in ca. two-thirds of the Middle Eastern specimens (including the Iranian ones) both small upper premolars were present (see Benda et al. 2006: 186, Table 27), i.e. with a similar frequency of occurrence as in European populations. Similarly, the differences in skull and/or body size between European and Middle Eastern populations noted by some authors (e.g. Kuzâkin 1950, DeBlase 1980) were not confirmed by the comparison of more extensive sets of specimens (Benda et al. 2006: 183, Table 26). Thus, Benda et al. (2006) considered the morphological characters mentioned by various authors to be typical for European and for Middle Eastern populations as examples of an extremely broad variation rather than as an evidence of distinctness useful for subspecific division, and concluded that the morphological delimitation of taxa in the western Palaearctic was unsubstantiated. According to this opinion, the Iranian populations of *H. savii* belong to the nominotypical form (type locality: Pisa [Tuscany, Italy]; Bonaparte 1837 [sine pag.]).

The few examined specimens of *H. savii* from Iran exhibited a very similar colouration pattern (Figs. 139–142) as in other parts of the Middle East (see Benda et al. 2006). Both the dorsal and ventral pelages are bi-coloured; the proximal two-thirds of dorsal hairs are dark brown, distal parts dark beige, the latter colour giving the overall tinge to the dorsal pelage, slightly paler in some individuals. Proximal halves of the ventral hairs are dark brown, while their distal parts are creamy or whitish; skin of face, ears and wing membranes is very dark brown to blackish.

Recently, a hidden cryptic diversity has been found in *H. savii* in the circum-Mediterranean region, in the populations from Morocco, southern Europe, Turkey and the Levant (Ibáñez et al. 2006, Mayer et al. 2007, García-Mudarra et al. 2009). In total, four deeply divergent lineages

(>8% of genetic distance) were documented by analyses of various genes; the Moroccan lineage, south-west-European lineage (recorded from southern Iberia to Switzerland), Israeli lineage, and a lineage found in samples from south-eastern Europe and south-western Asia (Croatia, Greece, Turkey, Israel); all lineages were preliminarily interpreted as representing separate species. Mayer et al. (2007) and García-Mudarra et al. (2009) co-identified the latter lineage with *H. savii* s.str. and since this form was documented in the Levant (Israel) and Anatolia, it could also occur in Iran. However, Mayer et al. (2007) reported another lineage from Israel, differing in 13.8% of genetic distance from the nominotypical form, also collected in this country. Hence, as two species (in a tentative sense) of the *H. savii* complex were reported to occur in the Levant, both can theoretically occur also in Iran. However, this needs to be solved only by a molecular genetic analysis.

Echolocation. *Hypsugo savii* produces calls which are frequency-modulated in their initial phase and quasi-constant-frequency in the final phase, starting at ca. 47–55 kHz and ending at ca. 32–37 kHz. Maximum frequency range is between 30–40 kHz in the European populations (Zingg 1988, Russo & Jones 2002, Papadatou et al. 2008). A similar range of the peak frequency values was obtained also from the Syrian populations of *H. savii* (Benda et al. 2006). In Iran, we analysed echolocation calls of this bat from one site (Fig. 144), basic call values are given in Table 3. In general, our data conform to the previously published findings on this species.

Feeding ecology. *Hypsugo savii* is a small aerial hawker, hunting its prey along cliffs, above trees, in karst valleys etc., usually quite high above ground; however, circling 2–3 m above anthills and catching of the rising flying ants was also observed (Dietz et al. 2007). The diet analyses showed Lepidoptera, Diptera, Hymenoptera and Neuroptera to prevail in Switzerland (Beck 1995), while Homoptera, Heteroptera and smaller representatives of Lepidoptera were identified in samples from the Balkans and West Turkestan (Bauerová in Horáček & Benda 2004).

As far as the diet of the Middle Eastern populations of *H. savii* is concerned, Formicoidea, Heteroptera, Coleoptera and Lepidoptera were found to prevail in samples collected in Syria (Benda

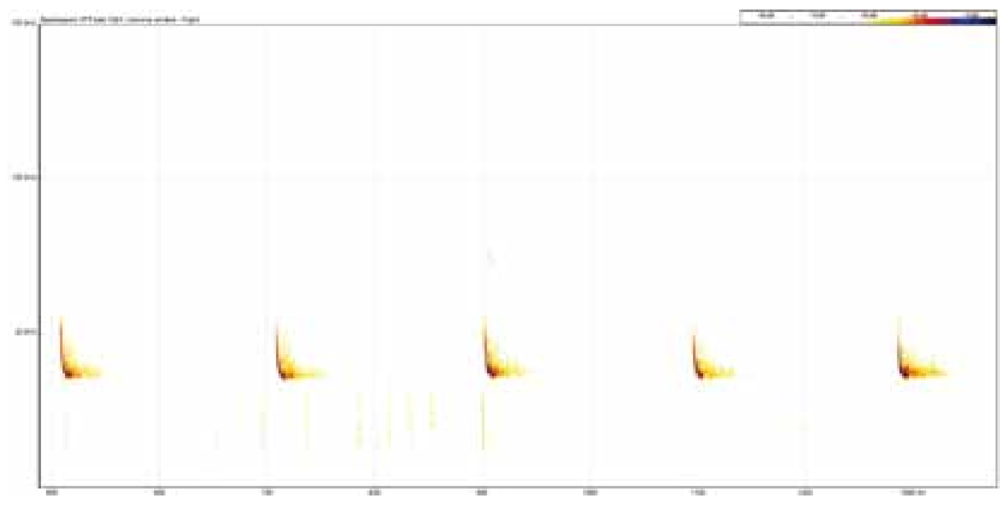


Fig. 144. Spectrogram of echolocation calls of *Hypsugo savii* (Bonaparte, 1837); an individual foraging in the valley near Hesar (Fars).

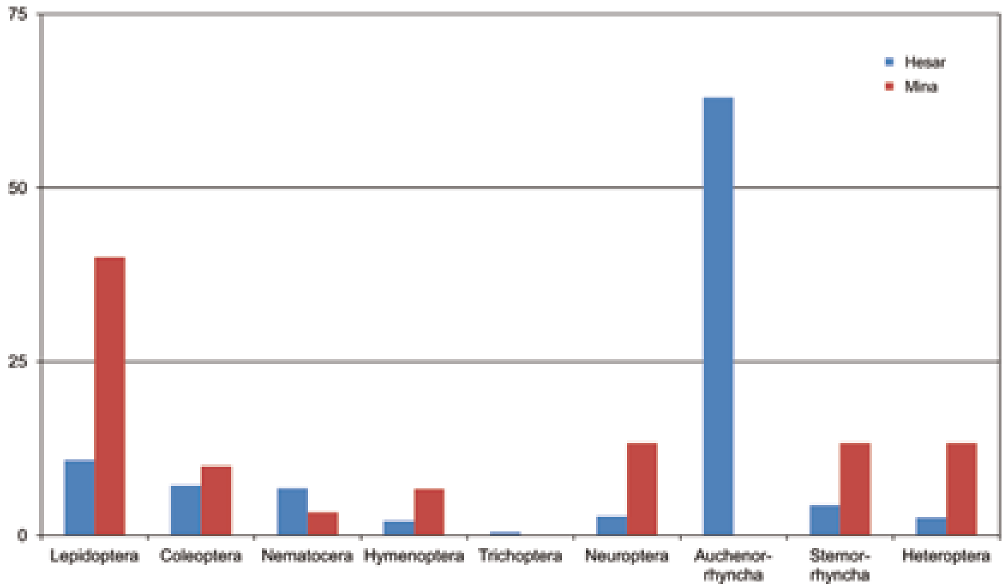


Fig. 145. Percentage volume of particular food items in the diet of *Hypsugo savii* (Bonaparte, 1837) in Iran. Material analysed: Hesar (62 faecal pellets from five bats), Mina (three pellets from one bat).

et al. 2006), Coleoptera and Formicoidea were identified as major diet components in Turkey (Whitaker & Karataş 2009), and Hymenoptera, Coleoptera and Heteroptera were shown to be the prevailing food items in the samples from Lebanon and Greek islands (own unpubl. data).

From Iran, two sets of diet samples of *H. savii* were analysed (Fig. 145); altogether 65 faecal pellets from Hesar (Fars) and Mina (Khorasan). A more representative sample from Hesar showed Auchenorrhyncha as the most important food item, being complemented by small proportions of small Lepidoptera, Coleoptera (mainly Staphilinidae), nematoceran Diptera (Chironomidae, Culicidae), Sternorrhyncha (Aphididae), Neuroptera (Chrysopidae, Hemerobiidae), Heteroptera, Hymenoptera (small Apocrita), and Trichoptera. In the faeces from Mina, small Lepidoptera prevailed and Neuroptera (Chrysopidae), Sternorrhyncha (Aphididae), Heteroptera, Coleoptera, and nematoceran Diptera (Culicidae) represented much smaller proportions of the diet volume (Fig. 145).

H. savii seems to be a very flexible bat that is able to feed opportunistically on many different types of temporarily abundant prey, which may consequently prevail markedly in its diet.

The material of the bat diet samples collected at Hesar (Fars) enabled a more detailed comparison of trophic niches in three small-sized bats applying aerial hawking (*Hypsugo savii*, *Pipistrellus pipistrellus*, *P. kuhlii*). Due to a similar foraging strategy and insignificant differences in body size, similar features in their diets could be anticipated. On the other hand, certain resource partitioning was also likely to be observed, since a difference in niche parameters in co-occurring animals is generally expected to enable their syntopic coexistence (e.g. MacArthur & Pianka 1966, Siemers & Schnitzler 2004). Nevertheless, very similar diet compositions were surprisingly recorded within the Hesar bat community (Fig. 146). It may indicate that collecting of the diet samples was carried out in a period of very high abundance of a preferred prey type, which overrode the effects of

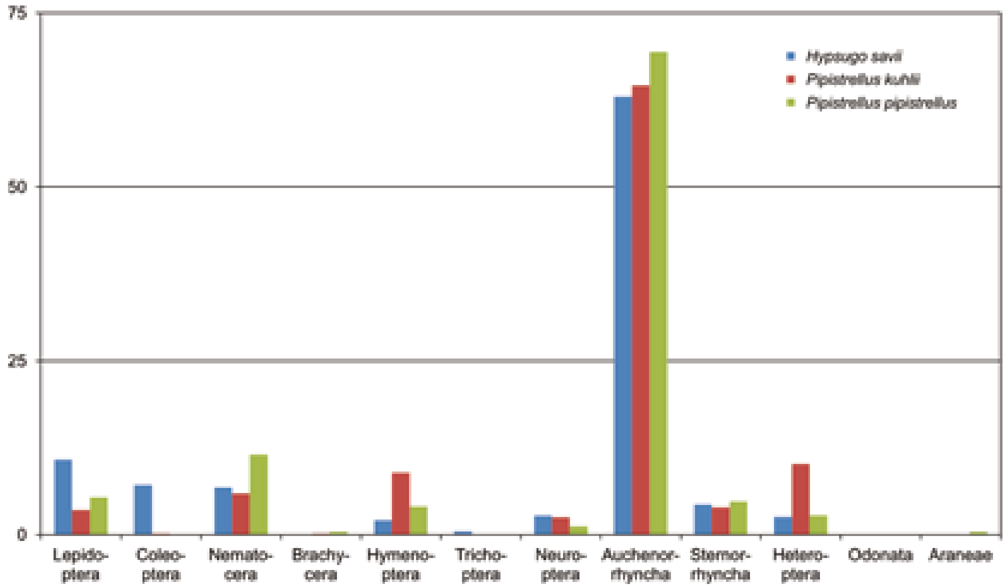


Fig. 146. Percentage volume of particular food items in the diet of *Hypsugo savii* (Bonaparte, 1837), *Pipistrellus pipistrellus* (Schreber, 1774) and *P. kuhlii* (Kuhl, 1817) collected at Hesar (Fars) on 5 October 2011. Material analysed: *H. savii* (62 faecal pellets / from five bats), *P. pipistrellus* (164 / 13), *P. kuhlii* (123 / 10).

Fig. 147. *Hypsugo arabicus* (Harrison, 1979) from Pir Sohrab (Baluchestan). Photo by A. Reiter.

resource partitioning (on the contrary, effective resource partitioning was observed in forest foliage gleaners; see Andreas et al. 2012b). It can be hypothesised that the spatially more diversified and cluttered forest environment may result in significant diversification of a bat community, where specialisation trends lead to more obvious resource partitioning as compared to a homogeneous environment of open air space in dry steppe habitats of southern Iran.

Hypsugo arabicus (Harrison, 1979)

RECORDS. **Original data**: S i s t â n v a B a l u c h e s t â n: Pir Sohrab [1], 54 km NE of Chabahar, above a pool, 12 April 2000: net. 4 ma, 2 fa, 6 fG (NMP 48409–48420; Fig. 147; cf. Benda et al. 2008, 2011b).

DISTRIBUTION. *Hypsugo arabicus* is a very rare bat species in Iran – only one record site is available from the south-eastern corner of the country (Fig. 138). Until this new record from the Mekran region of southern Baluchestan was made (preliminary reported by Benda et al. 2002, 2008, 2011b), *H. arabicus* had been considered an endemic of the Hajjar Mts. in north-eastern Oman (Harrison & Bates 1991, Koopman 1993, Horáček et al. 2000). The Baluchestani locality thus represents the easternmost occurrence spot within the whole range of *H. arabicus* and also the only site out of the Arabian peninsula. However, since in its limited range in Oman this species was found to be an abundant bat by a recent survey (about 20 localities are known; cf. Benda et al. 2011b and own unpubl. data), its more common occurrence in the Hormozgan province and southern Baluchestan of Iran is also quite likely.

FIELD NOTES. *Hypsugo arabicus* was recorded at one site in Iran only – twelve individuals were caught into a net stretched above a pool of remaining water in the dry valley of the Kaju river at Pir Sohrab near Chabahar (Baluchestan) on 12 April 2000 (Fig. 148). The pool was situated in a deep meander of the valley, it was a single remain of water in the river bed for several hundred metres in both directions of the course. It was ca. 12–15 m wide and served as a watering site for

Fig. 148. Pool in the Kaju river valley at Pir Sohrab (Baluchestan), a foraging habitat of *Rhyneptesicus nasutus*, *Hypsugo arabicus*, *Pipistrellus kuhlii*, *Otonycteris hemprichii* and *Nyctinomus aegyptiacus*; a roost of *Rhinopoma muscatellum* was documented in the wadi wall (in the left part of the picture). Photo by A. Reiter.

Table 27. Basic biometric data on the examined samples of *Hypsugo arabicus* (Harrison, 1979) from Iran and Oman and results of their statistical comparison (ANOVA). For abbreviations see p. 171

	Iran					Oman					ANOVA	
	n	**M**	min	max	SD	n	**M**	min	max	SD	df	F *p*
LC	12	**45.7**	37	48	3.085	26	**43.3**	40	48	1.668	–	–
LCd	12	**38.8**	37	41	1.749	26	**40.3**	37	44	2.205	–	–
LAt	12	**31.06**	29.9	32.4	0.667	27	**31.61**	28.9	34.3	1.043	38	2.60 *
LA	12	**11.61**	10.5	12.5	0.620	26	**12.40**	11.2	13.5	0.445	–	–
LT	12	**5.18**	4.8	5.7	0.289	26	**5.12**	4.7	5.8	0.272	–	–
LCr	9	**11.43**	11.08	11.63	0.167	23	**11.54**	10.97	12.09	0.264	31	1.30
LCb	8	**10.80**	10.36	11.04	0.204	23	**10.92**	10.47	11.26	0.244	30	1.56
LaZ	8	**7.28**	7.00	7.52	0.180	20	**7.28**	6.93	7.56	0.198	27	0.00
LaI	9	**2.89**	2.75	2.98	0.086	23	**2.90**	2.69	3.15	0.113	31	0.08
LaInf	9	**3.34**	3.09	3.43	0.108	23	**3.29**	3.07	3.56	0.129	31	0.95
LaN	9	**5.93**	5.72	6.08	0.135	23	**5.78**	5.59	6.02	0.125	31	9.54 **
LaM	9	**6.15**	5.92	6.28	0.138	23	**6.25**	5.97	6.48	0.140	31	3.12
ANc	8	**4.14**	4.03	4.24	0.079	23	**4.02**	3.76	4.22	0.103	30	7.99 **
LBT	9	**2.63**	2.52	2.77	0.082	22	**2.71**	2.52	2.97	0.138	29	2.05
CC	9	**3.37**	3.18	3.44	0.079	23	**3.31**	3.01	3.62	0.145	31	1.71
M^3M^3	9	**4.66**	4.35	4.82	0.135	22	**4.66**	4.39	5.09	0.148	30	0.02
CM^3	9	**3.93**	3.75	4.10	0.094	22	**3.95**	3.72	4.13	0.120	30	0.37
LMd	9	**7.66**	7.38	7.88	0.168	23	**7.79**	7.38	8.15	0.220	31	2.72
ACo	9	**2.30**	2.11	2.42	0.103	23	**2.30**	2.19	2.47	0.084	31	0.04
CM_3	9	**4.11**	3.98	4.22	0.072	23	**4.19**	3.93	4.48	0.126	31	3.55

numerous birds and mainly, for a small population of the marsh crocodiles (*Crocodylus palustris* Lesson, 1831) – during three hours of the netting session, at least twelve different individuals were observed to lurk for prey (however, such a group represents a significant part of the estimated Iranian population, see da Silva & Lenin 2010). The valley, some 4–6 m deep at the site, was surrounded by dry steppe landscape, extensively used for agriculture in the belt along the

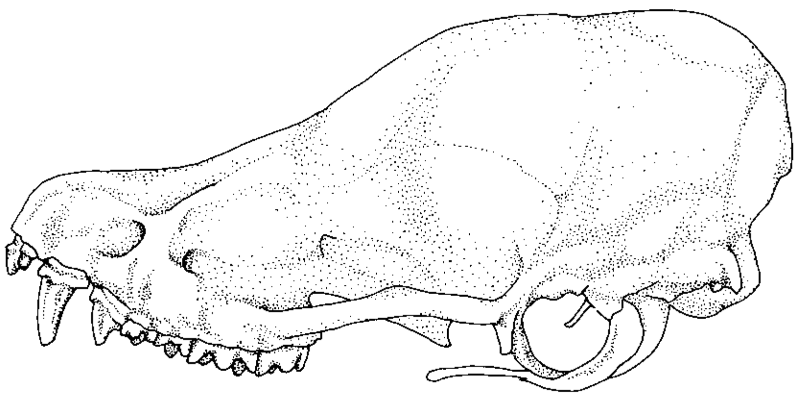


Fig. 149. Skull of *Hypsugo arabicus* (Harrison, 1979), NMP 48409, Pir Sohrab (Baluchestan).

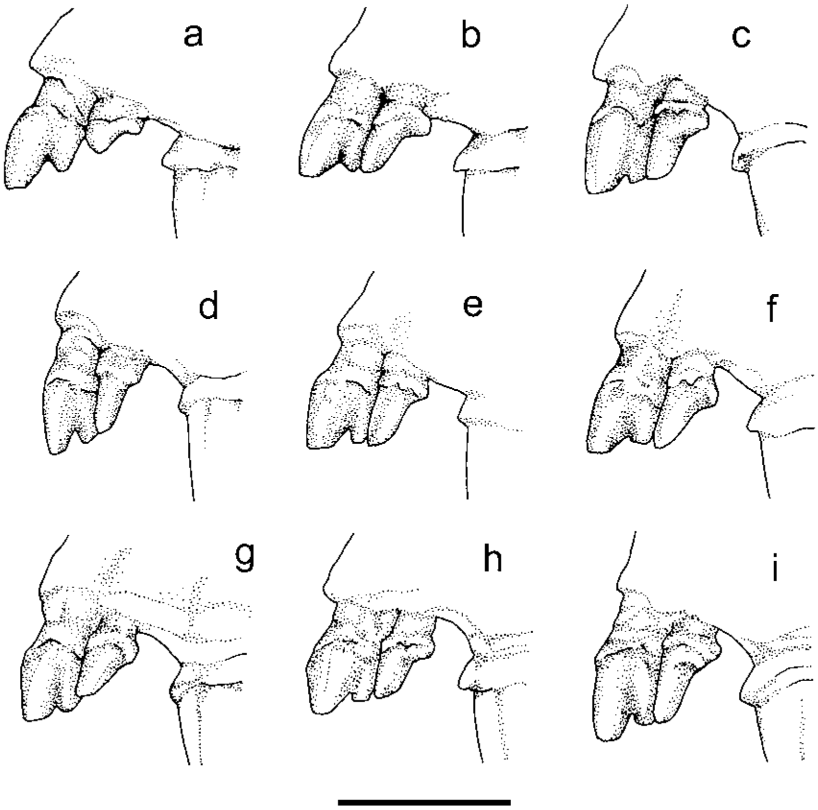


Fig. 150. Antero-lateral views of the incisors of *Hypsugo arabicus* (Harrison, 1979) from Iran (Pir Sohrab, Baluchestan); a – NMP 48409, b – NMP 48410, c – NMP 48414, d – NMP 48415, e – NMP 48416, f – NMP 48417, g – NMP 48418, h – NMP 48419, i – NMP 48420. Scale bar – 1 mm.

river (small fields and pastures). During the session, *Rhyneptesicus nasutus*, *Pipistrellus kuhlii*, *Otonycteris hemprichii*, and *Nyctinomus aegyptiacus*, were also netted.

All netted *H. arabicus* were adult individuals, four males and eight females; six females were pregnant, each contained two foeti of the crown-rump length 3.9–18.8 mm (mean 11.7 mm). Hence, the catch probably represented a part of a nursery colony roosting nearby; the houses in the Pir Sohrab village, fissures in the walls of the wadi as well as trees in the oasis adjacent to the village, all provided numerous roosting opportunities. The size of foeti as well as the date of the catch suggest the period of births in the Iranian population of *H. arabicus* to occur in the first half of April. Harrison & Bates (1991) reported a pregnant female of *H. arabicus* containing two foeti caught in Oman on 18 March, however, they did not specify the size of the foeti. During a recent survey (own unpubl. data), pregnant females of *H. arabicus* were caught in Oman between 3 and 14 April, lactating females on 7 April. All these data roughly conform to the estimated term of births.

Material examined. 4 ♂♂, 8 ♀♀ (NMP 48409, 48410, 48414–48417, 48419, 48420 [S+A], NMP 48411–48413, 48418 [A]), Pir Sohrab (Sistan va Baluchestan Prov.), 12 April 2000, leg. P. Benda & A. Reiter.

MORPHOLOGY AND VARIATION. External and cranial dimensions of the Iranian specimens of *Hypsugo arabicus* are shown in Table 27. For the material examined see above.

H. arabicus is one of the least known Palaearctic bats, records of only five individuals of this bat were previously published from three sites in north-eastern Oman (Harrison 1979, 1982). Therefore, this bat was considered an endemic of this mountainous region (Harrison & Bates 1991, Koopman 1993, Horáček et al. 2000) and naturally regarded monotypic (type locality: Wadi Sahtan, Oman; Harrison 1979: 575). However, *H. arabicus* has recently been documented to be a relatively common faunal element in the Hajjar Mts. of Oman (see Distribution) and it was also found in Iranian Beluchestan. Therefore, we were able to compare basic data on both these

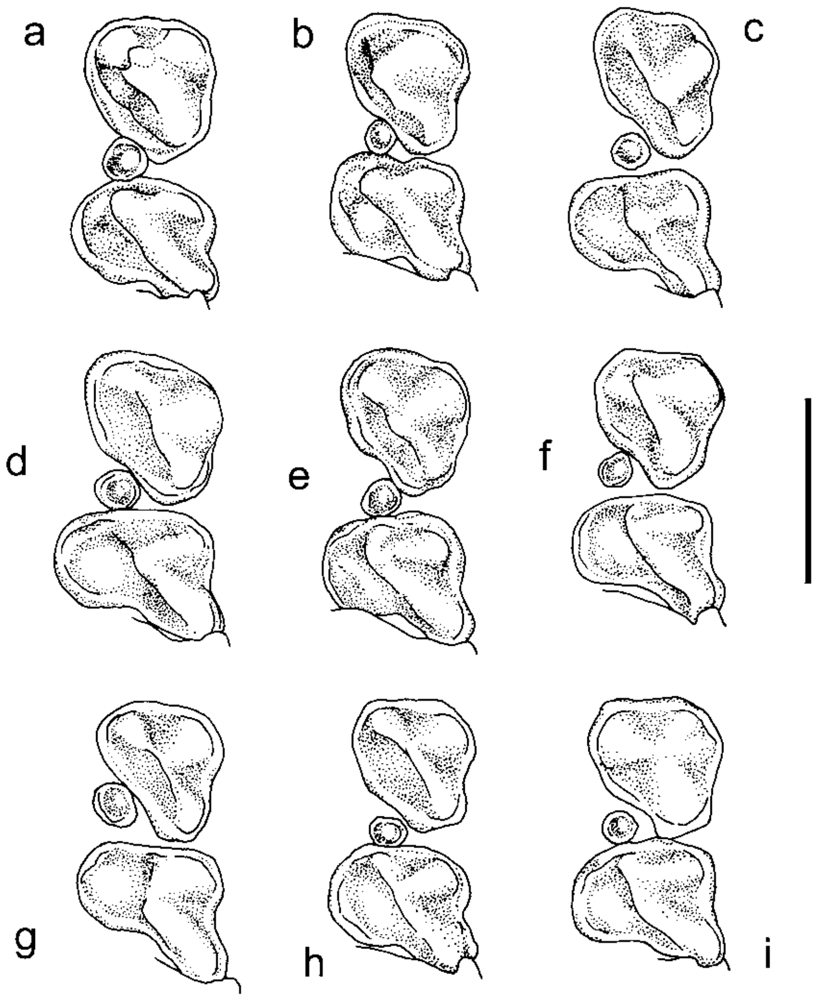
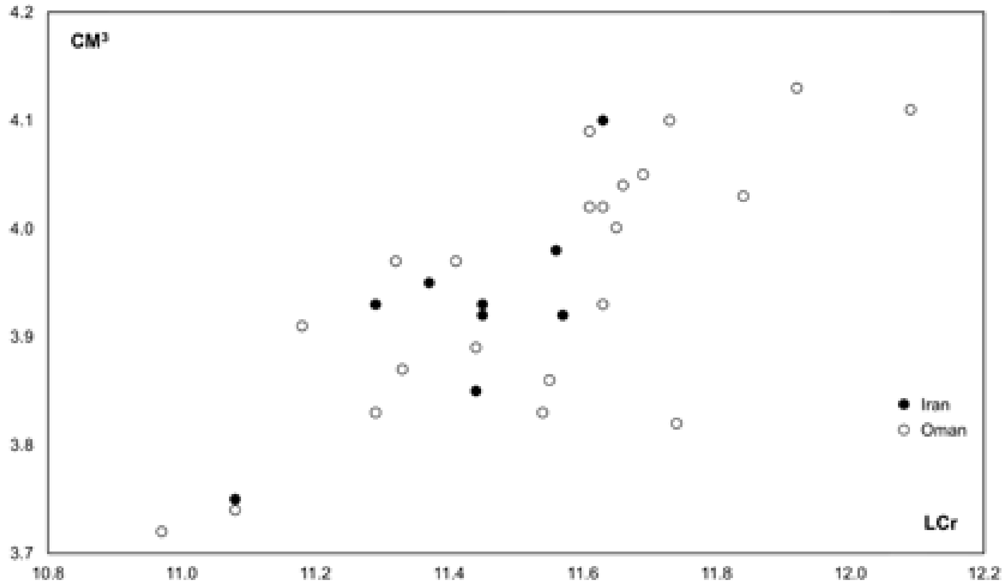
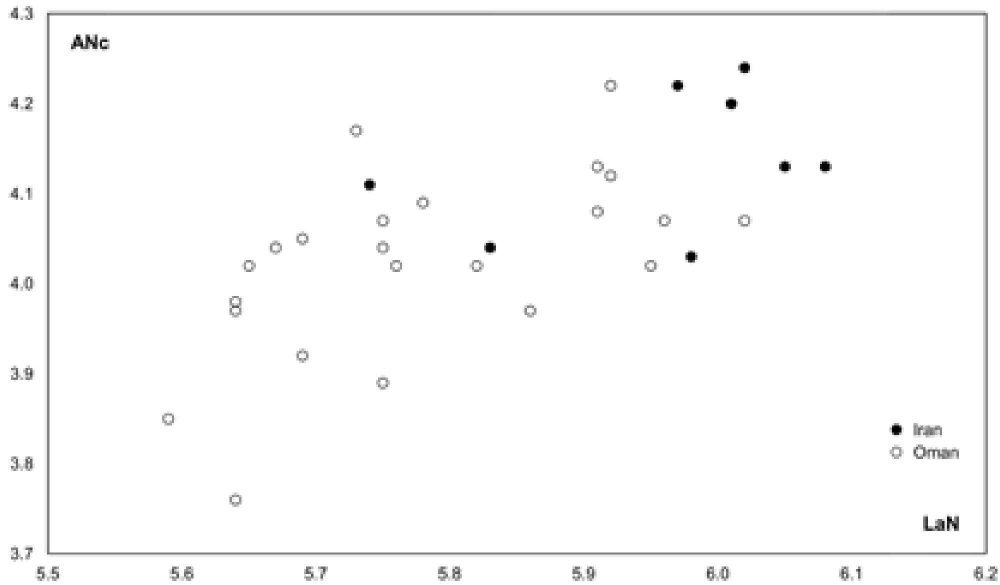


Fig. 151. Occlusal views of the unicuspidal upper tooth-row of *Hypsugo arabicus* (Harrison, 1979) from Iran (Pir Sohrab, Baluchestan). For legend see Fig. 150. Scale bar – 1 mm.





Figs. 152, 153. Bivariate plots of the examined Iranian and Omani samples of *Hypsugo arabicus* (Harrison, 1979). 152 (top) – greatest length of skull (LCr) against the length of upper tooth-row (CM^3). 153 (bottom) – neurocranium width (LaN) against the neurocranium height (ANc).

populations and to assess variation in several characters. The morphology of skull and teeth (Fig. 149) of the Iranian bats conforms almost completely to the description by Harrison (1979); the

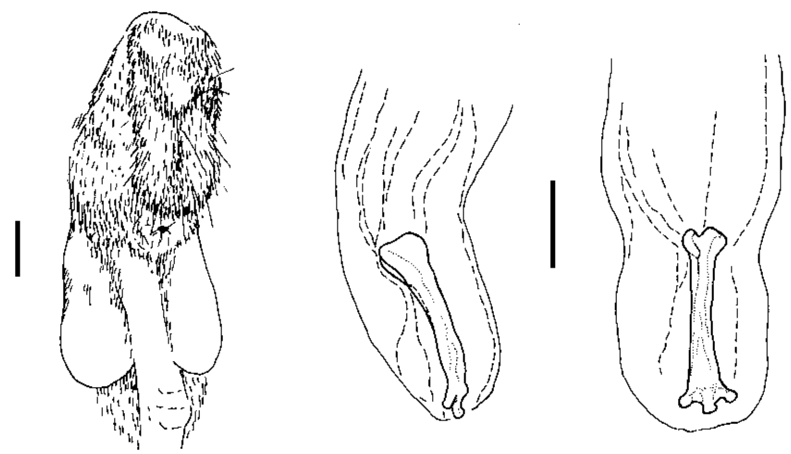


Fig. 154. Schematic drawing of penis and position of baculum in the penis of *Hypsugo arabicus* (Harrison, 1979) from Iran (Pir Sohrab, Baluchestan). Scale bars – 1 mm.

first upper incisor (I^1) is bicuspidate, the second upper incisor (I^2) is relatively large and attaining the secondary cusp of the first incisor (Fig 150); the upper canine and the large premolar (P^4) are separated in ca. a half of the specimens, while in other cases, these teeth are in contact medio-distally (Fig. 151); the small upper premolar (P^2) is laterally visible only in some cases, it is mostly rather smaller than in the holotype specimen as depicted by Harrison (1979). The forearm lengths (LAt) are slightly larger in the Iranian bats than the values of the type series given by Harrison (1979), however, they conform to the range of this dimension found in rather numerous newly collected bats from Oman (Table 27); similarly, the greatest length of skull (LCr) is slightly smaller in Iranian bats than in the type series, but within the range of the new Omani bats.

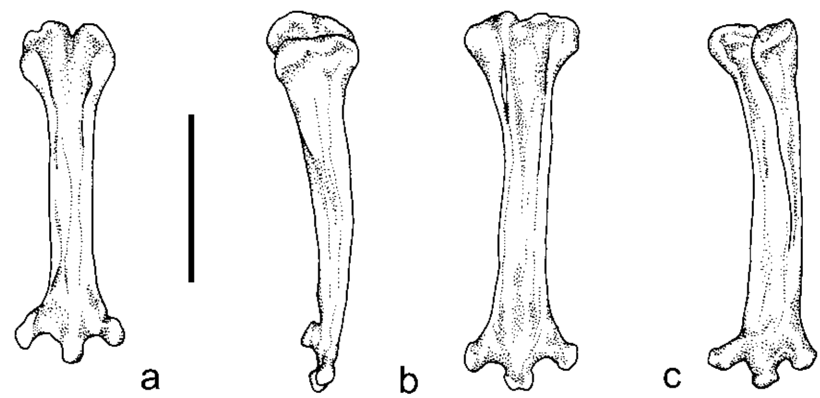


Fig. 155. Bacula of *Hypsugo arabicus* (Harrison, 1979) from Iran (Pir Sohrab, Baluchestan); a – NMP 48415, b – NMP 48418, c – 48419. Scale bar – 1 mm.

In external and cranial dimensions, the Iranian samples of *H. arabicus* conform to the samples from Oman (Table 27, Fig. 152), in most dimensions the values of the Iranian bats fall into the range of the Omani bats. The Iranian bats differ only in size and shape of the braincase, in these samples the neurocranium is significantly higher and broader than in the Omani samples (Table 27, Fig. 153). This difference suggests a possible shift in some morphological characters between Omani and Iranian populations of *H. arabicus*; however, to be able to assess the mutual position of these populations, this possibility needs to be tested namely by means of a molecular genetic analysis.

The shape of penis in Iranian *H. arabicus* (Fig. 154) is similarly angulated as that described by Harrison (1982) and the position of baculum in the penis (Fig. 154) is identical as in *H. savii* (see Horáček & Benda 2004), i.e. perhaps as in the whole genus. The baculum in the Iranian samples of *H. arabicus* (Fig. 155) is identical in size and structure with the specimens depicted by Harrison (1982) and Hill & Harrison (1987), while completely differing from the otherwise morphologically very similar species *H. ariel* (Thomas, 1904) and *H. lanzai* Benda, Al-Jumaily, Reiter et Nasher, 2011 (see Harrison 1982 and Benda et al. 2011c). Hence, according to the differences in penial anatomy, *H. arabicus* certainly represents a taxon clearly separated from *H. ariel* (contra Horáček et al. 2000 and/or Simmons 2005).

Echolocation. No published data on echolocation parameters of *Hypsugo arabicus* are available and we did not record any calls of this species in Iran. According to the preliminarily evaluated data from Oman (own upubl. results), *H. arabicus* has frequency-modulated calls in the initial phase, while the end phase of the calls has a quasi-constant-frequency pattern. The start frequency is between 36–48 kHz, the end frequency at ca. 30–34 kHz. The peak frequency values are

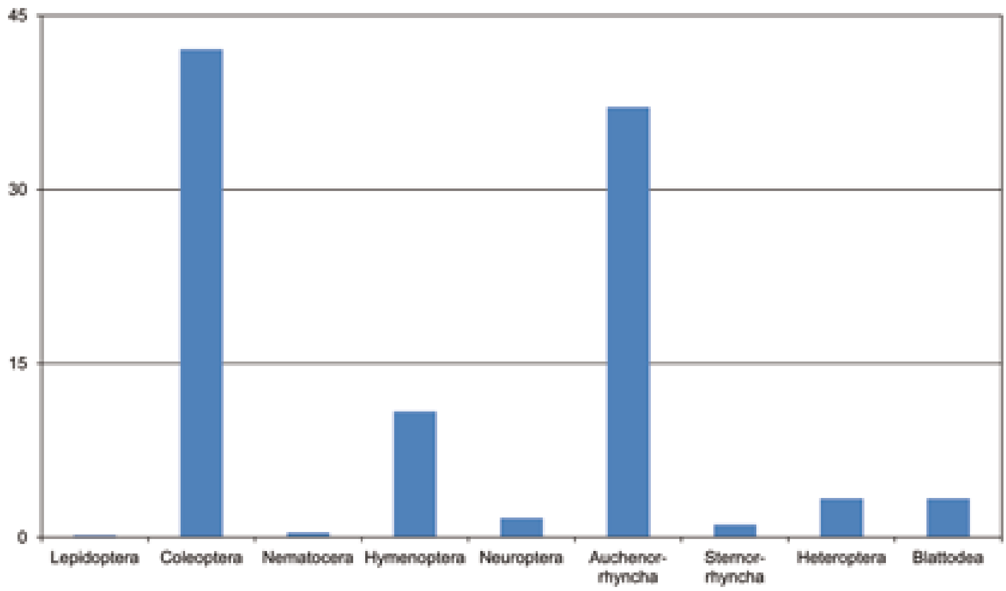


Fig. 156. Percentage volume of particular food items in the diet of *Hypsugo arabicus* (Harrison, 1979) in Pir Sohrab, Baluchestan, Iran. Contents of twelve digestive tracts were analysed.

between 32–36 kHz and overlap with those of other bat species with similar echolocation call patterns occurring in the region (e.g. *Eptesicus bottae*).

FEEDING ECOLOGY. *Hypsugo arabicus* is a small aerial hawker hunting in open spaces of semi--deserts and desert habitats of Oman and Baluchestan (see above); no data on feeding ecology of the species were published. The analysis of ten sample sets of faeces from north-eastern Oman showed Coleoptera, Hymenoptera, Lepidoptera and Heteroptera to be dominant in the diet, Auchenorrhyncha were also an important prey item (our unpubl. results).

From Iran, we analysed twelve digestive tracts of *H. arabicus* collected at Pir Sohrab (Baluchestan). The diet was dominated by small Coleoptera and Auchenorrhyncha; Formicoidea also represented a significant proportion of the diet, while the volume of other food items was negligible. Lepidoptera were represented by small-sized species, nematoceran Diptera by Culicidae and Sternorrhyncha by Aphididae (Fig. 156). The diet of *H. arabicus* seems to be similar to the diet of other aerial hawkers of a comparable body size occurring in the Middle East.

Pipistrellus pipistrellus (Schreber, 1774)

RECORDS. **Original data**: A r d a b i l: Arbab Kandi [1], 33 km ENE Meshginshahr, at the Qarah Su river, 5 June 2006: det. several inds. – Â z a r b â i j a n - e S h a r q i: Chope Darag [2], ca. 30 km W of Kalibar, alluvium grove, 28 September 2011: det. & rec. calls of several foraging inds. – E s f a h â n: valley 2 km S of Kareh [3], 18 km W of Shahreza, at a stream and poplar grove, 3 October 2011: det. & rec. numerous foraging inds. – F â r s: valley 10 km NW of Hesar [4], 66 km NW of Marv Dasht, above a stream, 5 October 2011: net. 7 ma, 3 fa, 2 fs, coll. 1 m (NMP 93872; Fig. 158), det. & rec. calls of numerous foraging inds.; – Bishapur [5], 20 km NW of Kâzerun, Shahpur cave, 3 May 1996: remnant of 1 ind. (mandible) found in *Bubo bubo* pellets; – Bishapur [6], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April 2000: remnants of 2 inds. (2 right and 1 left mandibles, 4 skull fragments) found in *Bubo bubo* pellets and of 1 ind. (pair of mandibles) in *Strix aluco* pellets (cf. Obuch 2011); – Firuz Abad [7], ruins of Atas Kade mosque, 20 April 2000: remnants of 5 inds. (3 right and 4 left mandibles, 3 skull fragments) found in *Athene noctua* pellets (cf. Obuch & Krištín 2004); – Schiras [= Shiraz] [8], 1894: 1 ma (NMW 13147; leg. B. Wagschal). – G i l â n: valley 5 km S of Qal'eh Bin [9], 60 km S of Astara, 3 July 1977: net. 1 fa (NMP 48471); – Bandar Anzali [10], 22–24 August 2007: remnants of 1 ind. found in *Tyto alba* pellets (leg. A. Khaleghizadeh; cf. Obuch & Khaleghizadeh 2011); – Seqâlaksâr [11], 12 km S of Rasht, attic of a house, September 2008: obs. a colony of ca. 200 inds. – G o l e s t a n: oak forest 5 km E of Tunel-e Golestan [12], 44 km E Kalaleh, 26 May 2006: net. 2 ma, 2 fG (NMP 90838–90841; Fig. 159; cf. Benda et al. 2006, Hulva et al. 2007b, 2010); – Persiâ, Astrabad' [= Iran, Gorgan] [13], May 1904: coll. 1 ind. (ZIN 283-1915; leg. K. A. Satunin). – K h o r a s â n - e R a z a w i: valley 5 km W of Chenarbu [14], 13 km SE of Qalandar Abad, above a stream, 17 May 2006: det. min. 2 inds., net. 1 fG (NMP 90776; Fig. 160; cf. Benda et al. 2006, Hulva et al. 2007b, 2010); – valley 2 km S of Dorbadam [15], 16 km S of Bajgiran, 23 May 2006: net. 1 ma (NMP 90832; cf. Benda et al. 2006, Hulva et al. 2010), det. calls of 2+ inds.; – valley 3 km SW of Tahir Abad [16], 45 km NE of Mashhad, 21 May 2006: det. calls of 1+ ind.; – valley 7 km E of Bazangan [17], 14 km NNW of Mazdavand, 17 May 2006: det. calls of 2+ inds.; – Shurlaq [18], 53 km WSW Sarakhs, above a stream, 18 May 2006: net. 1 ma (NMP 90791; cf. Benda et al. 2006, Hulva et al. 2007b, 2010). – K h o r a s â n - e S h o m â l i: Ghezel Ghan [19], 22 km NNE of Bojnurd, around street lamps, 24 May 2006: det. calls of min. 1 ind.; – valley 7 km W of Kalatah Chenar [20], 27 km N of Ashkaneh, 25 May 2006: obs. & det. calls of 5+ ind. – K o h g i l u y e v a B o y e r A h m a d: valley 3 km N of Meymand [21], 24 km N of Pataveh, above a river, 4 October 2011: net. 3 fa, 2 fs, coll. 1 f (NMP 93866), det. & rec. calls of numerous foraging inds. – L o r e s t a n: Lenje Abad [22], 6 km SW of Dorud, above a river, 8 October 1998: net. 1 fs (NMP 48155; cf. Benda et al. 2004b, 2006); – valley 3 km S of Lenje Abad [23], 9 km SW of Dorud, 1 October 2011: net. 1 fs (NMP 93863; Fig. 161), det. & rec. calls of numerous inds.; – valley 5 km W of Arjank [24], 52 km SE of Dorud, at a stream, 2 October 2011: det. & rec. calls of numerous foraging inds. – M â z a n d a r a n: valey 8 km W of Pul [25], 26 km SSE of Chalus, above a river, 1 June 2006: det. 5+ inds. – Y a z d: Dakhmeh-e Zartoshtiyun [26], SW edge of Yazd, abandoned buildings below the towers, 4 May 1997: coll. 1 ms, 1 fG (NMP 48112, 48113; cf. Benda et al. 2004b, 2006, Hulva et al. 2004, 2010). – Z a n j â n: oasis 2 km SE of Garmab [27], above a pool, 30 September 2011: det. & rec. calls of several foraging inds. – Iran (undef.): Sev. Iran, vost. sklon Bagrov'-Dal' [= northern Iran, eastern slope of the Bagrov-Dal Mt.] [*28*], June 1914: coll. 1 ind. (ZIN 513-1914; leg. S. N. von Vik'). – Iran (undef.): Persiâ [= Iran], 1890: coll. 1 ind. (ZIN 8101; leg. Graničevskij). – **Published data**: A r d a b i l: Barandaq [29], 45 km S Khalkhâl, ceiling of water channel under road, 6 November 2006: coll. 1 m, 2 f (Sheikh-Jabbâri 2008); – 2 km N Hashtjin [30], ceiling of water channel under road, 7 November 2006: coll. 1 m[a, HMNH], 1 f (Sheikh-Jabbâri 2008); – Mazra'eh [31], 25 km SW Khalkhâl, ceiling of water channel under road, 7 November 2006: coll. 1 f (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: “seemingly Khwoy” [32] (Lay 1967, cf. Vereŝagin 1959); – 2 km. west of Maku [33], over the Zangamar River, 3 October 1962: 1 m, 1 f, FMNH (Lay 1967 [as *P. kuhlii*], Neuhauser & DeBlase 1971, DeBlase 1980). – C h a h â r M a h â l v a B a k h t i â r i: 8 km NW of Kuh Rang [34], over broad treeless stream valley, 25 and 26 September 1968: shot 7 inds., resp. 3 m, 2 f, FMNH (Neuhauser & DeBlase 1971, DeBlase 1980); – Sar Dasht [35], SW Lordegan, over jube in valley, 1 October 1968: shot 1 m, FMNH (Neuhauser & DeBlase 1971, DeBlase 1980). – E s f a h â n: Derbent [= Darband] [36], 50 mi. W. of Isfahan, 6500’, among poplar trees near the village, 14 May 1905: shot 1 m, BMNH (Thomas 1905 [as *P. aladdin*], Neuhauser & DeBlase 1971, DeBlase 1980). – F â r s: Bagh Mizathahami / Bagh-i-Jaffarani [37], Shiraz, 10 inds. (Cheesman 1921 [as *P. mimus*], Neuhauser & DeBlase 1971, DeBlase 1980); – Jahrom [38], in an orange grove, 9 November 1968: shot 1 ma, FMNH (DeBlase 1980); – Kazerun [39], Spring 1965: some specimens, resp. 1 f (Etemad 1967, 1969 [as *P. kuhlii*], DeBlase 1980); – Shahpur Cave [40], in a room of the cave, 9 October 1968: shot 1 ind. ad, FMNH (Neuhauser & DeBlase 1971, DeBlase 1980); – Shiraz [8], 7 July to 8 August 1919: 12 m, 81 f, 6 inds. (–10 inds.), resp. 3 m, 3 f, BMNH (Cheesman 1921 [as *P. mimus*], Neuhauser & DeBlase 1971, DeBlase 1980). – G i l â n: Siahkal [41], 15 June and 16 July 1969: 1 m, 1 ind., IPHR (Farhang-Azad 1970a ex DeBlase 1980). – G o l e s t a n: 4.8 km. west of Pahlavi Dezh [= Aq Qala] [42], attic beneath tin roof, 31 October 1962: 2 f, 7 inds. (mummies), FMNH (Lay 1967, Neuhauser & DeBlase 1971, DeBlase 1980); – 8 km. north of Gorgan [43], 29 October 1962: 3 inds., resp. shot 1 f, FMNH (Lay 1967, Neuhauser & DeBlase 1971, DeBlase 1980); – 28 km. W Gorgan [44], 12 and 14 June 1963: 1 mj, 1 fj, USNM (DeBlase 1980, cf. Dittmar de la Cruz 2012 [as *Pipistrellus* sp.]); – Gombad-i-Kabous [45], 27 June 1952: 2 ma, 2 fa, SMNS (Lay 1967, Neuhauser & DeBlase 1971, DeBlase 1980); – South coast of Caspian [= vicinity of Bandar-e Gaz]

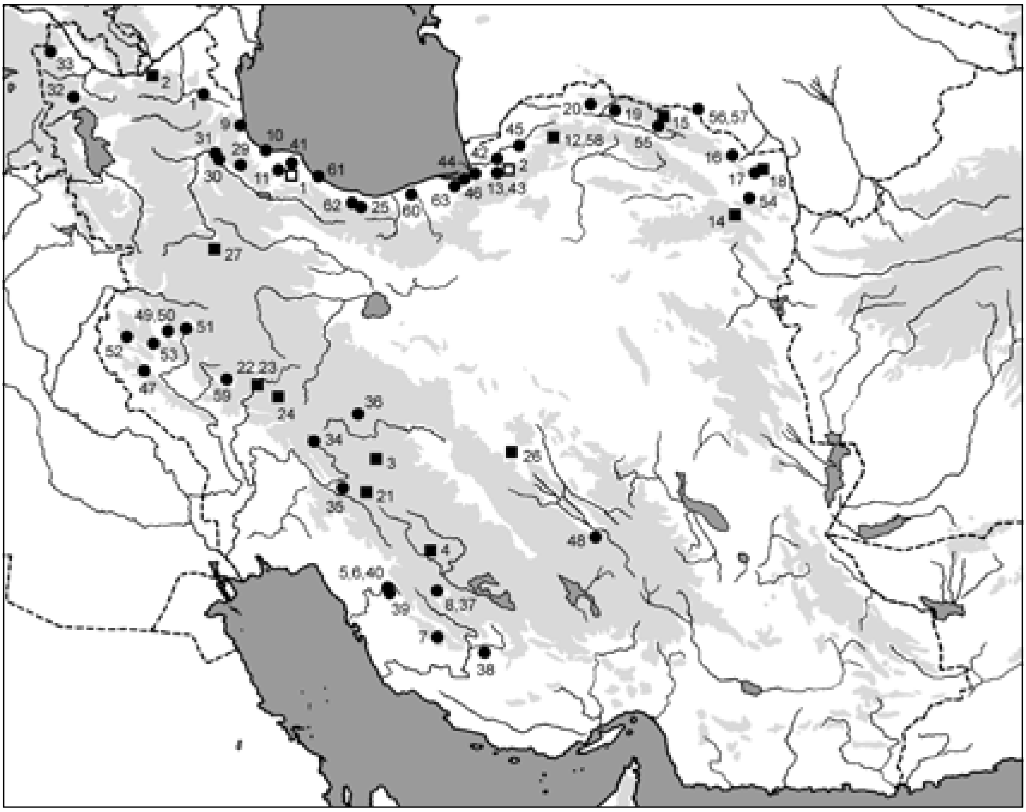


Fig. 157. Records of bats of the *Pipistrellus pipistrellus* complex in Iran: *Pipistrellus pipistrellus* s.l. (circles), *P. pipistrellus* (Schreber, 1774) (closed squares) and *P. pygmaeus* (Leach, 1825) (open squares).

[46], 150', 28 March 1907: 1 m, BMNH (Thomas 1907, Neuhauser & DeBlase 1971, DeBlase 1980). – I l â m: Ilam [47], grove of large old trees in garden in town, 1 September 1968: net. 1 ma, FMNH (Neuhauser & DeBlase 1971, DeBlase 1980). – K e r m â n: Rafsanjan [48], 1972: 1 m, SMF (DeBlase 1980, Benda et al. 2004b, 2006). – K e r m â n s h a h: 6.4 km N Kermanshah [49], above trees along stream, 20 and 21 August 1968: shot 1 m, 3 f, FMNH (Neuhauser & DeBlase 1971, DeBlase 1980); – 7.2 km N Kermanshah [50], behind sign over door of school, 22 August 1968: 1 m, 8 f, FMNH (Neuhauser & DeBlase 1971, DeBlase 1980); – junction of the River Dinevar with the River Gamasiab [51], at Bisotun, 10 August – 10 September (19 nights), [det. numerous inds.] (Akmali et al. 2004); – Kerend cave [52], 5 km W Kerend-e Gharb (Akmali et al. 2011a); – Mâhidasht Cave [53], 30 km SW Kermânshâh (Akmali et al. 2011a). – K h o r a s â n - e R a z a w i: 71 km. SE Meshad [54], 3 July 1969: 3 m, 5 f, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – Chelmir [55], 12 and 13 July 1969: 69 inds., incl. 8 ms, 6 fa, 9 fs, IPHR (Farhang-Azad 1970a ex DeBlase 1980), 27 km W of Derregaz [= Dargaz] town, 12–17 July 1969 (Filippova et al. 1976); – Hessar near Loft-abad [56], July 1968: net. 2 m, IPHR (Farhang-Azad 1969a); – Loft-abad [57], old fort, ceiling, July 1968: 56 m, 65 f, IPHR (Farhang-Azad 1969a), sel. Letfabad, 27 km zapadnee Derregeza, čerdak starogo doma [= Loft Abad village, 27 km W of Dargaz, attic of an old house], 3 July 1969: 1 ind. (Kudrâšova 1975). – K h o r a s â n - e S h o m â l i: 3 km. SW Dasht [58], 17 May 1963: 1 f, USNM (DeBlase 1980). – L o r e s t a n: 1.6 km S Khurramabad [59], poplar tree grove along the Kashkan / Ab-i-khurramabad River, 9 September 1968: net. 1 fa, FMNH (Neuhauser & DeBlase 1971, DeBlase 1980). – M â z a n d a r a n: Babol [60], Summer 1963: 1 ind. (Etemad 1967, 1969), Barfurush [= Babol], house of Imperial Bank of Persia, 6–7 July 1927: 10 inds., resp. 2 ms, 3 fa, 3 fs, 1 ind., BMNH (Lay 1967, Neuhauser & DeBlase 1971, DeBlase 1980); – Ramsar [61], 1952, July 1962 (Klein et al. 1963), August 1965 (Farhang-Azad 1969b); – Sama [62], over a small pool, 22 August 1962: 2 inds., resp. net. 1 fa, FMNH (Lay 1967, Neuhauser & DeBlase 1971, DeBlase 1980); – Tir Tash [63], building and grounds of Tobacco Institute, 20 August to 7 September 1970: 13 m, 45 f, MMTT, BMNH (DeBlase 1980).

DISTRIBUTION. Bats of the *Pipistrellus pipistrellus* complex (sensu e.g. Hulva et al. 2004) represent a very common bat form in Iran, at least 65 record sites are known from the country (Fig. 157) and

Fig. 158. *Pipistrellus pipistrellus* (Schreber, 1774) from Hesar (Fars). Photo by A. Reiter.

Figs. 159, 160. *Pipistrellus pipistrellus* (Schreber, 1774) from Tunel-e Golestan (Golestan) (left) and from Chenarbu (Khorasan) (right). Photos by A. Reiter.

the complex represents the third most frequently documented bat in Iran. However, the analyses of molecular genetic traits and echolocation call recordings revealed two species within the complex in Iran, *P. pipistrellus* and *P. pygmaeus* (Hulva et al. 2007b, own data). Such evidence is available from 15 sites, *P. pipistrelus* s.str. was confirmed from 13 of them (Fig. 157).

The distribution range of the complex in Iran is comprised of two rather separated areas, the north-Iranian mountains and the Zagros Mts. While in the northern range both species of the complex were evidenced, in the southern range only *P. pipistrellus* s.str. was found. In the only locality between these two ranges, near Garmab in the Zanjan province, the calls of *P. pipistrellus* s.str. were detected (Fig. 105). Although DeBlase (1980) reported less than a half of the currently known record sites, the general picture of distribution range of the complex in Iran remains very similar. The newly gathered records only make the known occurrence area more precise.

The occurrence of *P. pygmaeus* in northern Iran has a plausible biogeographical explanation, this species has a similar pattern of general distribution as e.g. *Myotis bechsteinii* (see above), and its occurrence in Iran is most probably confined to the limited range along the Caspian shore (see below). In other areas of Iran where occurrence of the complex was documented (Azarbaijan, Zagros Mts., Khorasan), the species affiliation of the respective populations is most probably only *P. pipistrellus* s.str.

P. pipistrellus s.str. has a wide distribution in the Middle East and areas adjacent to it from the north (Balkans, Transcaucasia and West Turkestan), see Benda & Horáček (1998), Hanák et al. (2001), and Benda et al. (2011c). The Iranian occurrence in the south of the Fars province represents the southernmost extension of the whole distribution range of the species. Other southern extensions of the species distribution are known from the Levant (southern Jordan; Benda et al. 2010) and the Maghreb (Morocco; Benda et al. 2004d).

Field notes. *Pipistrellus pipistrellus* was recorded in Iran mainly in its foraging habitats, only about one quarter of the records are findings in roosts. At four sites, bone remains of *P. pipistrellus* from owl pellets were collected. However, some observations from northern Iran (the provinces of Gilan, Golestan and/or Mazandaran) could concern *P. pygmaeus*, since they predated the recognition of this bat as a species and only limited number of specimens have been confirmed on the basis of echolocation or genetic characters.

At several sites, aggregations of *P. pipistrellus* were found which could be interpreted as nursery colonies or their remains. All these records come from synanthropic conditions. Lay (1967) and DeBlase (1980) reported on ten BMNH specimens collected in the house of Imperial Bank of Persia in Babol (Mazandaran) on 6–7 July 1927, composed of: "Three adult females, rest immature, one prevolant." (DeBlase 1980: 214). Unfortunately, there are no detailed data on the roost of this colony. Farhang-Azad (1969a: 731) reported a group composed of 56 males and 65 females "collected from ceiling of an old fort" in Loft Abad (Khorasan), Kudrâšova (1975) specified the ceiling as an attic and the date of collection as 3 July 1969. These two findings most probably represent nursery colonies, considering the sex and age composition and the date (early July) of the two collections. A record of 69 individuals collected on 12 and 13 July 1969 at Chelmir (Khorasan) (Farhang-Azad 1970a) is perhaps also related to a nursery colony; DeBlase (1980) examined a third of these specimens and found six adult females and seventeen immature bats (8 males, 9 females).

Other aggregation records of *P. pipistrellus* from Iran most probably represent only remains of former nursery colonies, considering the late summer or autumn dates of the findings. DeBlase (1980: 218) mentioned: "On 22 August 1968 a group of boys sold us one male and eight female *P. p. aladdin* at our camp at [7.2 km N of] Kermanshah. At my request they took us to their village and pointed out a sign over the door to the schoolhouse […]. According to the boys, the bats had been roosting in the slight space between the 1 ft. × 2 ft. sign and the adobe wall of the building

Fig. 161. Portrait of *Pipistrellus pipistrellus* (Schreber, 1774) from Lenje Abad (Lorestan). Photo by A. Reiter.

to which it was attached." At another page, DeBlase (1980: 314) added: "They said about 20 more had escaped their attempts to capture. Other villagers told us that bats inhabited holes in the adobe construction all over the village. A check of several such cracks and holes yielded no further specimens." Another similar record is represented by the BMNH series of 58 *P. pipistrellus* collected in 1970; DeBlase (1980: 218–219) described available the data as follows: "The Tir Tash [Mazandaran] series was collected from the building and grounds of the Tobacco Institute over a period of days. Between 20 August and 4 September four males and six females were netted or otherwise collected from the gardens and hedgerows. On 7 September nine males and 36 females were collected from their roost in the loft of a Tobacco Institute building." In September 2008, a large colony of some two hundred *P. pipistrellus* was observed in an attic of a house in Seqalaksar near Rasht (Gilan); such a large aggregation most probably was a remaining group from a nursery colony of that year. Lay (1967: 76) described a finding of nine bats (most of them mummified) beneath tin roof of a house made on 31 October 1962: "*Pipistrellus pipistrellus* roosted in the attics of buildings in the Turkoman village of Pahlavi Dezh [Golestan], situated on banks of the Gorgan River 19 km. north of Gorgan." These dead individuals perhaps represented a remain of a (nursery) colony in its roost.

In some roosts, single individuals or very small groups (two or three bats) of *P. pipistrellus* were documented. DeBlase (1980: 301) reported a rather curious finding of an adult individual in torpor that "hung inside the hollow center of a broken stalactite" in the Shahpur cave (Fars) on 9 October 1968. The bat roosted in a side room close to the entrance of the cave, however, DeBlase (1980) did not mention whether it was completely dark or certain traces of daylight there. Sheikh-Jabbâri (2008) found a triad, a pair and an individual of *P. pipistrellus* roosting in fissures of ceilings of water channels under roads at three sites of the Ardabil province in early November 2006. All these findings from October–November most probably represent transient roosts of individuals. A different case is the record from Yazd (Yazd) made on 4 May 1997; two bats, a pregnant female and a subadult male were discovered in fissures in muddy walls of abandoned buildings below the hill with Dakhmeh-e Zartoshtiyun (Towers of Silence) at the SW edge of the town. Since the female most probably originated from a nursery colony somewhere nearby, the roost was perhaps an alternative shelter used only irregularly.

Akmali et al. (2011a) reported findings of *P. pipistrellus* from the Kerend and Mahidasht caves (Kermanshah), however, they did not specify the type of evidence.

A majority of the roosts was inhabited solely by *P. pipistrellus* and only some of them were shared with other bat species. DeBlase (1980: 333) mentioned: "Heinroth collected one *R. hipposideros*, three *M. emarginatus*, and nine *P. pipistrellus* from the "House of the Imperial Bank of Persia" at Barfurush (= Babol)." However, it is not clear whether these bats shared one roost or whether they inhabited different parts of the house. From the loft of the Tobacco Institute at Tir Tash, DeBlase (1980) reported findings of colonies of *Rhinolophus ferrumequinum* and *Myotis emarginatus* along with *P. pipistrellus*. Lay (1967) collected mummies of *P. pipistrellus* at Pahlavi Dezh along with several live and dead individuals of *Eptesicus serotinus*, however, it is not sure whether the findings were made from the same house (see DeBlase 1980). When the individual of *P. pipistrellus* was found in the Shahpur cave, DeBlase (1980) documented also presence of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis capaccinii*, and *Miniopterus pallidus* inside the cave during the same visit on 9 October 1968.

At a lot of sites, foraging individuals of *P. pipistrellus* were recorded, mostly by shooting or netting. The first such record was indirectly reported by Thomas (1905), who described the species *Pipistrellus aladdin* [= *P. pipistrellus*] on the basis of the specimen shot "from among the poplar trees near the village of Derbent [= Darband], 50 miles W Esfahan, 1,982 m. elevation" as reported by DeBlase (1980: 292) according to the specimen label; two *Myotis blythii* were collected on this occasion on 14 May 1905. Lay (1967) collected two individuals (netted/shot) flying over the Zangamar River west of Maku (Azarbaijan), along with one *Myotis* cf. *mystacinus* on 3 October 1962. On 22 August 1962, two individuals of *P. pipistrellus* were netted at Sama (Mazandaran); Lay (1967: 100) added the following details: "We observed bats flying in many places around Sama. Large and small bats frequented certain places or traveled, seemingly erratically, over all types of country. A pool in the stream near camp proved a favorite spot for these mammals. We caught the bats *Nyctalus noctula* [= *N. leisleri*], *Pipistrellus pipistrellus*, and *Eptesicus nilssoni* in a mist net placed over this pool." Lay (1967: 142) collected three individuals, including one female, at a foraging ground 8 km north of Gorgan (Golestan) on 29 October 1962; he described the situation as follows: "Attempts to net this species over a lagoon 8 km. north of Gorgan failed; however, shooting by spotlight produced a number of individuals the majority of which proved unfit for preservation as specimens." *Myotis* cf. *mystacinus* and *Miniopterus pallidus* were simultaneously shot at the latter site. Two males of *P. pipistrellus* were netted at Hessar near Loft Abad (Khorasan) in July 1968 (Farhang-Azad 1969a). Another foraging record of *P. pipistrellus* was described by DeBlase (1980: 289) as follows: "On 25 and 26 September 1968 we shot seven *Pipistrellus pipistrellus* [including three males and two females] and one *Myotis nattereri* [= *M. schaubi*] as they flew above our camp, which was at an elevation of 2,592 m. in a broad stream valley […], about 8 km. N the village of Kuh Rang [Chahar Mahal va Bakhtiari]." DeBlase (1980: 291) reported on a record of foraging *P. pipistrellus* in the Chahar Mahal va Bakhtiari province as follows: "On 29 September [1968] we set two mistnets over a jube […] near the village of Sar Dasht, a few km. SW Lordegan. Although the nets were left up for three nights and numerous bats were seen flying along the jube at dusk, none were collected by mistnet. On 1 October we shot three of the many bats seen flying. These included one each of *Vespertilio murinus*, *P*. *pipistrellus*, and *P*. [= *Hypsugo*] *savii*." Concerning another collection of foraging individuals of *P. pipistrellus*, DeBlase (1980: 295) says: "On the evening of 9 November [1968] we shot one *P. kuhli* [and another one on 11 November] as it flew over the [orange] garden in which we were camped on the southeast

Fig. 162. Poplar grove in the valley near Kareh (Esfahan), a foraging habitat of *Pipistrellus pipistrellus*. Photo by A. Reiter.

edge of Jahrom [Fars]. A [male] *P. pipistrellus* was shot at the same locality on 11 November." In the city of Ilam (Ilam), DeBlase (1980: 218) collected one individual and noted: "we were told that bats roosted in the hollows of large trees in a grove [of large old trees] in a garden in the city. […] We set up a mistnet and on 1 September 1968 collected one adult male [of *P. pipistrellus*]. Many other bats were visible flying about the garden, but they managed to avoid our net." Four foraging specimens of *P. pipistrellus*, at least one of them being a male, were collected by DeBlase (1980: 314) near Kermanshah (Kermanshah); he described the record as follows: "Between 19 and 24 August the 1968 Street Expedition camped next to a stream and poplar grove 6.4 km. north of Kermanshah. Each evening at dusk we observed hundreds of bats flying above and around our campsite. Mistnets were set at several locations across the stream and along the edge of the relatively lush riparian vegetation in an open field. These nets and some shooting yielded one *Myotis mystacinus*, four *Pipistrellus pipistrellus*, and one *P. kuhli*." At the confluence of the Dinevar and Gamasiab rivers at Bisotun near Kermanshah, numerous echolocation calls of *P. pipistrellus* were recorded by Akmali et al. (2004) in late summer. An individual of *P. pipistrellus* was netted by DeBlase (1980: 330) in the Lorestan province: "The 1968 Street Expedition camped in a poplar grove along the Ab-i-khurramabad River about 1.6 km. S Khurramabad. Several bats were seen flying among the poplar trees and over the river each evening. We set several mistnets in these areas but took only two bats, one *Pipistrellus khuli* [= *kuhlii*] and one [female] *P. pipistrellus*, from the nets. Both of these were taken on 9 September. On 10 September one of our party shot another *P. kuhli* that was flying along the river."

In the Lorestan province, foraging individuals of *P. pipistrellus* were documented also at three additional localities; the species was twice recorded in the broad valley of the Dez river at Lenje Abad south of Dorud (Fig. 40). One female was netted there on 8 October 1998 (along with one *Vespertilio murinus* and one *Miniopterus pallidus*) and another female on 1 October 2011, some three kilometres to the south; during the latter evening, echolocation calls of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Asellia tridens*, *Pipistrellus kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis* were detected and recorded. On 2 October 2011, echolocation calls of one foraging individual of *P. pipistrellus* were detected and recorded at a stream at Arjank near Dorud (calls of a foraging *Barbastella* individual were also recorded there). This site is a narrow valley between dry pastures almost free of tree vegetation, situated within high mountains at 2424 m a. s. l. (Fig. 194); the bats foraged around the few trees growing along the stream and along the road on the valley bottom.

One adult female *P. pipistrellus* was netted and echolocation calls of at least two additional individuals were detected in the mountain steppe valley at Chenarbu near Qalandar Abad (Khorasan) on 17 May 2006 (Fig. 72), where a small stream created a pool where one net was possible to erect; one individual of *Myotis blythii* was also netted there and calls of *Hypsugo savii* detected. An adult male of *P. pipistrellus* was netted above a stream at Shurlaq near Sarakhs (Khorasan) on 18 May 2006; Shurlaq lies at the northern foothill of the Kopetdagh Mts. and on the southern border of the Karakum desert, it is a very arid place covered by a dry steppe (Fig. 189). Besides *P. pipistrellus*, also *Eptesicus ognevi*, *Pipistrellus kuhlii*, *Otonycteris leucophaea*, and *Tadarida teniotis* were netted there. An adult male was captured into a net over a small stream and calls of several other individuals of *P. pipistrellus* were detected in a broad valley at Dorbadam near Bajgiran on the southern slope of the Kopetdagh Mts. (Khorasan) on 23 May 2006 (Fig. 214); one *Myotis blythii* and one *Tadarida teniotis* were caught there along with *P. pipistrellus*. Four adult *P. pipistrellus* were netted above a stream hidden in a dense oak forest near Tunel-e Golestan on 26 May 2006; at this site, also individuals of *Myotis bechsteinii* and *Barbastella barbastellus* were netted and echolocation calls of *Nyctalus leisleri* and *Tadarida teniotis* were detected. Five individuals of *P. pipistrellus* were netted into a net exposed above a river in the valley near Meymand (Kohgiluye va Boyer Ahmad) on 4 October 2011 (Fig. 48); at this site *Pipistrellus kuhlii* and *M. pallidus* were also netted and their calls detected. Ten adult and two subadult individuals of *P. pipistrellus* were caught into a net installed above a small stream in a pasture valley near Hesar (Fars) on 5 October 2011 and calls of numerous foraging individuals were recorded around (Fig. 143); *Myotis blythii*, *Hypsugo savii*, *Pipistrellus kuhlii*, *Miniopterus pallidus*, and *Tadarida teniotis* were netted along with *P. pipistrellus* at Hesar.

At ten sites, only the echolocation calls of foraging *P. pipistrellus* were detected (including the above-mentioned record from near Arjank, Lorestan). Foraging calls of this species were recorded in the valley east of Bazangan near Mazdavand in the eastern Kopetdagh Mts. (Khorasan) on 17 May 2006 (along with netting of *Myotis blythii* and detecting of *Eptesicus serotinus*); in the valley at Tahir Abad northeast of Mashhad, also in the eastern Kopetdagh Mts. (Khorasan), on 21 May 2006 (Fig. 132; along with netted individuals of *M. blythii*, *E. serotinus*, *E. ognevi*, and *Tadarida teniotis*); around street lamps in the village of Ghezel Ghan near Bojnurd (Khorasan) on 24 May 2006 (along with the calls of *E. serotinus*); in the valley at Kalatah Chenar near Ashkaneh in the western Kopetdagh Mts. (Khorasan) on 25 May 2006 (along with the calls of *Hypsugo savii* and *T. teniotis*); in the forested valley of a river at Pul near Chalus on the northern slope of the central Alborz Mts. on 1 June 2006 (along with netted *Myotis emarginatus*); above the Qarah Su river in the agricultural landscape at Arbab Kandi near Meshginshahr (Ardabil) on 5 June 2006 (along with the calls of *H. savii*); in the floodplain grove at Chope Darag near Kalibar (Azarbaijan) on 28 September 2011 (Fig. 177; along with a netted group of *Nyctalus leisleri*); above a large pool at the oasis within an arid steppe landscape near Garmab (Zanjan) on 30 September 2011 (along with netted individuals of *Pipistrellus kuhlii* and detected calls of *Myotis capaccinii*); and at the stream and in the floodplain poplar grove at Kareh near Shahreza (Esfahan) on 3 October 2011, also situated in a rather arid steppe landscape (Fig. 162).

DeBlase (1980: 219) summarised the available information on the reproduction of *P. pipistrellus* in Iran as follows: "Nursery colonies of *P. p. pipistrellus* have been found in buildings in Iran in early July (Babol) and early September (Tir Tash) but were essentially empty of live bats in late October (Pahlavi Dezh). Immature *P. p. aladdin* were present in Shiraz on 7 July." To this review, some other and new data can be added. DeBlase (1980) also mentioned two prevolant USNM specimens (male and female) collected 28 km west of Gorgan (Golestan) on 12 and 14 June. At three sites, pregnant females of *P. pipistrellus* were newly collected. One female was found at Yazd on 4 May, one female was netted at Chenarbu near Qalandar Abad on 17 May, and two females at Tunel-e Golestan near Kalaleh on 26 May. The female from Yazd contained one foetus of the crown-rump length 4.0 mm; the Chenarbu female contained two foeti of the crown-rump length 9.7 mm; and the females from Tunel-e Golestan contained one foetus each, being 9.3 and 9.5 mm long, respectively. All these data suggest parturitions in the Iranian populations of *P. pipistrellus* to occur at the break of May/June. This timing seems to be slightly earlier than the terms in Europe as well as in Transcaucasia, where parturitions occur mostly in mid-June or even later (Taake & Vierhaus 2004, Rahmatulina 2005). Strelkov et al. (1978) and Rahmatulina (2005) mentioned two foeti per mother in majority of the *P. pipistrellus* populations of Transcaucasia and West Turkestan; however, the limited data from Iran show only 25% of the examined females bearing two foeti, while the rest contained one foetus.

Bone remains of *P. pipistrellus* were found in pellets of four owl species collected at four sites in Iran (Table 40), which is the highest number of bird predator species documented among the Iranian bat fauna. A mandible was found in the pellets of *Bubo bubo* collected in the Shahpur cave at Bishapur (Fars) on 3 May 1996 and three mandibles and four skull fragments (i.e. at least from two bats) were found in pellets of this owl collected from the large cave above the Sasan spring nearby on 21 April 2000; these bones made up 6.7% and 2.3%, respectively, of all prey items (and 16.7% and 2.8%, respectively, of mammal items) in the respective samples and 0.038% of all prey items (0.050% of mammal items) in the whole analysed eagle owl diet from Iran. One mandible of *P. pipistrellus* was found in the pellets of *Strix aluco* also in the large cave above the Sasan spring at Bishapur on 21 April 2000 (Obuch 2011); this record represented 0.50% of all prey items (and 4.17% of mammal items) in the respective sample and 0.15% of all prey items (0.37% of mammal items) in the whole analysed tawny owl diet from Iran. Remnants of five individuals (seven mandibles and three fragments of skulls) of *P. pipistrellus* were detected in *Athene noctua* pellets collected in the ruins of Atas Kade mosque in Firuz Abad (Fars) on 20 April 2000 (Obuch & Krištín 2004), making up 8.8% of all prey items (and 45.5% of mammal items) in the respective sample, but 0.26% of all prey items (1.78% of mammal items) in the whole analysed diet of the spotted owlet from Iran. Bones of one bat were discovered in *Tyto alba* pellets collected in Bandar Anzali (Gilan) on 22–24 August 2007 (Obuch & Khaleghizadeh 2011); they represented 1.56% of all prey items (and 1.59% of mammal items) in the respective sample, and 0.046% of all prey items (0.059% of mammal items) in the whole analysed diet of the barn owl from Iran. From the Middle East, evidence of *P. pipistrellus* in owl diet was previously available from Turkey, Syria, and Lebanon (Obuch 1994, 2011, Benda et al. 2006).

Material examined. 2 inds. (JOC unnumbered [Sf]), Bishapur (Fars Prov.), 21 April 2000, leg. J. Obuch; – 1 ♀ (NMP 90776 [S+A]), Chenarbu (Khorasan-e Razawi Prov.), 17 May 2006, leg. P. Benda & A. Reiter; – 1 ♂, 1 ♀ (NMP 48112, 48113 [S+A]), Dakhmeh-e Zartoshtiyun (Yazd Prov.), 4 May 1997, leg. P. Benda; – 1 ♂ (BMNH 5.10.4.13 [S+B], holotype of *Pipistrellus aladdin* Thomas, 1905), Derbend, 50 mls W of Isfahan, 6500 ft. [Esfahan Prov.], 14 May 1905, collector unlisted; – 1 ♂ (NMP 90832 [S+A]), Dorbadam (Khorasan-e Razawi Prov.), 23 May 2006, leg. P. Benda & A. Reiter – 4 inds. (JOC unnumbered [Sf]), Firuz Abad (Fars Prov.), 20 April 2000, leg. J. Obuch; – 1 ♂ (HMNH 2007.30.6. [S]), Hashtjin [Ardabil Prov.], 7 November 2006, leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari; – 1 ♂ (NMP 93872 [S+A]), Hesar (Fars Prov.), 5 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 48155 [S+A]), Lenje Abad (Lorestan Prov.), 8 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 93863 [S+A]), Lenje Abad (Lorestan Prov.), 1 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 93866 [S+A]), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 48471 [S+A]), Qal'eh Bin (Gilan Prov.), 3 July 1977, leg. B. Pražan; – 1 ♂ (SMF 46397 [S+B]), Rafsanjan [Kerman Prov.], 1972, leg. Pflanzeninstitut; – 1 ♂ (NMW 13147 [S+A]), Schiras [= Shiraz, Fars Prov.], 1894, leg. B. Wagschal; – 1 ♂ (NMP 90791 [S+A]), Shurlaq (Khorasan-e Razawi Prov.), 18 May 2006, leg. P. Benda & A. Reiter; – 2 ♂♂, 2 ♀♀ (NMP 90838, 90840, 90841 [S+A], NMP 90839 [A]), Tunel-e Golestan (Golestan Prov.), 26 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Pipistrellus pipistrellus* are shown in Table 28. For the material examined see above.

Taxonomic content of the recently re-defined species *P. pipistrellus* is still rather poorly known (for a review see Benda et al. 2006). Taake & Vierhaus (2004) and Simmons (2005) mentioned two subspecies within its rank, the nominotypical form and the paler form *P. p. aladdin* Thomas, 1905 (type locality: Derbent, 50 mi. W. of Isfahan, 6,500' [Esfahan, Iran]; Thomas 1905: 521). Taake & Vierhaus (2004) assigned the populations of south-western Iran, West Turkestan and with a question mark also those of Turkey to the latter form, while all those living west of this area to *P. p. pipistrellus*. On the other hand, Hulva et al. (2004), who analysed molecular traits in *P. pipistrellus* on a broad scale of the western Palaearctic, did not find any sharp genetic differences within its species rank but between populations of Eurasia and the Maghreb.

The name *Pipistrellus aladdin* which was formerly considered to represent a separate species (Thomas 1905, Tate 1942, Etemad 1967) or a synonym of several other species names (*P. coromandra*, *P. kuhlii*; Ellerman & Morrison-Scott 1951, Lay 1967), was indicated to be a junior synonym of *P. pipistrellus* by Neuhauser & DeBlase (1971). These authors showed the name *aladdin* to be a prior name for assignation of the populations of Central Asia including most of the Middle East, having a priority over the name *bactrianus* Satunin, 1905 (type locality: Tedžen' [= Tejen, Ahal

Table 28. Basic biometric data on the examined Iranian samples of *Pipistrellus pipistrellus* (Schreber, 1774), *P. pygmaeus* (Leach, 1825), and *P. kuhlii* (Kuhl, 1817). For abbreviations see p. 171

	Pipistrellus pipistrellus					*Pipistrellus pygmaeus*					*Pipistrellus kuhlii*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	14	**43.4**	40	49	2.818	14	**42.7**	40	46	1.729	35	**47.8**	42	53	2.143
LCd	14	**35.6**	32	39	1.906	14	**34.1**	31	38	1.875	35	**40.8**	38	45	1.992
LAt	32	**31.43**	29.5	33.9	1.131	14	**30.36**	29.0	31.3	0.726	56	**34.00**	30.4	37.2	1.358
LA	14	**12.05**	10.6	13.2	0.727	14	**12.29**	11.5	13.1	0.538	34	**13.61**	11.3	16.3	1.095
LT	14	**5.09**	4.6	5.9	0.368	14	**4.91**	4.3	5.6	0.375	33	**5.84**	5.0	6.7	0.443
LCr	16	**11.60**	11.00	12.16	0.343	11	**11.52**	11.09	11.90	0.228	37	**12.88**	12.11	13.71	0.395
LCb	16	**11.12**	10.43	11.68	0.395	11	**11.07**	10.82	11.51	0.225	37	**12.40**	11.74	13.36	0.397
LaZ	10	**7.23**	6.72	7.62	0.277	8	**7.45**	7.28	7.64	0.127	32	**8.35**	7.88	8.76	0.228
LaI	19	**3.20**	2.93	3.48	0.156	11	**3.24**	3.09	3.39	0.103	42	**3.27**	3.04	3.53	0.127
LaInf	17	**3.43**	3.00	3.81	0.201	11	**3.46**	3.22	3.67	0.134	45	**3.78**	3.44	4.15	0.156
LaN	17	**6.04**	5.62	6.47	0.183	11	**6.07**	5.81	6.22	0.121	39	**6.49**	6.14	6.96	0.188
LaM	17	**6.57**	6.29	7.03	0.185	11	**6.56**	6.16	6.74	0.172	32	**7.46**	7.02	7.95	0.275
ANc	18	**4.17**	4.02	4.34	0.091	11	**4.20**	4.10	4.31	0.074	37	**4.55**	4.32	5.08	0.179
LBT	15	**2.82**	2.54	3.21	0.196	10	**2.73**	2.63	2.88	0.080	33	**2.95**	2.71	3.27	0.143
CC	17	**3.49**	3.25	3.88	0.162	10	**3.46**	3.25	3.64	0.120	39	**4.03**	3.68	4.43	0.150
M^3M^3	17	**4.78**	4.32	5.29	0.250	11	**4.85**	4.75	5.17	0.126	38	**5.45**	4.98	5.83	0.179
CM^3	17	**4.13**	3.81	4.47	0.152	10	**4.05**	3.88	4.28	0.111	39	**4.76**	4.48	5.15	0.158
LMd	20	**8.07**	7.43	8.58	0.284	10	**8.02**	7.73	8.16	0.159	51	**9.19**	8.52	9.93	0.330
ACo	22	**2.32**	1.97	2.64	0.183	10	**2.24**	2.01	2.37	0.100	54	**2.83**	2.54	3.13	0.129
CM_3	16	**4.36**	4.17	4.61	0.129	9	**4.25**	4.14	4.46	0.094	39	**5.12**	4.83	5.50	0.167

province, Turkmenistan]; Satunin 1905: 67). The latter name was broadly considered to belong to the populations of *P. pipistrellus* of West Turkestan and adjacent regions by most of the former reviewing authors (see the review by Benda et al. 2011c). The opinion presented by Neuhauser & DeBlase (1971) was accepted by Corbet (1978), DeBlase (1980) and Koopman (1994), while rejected by Strelkov et al. (1978), Strelkov (1981a), and Butovskij et al. (1985), who considered *P. p. bactrianus* a valid subspecies in West Turkestan.

Neuhauser & DeBlase (1971: 275) summarised the main characters of *P. p. aladdin* (in its broader sense, incl. *bactrianus*) differing from the nominotypical form and found dissimilarities in colouration traits only. They found the two subspecies to be similar in size, dental characters and baculum shape. *P. p. aladdin* was described to be "a pale desert race characterised by a relatively broad white border on the wing membrane and uropatagium; dorsal pelage color light but variable at tips, basal halves blackish; ventral pelage similarly bicolored but lighter" which is in accordance with the previous descriptions of *P. p. bactrianus* (see Benda et al. 2006). Neuhauser & DeBlase (1971) considered *P. p. pipistrellus* from Europe and the Caucasus to be a dark brown form, without any indication of a white border on the wing membranes and uropatagium.

In the first molecular genetic analysis made on a geographically broad scale of samples, Hulva et al. (2004) found two lineages within the *P. pipistrellus* clade, Eurasian and Maghrebian, in the analysed partial sequences of a mitochondrial gene (402 bp of the cyt *b* gene). While between the Eurasian and Maghrebian lineages they found a rather deep divergence of 3.48–5.72% of uncorrected *p* distance, within the lineages they found rather shallow divergences of 0.25–3.23 and 0.50–1.74%, respectively. Since the isolation-by-distance model has been documented within the Eurasian lineage, the only Iranian specimen included in the analysis (Yazd; the haplotype IRA1 in Fig. 163) was found to be distant for 0.25–0.75% of genetic distance from other samples from the Middle East and Caucasus, 1.24–1.99% from the European samples, and 1.74% from one sample from eastern Kazakhstan (KAZ1). Hulva et al. (2007b) repeated the comparison of the partial cyt *b* sequences of *P. pipistrellus*, to which they added several new samples including three bats from north-eastern Iran (Khorasan, Golestan). These sequences produced two new unique haplotypes (IRA2, IRA3) clustering very closely to the Kazakhstani haplotype KAZ1 and differing from them by only one substitution (0.25%); these three haplotypes formed a separate sublineage (see also Fig. 163).

Here we complemented the data sets used by Hulva et al. (2007b) and Benda et al. (2010) with samples of *P. pipistrellus* from all Iranian localities where the material for a molecular genetic analysis was available (Table 29). The partial cyt *b* sequences from fourteen Iranian samples produced

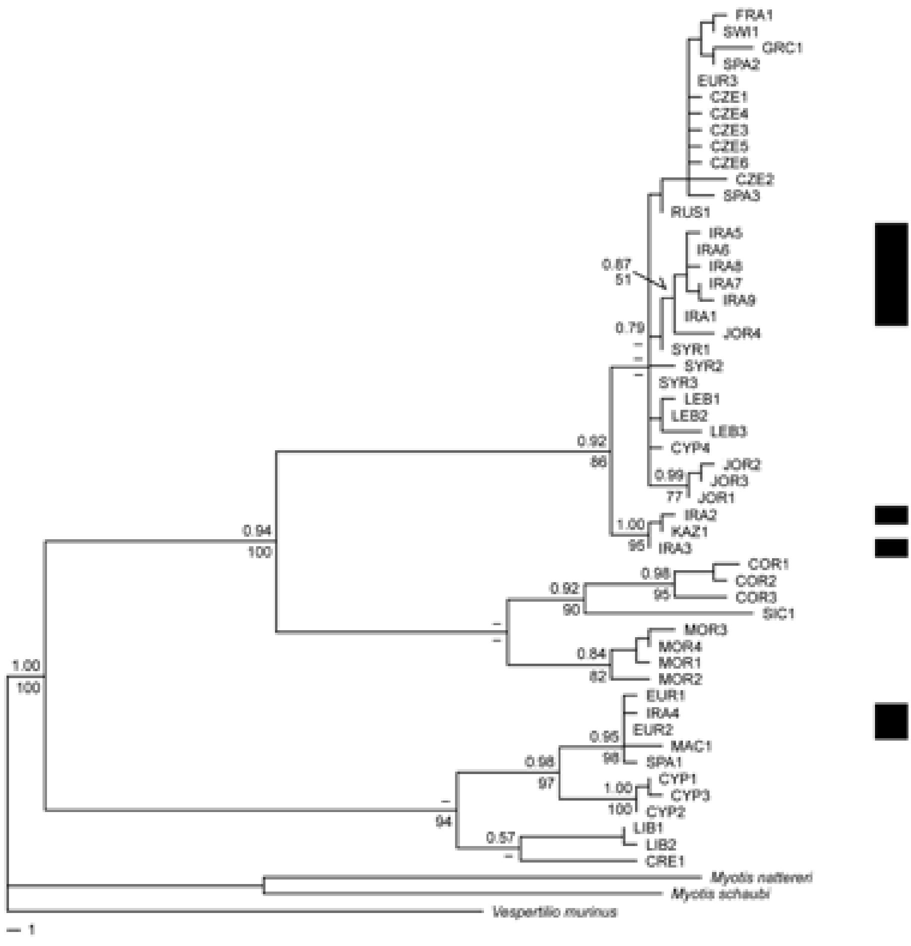


Fig. 163. Neighbour-joining tree based on *p* distances showing position of the Iranian haplotypes of the *Pipistrellus pipistrellus* complex (black vertical bars) (402 bp sequence of cytochrome *b*). MP bootstrap support is indicated below and posterior probability of Bayesian analysis above the respective branches.

Table 29. GenBank Accession Numbers of the examined Iranian specimens of the *Pipistrellus pipistrellus* complex (402 bp of the cytochrome *b* gene); * = after Hulva et al. (2004), † = after Hulva et al. (2007b)

haplotype	GBAN	voucher	sex	colection site & date
Pipistrellus pipistrellus				
IRA1	AY316335*	NMP 48112	m	Yazd, Dakhmeh-e Zartoshtiyun, 4 May 1997
	KF874512	NMP 93863	f	Lenje Abad, 1 October 2011
	KF874515	biopsy	f	Meymand, 4 October 2011
IRA2	EU084886†	NMP 90776	m	Chenarbu, 17 May 2006
		NMP 90791	m	Shurlaq, 18 May 2006
IRA3	EU084887†	NMP 90838	f	Tunel-e Golestan, 26 May 2006
IRA5	KF874513	NMP 93866	f	Meymand, 4 October 2011
IRA6	KF874514	biopsy	f	Meymand, 4 October 2011
	KF874516	biopsy	f	Meymand, 4 October 2011
	KF874517	NMP 93872	m	Hesar, 5 October 2011
	KF874519	biopsy	m	Hesar, 5 October 2011
IRA7	KF874518	biopsy	f	Hesar, 5 October 2011
IRA8	KF874520	biopsy	m	Hesar, 5 October 2011
IRA9	KF874521	biopsy	m	Hesar, 5 October 2011
Pipistrellus pygmaeus				
IRA4	EU084882†	NMP 90885	m	Tutaki, 3 June 2006
EUR2	AY316321†	NMP 90875	m	Ali Abad, 28 May 2006

eight unique haplotypes which clustered into two groups, representing two separate sublineages (Fig. 163); the haplotypes grouped in accordance with their geographic origin, creating the north-east-Iranian (Khorasani mountains) group (haplotypes IRA2, IRA3) and the south-Iranian (Zagros Mts.) group (IRA1, IRA5–IRA9). Variation within the Khorasani group/sublineage (including also one Kazakhstani haplotype, see above) was low, 0.25–0.50% of uncorrected *p* distance (Table 30); within the Zagrosian group (including one Jordanian and one Syrian/Jordanian haplotypes) it was higher, 0.25–1.49% (1–6 substitutions). Divergence between the groups was 1.24–2.74% (5–11 substitutions). However, the Zagrosian group was incorporated into the Eurasian sublineage, while the Khorasani group is a sublineage of its own. Moreover, although the latter group/sublineage is only slightly separated from the remaining Eurasian sublineage, including the Zagrosian haplotype group (1% of genetic distance as a minimum), it is rather well supported by values of the MP bootstrap and Bayesian posterior probability (Fig. 163).

It is important from the taxonomic point of view, that the Zagrosian group of haplotypes originates from the area encompassing the type locality of *P. aladdin* Thomas, 1905 (it is situated in the middle of the line connecting two sites, Lenje Abad and Yazd, where the haplotype IRA1 was found), while the Khorasani group from the area close to Tedžen, Turkmenistan, the type locality of *P. bactrianus* Satunin, 1905. This record conforms to the opinion by several authors (see above), who considered these two forms separated, contra the revision by Neuhauser & DeBlase (1971), who suggested their synonymy. The populations from the Zagros Mts. create an integral part of the Eurasian sublineage and the name *aladdin* is thus undoubtedly a synonym of *P. p. pipistrellus* (Schreber, 1774) (type locality: Beauvais Cathedral, Normandy, France; ICZN 2003: 95). On the other hand, the populations of West Turkestan, including those of the Khorasani mountains of Iran, are separated as a sublineage in a sister position to the Eurasian sublineage. If the subspecific status for Central Asian populations (sublineage) of *P. pipistrellus* is accepted, the name *bactrianus* is the prior available name to label this taxon (see Benda et al. 2011c). However, the shallow divergence between these sublineages does not support a taxonomic division of the whole Eurasian lineage.

The morphometric comparison of west-Palaearctic populations of *P. pipistrellus* by Benda et al. (2004b) showed samples from the Middle East, incl. several bats from Iran, to possess a much broader variation range in skull dimensions than the samples from Europe (see also Benda et al. 2006: 192, Table 28). The range of dimension values found in the bats of the Middle East covers almost completely the ranges of European sets of two species samples, i.e. *P. pipistrellus* and *P. pygmaeus*, which seem to be mostly separated in skull dimensions. On the other hand, all compared samples concur in dental traits. The three analyses (Benda et al. 2003, 2004b, Hulva et al. 2004) indicated existence of character displacement in the *P. pipistrellus* complex in the western Palaearctic: where two species live in sympatry (Europe), their dimension ranges are narrower than in the regions where only one species occurs (large part of the Middle East).

Echolocation. *Pipistrellus pipistrellus* emits short calls, which are frequency-modulated in the initial phase and quasi-constant frequency in the final part. In the European populations, the calls usually have the peak frequency between 42–52 kHz, on average around 45 kHz (Jones & van Parijs 1993, Barlow & Jones 1997, Russo & Jones 2002, Jahelková 2003, Papadatou et al. 2008). In the Levantine populations of *P. pipistrellus* (Benda et al. 2006, 2010), the frequencies of maximum energy have higher values, documented between 46–54 kHz (Syria) and 46–50 kHz (Jordan). Similar values were observed also in Iran (Table 3); we analysed 54 echolocation calls of *P. pipistrellus* from three sites (Figs. 108, 164) and recorded a wider range of the values of frequency of maximum energy, typically between ca. 44–54 kHz. The highest values (about 57 kHz) were observed in the valley near Kareh (Esfahan), where numerous individuals foraged over a stream surrounded by a poplar grove. Such a large variation in echolocation parameters could be in agreement with the hypothesis that *P. pipistrellus* modifies patterns of its calls depending on the presence or absence of other individuals of the same species (e.g. Bartonička et al. 2007).

Feeding ecology. *Pipistrellus pipistrellus* is a small aerial-hawking bat (Norberg & Rayner 1987). In Europe, the species was found to feed mostly on small swarming nematoceran Diptera above

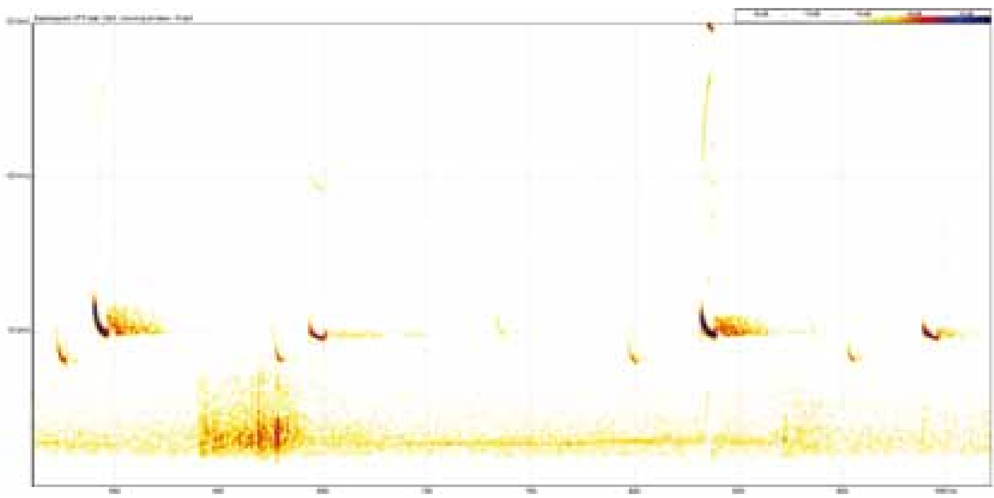


Fig. 164. Spectrogram of echolocation calls of *Pipistrellus pipistrellus* (Schreber, 1774) and *P. kuhlii* (Kuhl, 1817); individuals foraging in the Dez river valley at Lenje Abad (Lorestan).

Table 30. Percent pairwise unncorrected genetic distances among haplotypes of the *Pipistrellus pipistrellus* complex and outgroups (vespmur = *Vespertilio murinus*, myonat = *Myotis nattereri*, myosch = *M. schaubi*); see text for details

p [%]	IRA1	IRA2	IRA3	IRA4	IRA5	IRA6	IRA7	IRA8	IRA9	KAZ1	SYR1	SYR2	SYR3	LEB1	LEB2	LEB3	JOR1	JOR2
IRA2	1.99																	
IRA3	1.49	0.50																
IRA4	11.94	10.95	11.44															
IRA5	0.50	2.49	1.99	12.44														
IRA6	0.25	2.24	1.74	12.19	0.25													
IRA7	0.50	2.49	1.99	11.94	0.50	0.25												
IRA8	0.50	2.49	1.99	12.44	0.50	0.25	0.50											
IRA9	0.75	2.24	1.74	11.69	0.75	0.50	0.25	0.75										
KAZ1	1.74	0.25	0.25	11.19	2.24	1.99	2.24	2.24	1.99									
SYR1	0.25	1.74	1.24	12.19	0.75	0.50	0.75	0.75	1.00	1.49								
SYR2	1.00	1.99	1.99	11.94	1.49	1.24	1.49	1.00	1.74	2.24	0.75							
SYR3	0.50	1.49	1.49	11.94	1.00	0.75	1.00	1.00	1.24	1.74	0.25	0.50						
LEB1	1.00	1.99	1.99	12.44	1.49	1.24	1.49	1.49	1.74	2.24	0.75	1.00	0.50					
LEB2	0.75	1.74	1.74	12.19	1.24	1.00	1.24	1.24	1.49	1.99	0.50	0.75	0.25	0.25				
LEB3	1.49	1.99	1.99	11.94	1.99	1.74	1.99	1.99	2.24	2.24	1.24	1.49	1.00	1.00	0.75			
JOR1	1.24	2.24	2.24	11.69	1.74	1.49	1.74	1.74	1.99	2.49	1.00	1.24	0.75	1.24	1.00	1.74		
JOR2	1.74	2.74	2.74	11.69	2.24	1.99	2.24	2.24	2.49	2.99	1.49	1.74	1.24	1.74	1.49	2.24	0.50	
JOR3	1.49	2.49	2.49	11.44	1.99	1.74	1.99	1.99	2.24	2.74	1.24	1.49	1.00	1.49	1.24	1.99	0.25	0.25
JOR4	0.75	2.74	2.24	12.44	1.24	1.00	1.24	1.24	1.49	2.49	1.00	1.74	1.24	1.74	1.49	2.24	1.74	2.24
RUS1	0.75	1.74	1.74	11.69	1.24	1.00	1.24	1.24	1.49	1.99	0.50	0.75	0.25	0.75	0.50	1.24	1.00	1.00
EUR3	1.24	2.24	2.24	11.69	1.74	1.49	1.74	1.74	1.99	2.49	1.00	1.24	0.75	1.24	1.00	1.74	1.49	1.49
GRC1	1.99	2.99	2.99	11.94	1.99	1.74	1.99	1.99	2.24	3.23	1.74	1.99	1.49	1.99	1.74	2.49	2.24	2.24
FRA1	1.99	2.99	2.99	11.94	2.49	2.24	2.49	2.49	2.74	3.23	1.74	1.99	1.49	1.99	1.74	2.49	2.24	2.24
CZE1	1.49	2.49	2.49	11.44	1.99	1.74	1.99	1.99	2.24	2.74	1.24	1.49	1.00	1.49	1.24	1.99	1.74	1.74
CZE2	1.99	2.49	2.49	11.94	2.49	2.24	2.49	2.49	2.74	2.74	1.74	1.99	1.49	1.99	1.74	1.99	2.24	2.24
CZE3	1.49	2.49	2.49	11.94	1.99	1.74	1.99	1.99	2.24	2.74	1.24	1.49	1.00	1.49	1.24	1.99	1.74	1.74
CZE4	1.49	2.49	2.49	11.94	1.99	1.74	1.99	1.99	2.24	2.74	1.24	1.49	1.00	1.49	1.24	1.99	1.74	1.74
CZE5	1.49	2.49	2.49	11.94	1.99	1.74	1.99	1.99	2.24	2.74	1.24	1.49	1.00	1.49	1.24	1.99	1.74	1.74
CZE6	1.49	2.49	2.49	11.44	1.99	1.74	1.99	1.99	2.24	2.74	1.24	1.49	1.00	1.49	1.24	1.99	1.74	1.74
SPA2	1.74	2.74	2.74	12.19	2.24	1.99	2.24	2.24	2.49	2.99	1.49	1.74	1.24	1.74	1.49	2.24	1.99	1.99
SPA3	1.74	2.24	2.24	11.69	2.24	1.99	2.24	2.24	1.99	2.49	1.49	1.74	1.24	1.74	1.49	2.24	1.99	1.99
SWI1	1.74	2.74	2.74	12.19	2.24	1.99	2.24	2.24	2.49	2.99	1.49	1.74	1.24	1.74	1.49	2.24	1.99	1.99
EUR1	11.94	10.95	11.44	0.50	12.44	12.19	11.94	12.44	11.69	11.19	12.19	11.94	11.94	12.44	12.19	11.94	11.69	11.69
EUR2	11.69	10.70	11.19	0.25	12.19	11.94	11.69	12.19	11.44	10.95	11.94	11.69	11.69	12.19	11.94	11.69	11.44	11.44
MAC1	11.94	10.95	11.44	1.00	12.44	12.19	11.94	12.44	11.69	11.19	12.19	11.94	11.94	12.44	12.19	11.94	11.69	11.69
SPA1	11.94	10.45	10.95	0.50	12.44	12.19	11.94	12.44	11.69	10.70	11.69	11.44	11.44	11.94	11.69	11.44	11.19	11.19
vesmur	19.40	17.91	18.41	17.16	19.65	19.65	19.40	19.90	19.15	18.16	19.15	18.90	18.90	18.90	18.66	18.66	18.66	19.15
myonat	20.40	18.90	19.40	19.15	20.40	20.15	19.90	20.40	19.65	19.15	20.15	19.90	19.90	19.90	19.65	19.65	20.15	20.15
myosch	20.40	19.90	19.90	19.15	20.90	20.65	20.40	20.65	20.15	20.15	20.15	20.15	19.90	20.40	20.15	20.15	19.65	20.15

the surface of water bodies. Other important prey items included Lepidoptera, Heteroptera and Hymenoptera (Beck 1995, Barlow 1997, Arlettaz et al. 2000, etc.).

As far as the results of diet analyses of *P. pipistrellus* populations from the Middle East are concerned, data are available from Turkey, Azerbaijan, Syria, and Jordan (Rahmatulina 2005, Benda et al. 2006, 2010, Whitaker & Karataş 2009). The diet of the Middle Eastern populations is quite variable and dominated especially by smaller Coleoptera, Formicoidea, Heteroptera, smaller Lepidoptera, Ephemeroptera, Plecoptera, and Blattodea. Generally, compared to the results from Europe, nematoceran Diptera are with some exceptions nearly absent from the south-west-Asian diet samples, perhaps due to scarcity of large freshwater bodies. On the other hand, Formicoidea and sometimes Coleoptera are food items of much higher importance in the diet of *P. pipistrellus* in the Middle East than in Europe.

From Iran, we analysed the diet of *P. pipistrellus* from five sites throughout the country, altogether 255 faecal pellets were available (Figs. 165, 146). These analyses brought quite varied

	JOR3	JOR4	RUS1	EUR3	GRC1	FRA1	CZE1	CZE2	CZE3	CZE4	CZE5	CZE6	SPA2	SPA3	SWI1	EUR1	EUR2	MAC1	SPA1
	1.99																		
	0.75	1.49																	
	1.24	1.99	0.50																
	1.99	2.74	1.24	0.75															
	1.99	2.74	1.24	0.75	1.49														
	1.49	2.24	0.75	0.25	1.00	1.00													
	1.99	2.74	1.24	0.75	1.49	1.49	1.00												
	1.49	2.24	0.75	0.25	1.00	1.00	0.50	1.00											
	1.49	2.24	0.75	0.25	1.00	1.00	0.50	1.00	0.50										
	1.49	2.24	0.75	0.25	1.00	1.00	0.50	1.00	0.50	0.50									
	1.49	2.24	0.75	0.25	1.00	1.00	0.50	1.00	0.50	0.50	0.50								
	1.74	2.49	1.00	0.50	0.75	0.75	0.75	1.24	0.75	0.75	0.75	0.75							
	1.74	2.49	1.00	0.50	1.24	1.24	0.75	1.24	0.75	0.75	0.75	0.75	1.00						
	1.74	2.49	1.00	0.50	1.24	0.25	0.75	1.24	0.75	0.75	0.75	0.75	0.50	1.00					
	11.44	12.44	11.69	11.69	11.94	11.94	11.44	11.94	11.94	11.94	11.94	11.44	12.19	11.69	12.19				
	11.19	12.19	11.44	11.44	11.69	11.69	11.19	11.69	11.69	11.69	11.69	11.19	11.94	11.44	11.94	0.25			
	11.44	12.44	11.69	11.69	11.94	11.94	11.44	11.94	11.94	11.94	11.94	11.44	12.19	11.69	12.19	1.00	0.75		
	10.95	12.44	11.19	11.19	11.44	11.44	10.95	11.44	11.44	11.44	11.44	10.95	11.69	11.19	11.69	0.50	0.25	1.00	
	18.90	19.90	19.15	19.15	19.40	19.40	18.90	19.40	19.40	19.40	19.40	18.90	19.15	19.15	19.15	17.41	17.41	17.91	17.16
	19.90	20.65	19.65	19.65	19.40	19.40	19.40	19.90	19.90	19.90	19.40	19.40	19.65	19.65	19.65	18.90	18.90	19.65	18.66
	19.90	20.15	20.15	19.65	19.90	19.90	19.40	19.90	19.40	19.90	19.40	19.40	19.65	19.65	20.15	18.90	18.90	19.65	18.66

results; however, the most important food items included Nematocera, Hymenoptera, and Auchenorrhyncha. At Tunel-e Golestan (Golestan), where Hymenoptera prevailed in the diet, this taxon was represented by Formicoidea. Ichneumonoidea were frequent at other sites, but their volume was not important. Culicidae and Chironomidae were the most important nematoceran Diptera, but Psychodidae, Sciaridae, Simuliidae and Cecidomyidae were also found. Among Sternorrhyncha, Aphidoidea prevailed over Psylloidea. The most frequent Coleoptera were small--sized Carabidae.

The diet of *P. pipistrellus* in Iran is very variable and probably reflects opportunistic ability of this species to aim at currently the most profitable diet item. We recorded samples with a high proportion of nematocerans in a humid river valley (Lenje Abad) but no samples with abundant Coleoptera, unlike the results of some other analyses of the diet of this species in south-western Asia. On the other hand, the sample set with a majority of ants corresponds well with many results of diet analyses from the Middle East (also in other species).

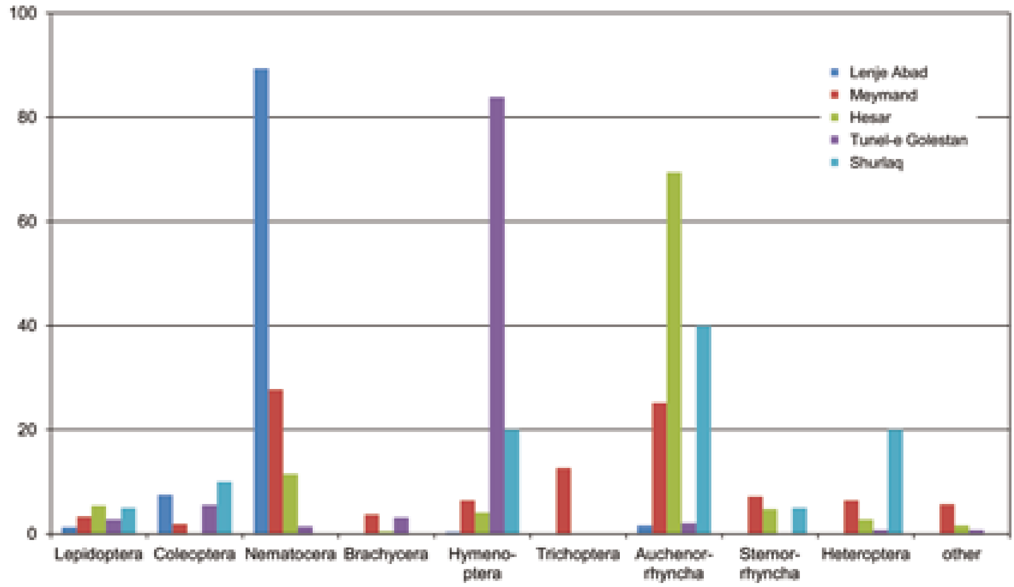


Fig. 165. Percentage volume of particular food items in the diet of *Pipistrellus pipistrellus* (Schreber, 1774) in Iran. Material analysed: Lenje Abad (16 faecal pellets / from one bat), Meymand (45 / 5), Hesar (164 / 13), Tunel-e Golestan (29 / 4), Shurlaq (1 / 1).

Records of ectoparasites. **Original data**: A r g a s i d a e: *Argas vespertilionis*: 1 larva (CMŠ [P]) from 1 fa (NMP 93866), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011. – M a c r o n y s s i d a e: *Steatonyssus* sp.: 1 ma (CMŠ [P]; det. P. Mašán) from 1 fa (NMP 93866), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011; – 1 protonymph (CMŠ [P]; det. P. Mašán) from 1 fs, Hesar (Fars Prov.), 5 October 2011. – **Published data**: I s c h n o p s y l l i d a e: *Ischnopsyllus octactenus*: 4 fa from unknown number of inds., Ramsar [Mazandaran Prov.], 1952 (Klein et al. 1963); – 1 ma, 1 fa from unknown number of inds., Ramsar [Mazandaran Prov.], July 1962 (Klein et al. 1963); – 1 ma, 1 fa from unknown number of inds., Ramsar [Mazandaran Prov.], August 1965 (Farhang-Azad 1969b). – P u l i c i d a e: *Xenopsylla nuttalli*: 1 ma from 1 ind. [as *Pipistrellus* sp.], 28 km W Gorgan, Mazanderan, 12 June 1963 (Dittmar de la Cruz 2012). – A r g a s i d a e: *Argas vespertilionis*: 15 larvae from unknown number of inds., 27 km W of Derregaz [= Dargaz] town, 12–17 July 1969 (Filippova et al. 1976). – I x o d i d a e: *Dermacentor marginatus*: 1 larva from 1 ind., 27 km W of Derregaz [= Dargaz] town, 12–17 July 1969 (Filippova et al. 1976). – T r o m b i c u l i d a e: *Schoutedenichia chilmirica*: 1 larva from 1 ind., sel. Letfabad, 27 km zapadnee Derregeza [= Loft Abad village, 27 km W of Dargaz; Khorasan-e Razawi Prov.], 3 July 1969 (Kudrâšova 1975, 1998, 2004, Kudrâšova et al. 1978).

Comments on ectoparasites. The bat flea *Ischnopsyllus octactenus* (Kolenati, 1856) is a west--Palaearctic form, *Pipistrellus pipistrellus* represents its principal host in its whole distribution range (Hůrka 1963), and one of two hosts registered in Iran (Klein et al. 1963, Peus 1968, Farhang-Azad 1969b). In neighbouring Azerbaijan, another bat flea *Ischnopsyllus dolosus* Dampf, 1912 was reported to parasitise this bat (Dubovčenko 1965) and its occurrence is quite likely also in north-western Iran.

The flea *Xenopsylla nuttalli* Ioff, 1930 is a common parasite of rodents; in Iran, it was previously collected from various gerbilids (Klein et al. 1963, Farhang-Azad 1969c, Tajedin et al. 2009). A finding of this flea from a bat is rather unusual and perhaps represents parasitation of a secondary host.

The bat tick *Argas vespertilionis* Koch, 1844 is a species parasitic almost exclusively on bats of the genus *Pipistrellus* (Dusbábek 1972), its finding on *P. pipistrellus* from Iran was previously mentioned only by Filippova et al. (1976). However, it was recently collected also from *Rhinolophus ferrumequinum*, *Pipistrellus pygmaeus* and *Miniopterus pallidus*. Pospelova-Štrom & Štrom (1940) reported *A. vespertilionis* from *P. pipistrellus* also from Transcaucasia.

The chigger mite *Schoutedenichia chilmirica* Kudrâšova, 1975, collected from *P. pipistrellus* at Loft Abad in the Khorasan province, was described as a new species (Kudrâšova 1975). It is an endemic of Iran, known only from the type locality in the Kopetdagh Mts. (Kudrâšova et al. 1978).

Two specimens of *Steatonyssus* sp. were collected from *P. pipistrellus* at two sites. This mite genus is a common parasite of bats of the genus *Pipistrellus*, e.g. *Steatonyssus periblepharus* Kolenati, 1858 and *S. spinosus* Willmann, 1936 (Radovsky 1967); the former species was recorded in Iran from *Pipistrellus kuhlii* (see below).

The tick *Ixodes redikorzevi* Olenev, 1927 is parasitic mainly on small terrestrial mammals, its record from a bat is quite unusual and its occurrence on bats is probably only accidental. The same is true for *Dermacentor marginatus* (Sulzer, 1776) – adults of this tick are parasitic on the wild and domestic ungulates, subadult individuals on small mammals. Its distribution range stretches from the western Mediterranean to West Turkestan (Kolonin 2009).

Pipistrellus pygmaeus (Leach, 1825)

Records. **Original data**: G i l â n: valley 5 km S of Tutaki [1], 37 km SE of Rasht, beech forest, above a river, 3 June 2006: net. 2 ma, 3 ms (NMP 90885–90889; cf. Benda et al. 2006 [as *P. pipistrellus*], Hulva et al. 2007b, 2010). – G o l e s t a n: valley 2 km SSE of Ali Abad [2], beech forest, above a stream, 28 May 2006: net. 4 ma, 1 ms, 4 fG (NMP 90873–90881; Fig. 166; cf. Benda et al. 2006 [as *P. pipistrellus*], Hulva et al. 2007b, 2010).

Distribution. *Pipistrellus pygmaeus* seems to be a rare species in Iran, as it was confirmed from only two sites in the northernmost part of the country (Hulva et al. 2007b; Fig. 157). These records represent the extreme east of the species distribution range, covering mainly southern and Central Europe (Mayer & von Helversen 2001). The Iranian occurrence in the Golestani forests at Ali Abad are the easternmost confirmed point of the whole documented range of the species.

Occurrence of *P. pygmaeus* has been recently documented from Azerbaijan and Georgia (Rahmatulina & Gasanov 2002, Buhnikašvili et al. 2004, Rahmatulina 2005) and from the Russian Caucasus (Kruskop 2007). On the other hand, the species is almost unknown from Turkey with exceptions of Turkish Thrace and one site in extreme north-western Anatolia (Benda et al. 2003, Dietz et al. 2005, Paksuz & Özkan 2011); a geographically isolated and taxonomically separated population was described from Cyprus (Benda et al. 2007). In other parts of the Middle East, *P. pygmaeus* has not yet been documented; only three continental localities of occurrence of the species are thus known from this extensive region, all at its northern edges (Manyas lake in NW Turkey and two Iranian sites, see above).

The Iranian occurrence in the Gilani and Golestani forests thus represents a natural termination of the Caucasus range, most of the records known from Transcaucasia come from the Lənkəran area of Azerbaijan (Rahmatulina 2005). The records of *P. pygmaeus* could be therefore awaited in the Hyrcanian mixed forests along the whole Caspian shore and adjacent mountain slopes of Gilan, Mazandaran and Golestan. The occurrence of this species in Iran could thus be more abundant than estimated from the two confirmed records only.

Field notes. Both known Iranian sites of *Pipistrellus pygmaeus* records lie in the belt of Hyrcanian forests stretching along the northern foothills of the Alborz Mts. Five males were netted above a river at Tutaki near Rasht (Gilan) on 3 June 2006 (Fig. 167). The locality is a wide alluvium covered by broad-leaved forest, composed mainly of beech trees. Other five males and four females were captured into nets installed above a stream in a dense beech forest at Ali Abad (Golestan) on 28 May 2006 (Fig. 76); at this site, also *Myotis blythii*, *M. bechsteinii*, *M. nattereri*, *M. emarginatus*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Eptesicus serotinus*, and *Nyctalus leisleri*, were caught.

At Ali Abad, four pregnant females were collected, suggesting presence of a maternity roost in the valley, perhaps in a tree hole; each female contained two relatively large foeti of the crown--rump length 9.7–13.5 mm (mean 11.03 mm). The size of foeti suggests the parturition term in the north-Iranian populations of *P. pygmaeus* to occur at the break of May/June.

Material examined. 5 ♂♂, 4 ♀♀ (NMP 90873–90877, 90879, 90880 [S+A], NMP 90878, 90881 [A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 5 ♂♂ (NMP 90885–90887, 90889 [S+A], NMP 90888 [A]), Tutaki (Gilan Prov.), 3 June 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Pipistrellus pygmaeus* are shown in Table 28. For the material examined see above.

The knowledge of geographic variation in the relatively recently discovered species *P. pygmaeus* still remains incomplete known. Two subspecies are currently recognised within its rank, *P. p. cyprius* Benda, 2007 from Cyprus and the nominotypical form from the rest of the species range (Benda et al. 2007, Hulva et al. 2010). Genetic traits of the Iranian populations were examined by Hulva et al. (2007b); the molecular genetic analysis of partial sequences of a mitochondrial gene (402 bp of the cyt *b* gene) revealed two haplotypes from two specimens originating from both known localities of the species in Iran (Fig. 163). One haplotype (EUR2), found in Ali Abad

Fig. 166. *Pipistrellus pygmaeus* (Leach, 1825) from Ali Abad (Golestan). Photo by A. Reiter.

Fig. 167. Alluvial valley near Tutaki (Gilan), a foraging site of *Pipistrellus pygmaeus*. Photo by J. Hájek.

(Golestan), is the most common haplotype of the species, it was previously documented in Central and southern Europe (Czech Republic, Spain, Greece, Romania, Turkey; Hulva et al. 2004) and is thus widespread over the whole range of the species (from Spain to Iran, i.e. the maximum geographical span), while the other one (IRA4) is a unique haplotype known only from Tutaki (Gilan); however, these two haplotypes differed only by one substitution (0.25% of uncorrected *p* distance). In body and skull size, the Iranian specimens of *P. pygmaeus* conform to the samples from Europe (comp. Table 28 and Benda et al. 2007: 102, Table 3).

These data clearly suggest the Iranian populations to belong to the widespread and invariable nominotypical subspecies (type locality: Chew Valley Lake, Bath and North East Somerset, United Kingdom; ICZN 2003: 85).

Echolocation. *Pipistrellus pygmaeus* produces echolocation calls similar to its closest relative species, *P. pipistrellus* (see above), but with the frequency of maximum energy shifted up, in the UK on average at ca. 54–57 kHz (Jones & van Parijs 1993, Barlow & Jones 1997, 1999, Russo & Jones 2002), in Greece at 52–66 kHz (Papadatou et al. 2008). We did not analyse calls of *P. pygmaeus* in Iran.

Feeding ecology. *Pipistrellus pygmaeus* is a small aerial hawker foraging close to vegetation (Arnold et al. 2003, Dietz et al. 2007). The diet of the European populations of this species contained an overwhelming majority of nematoceran Diptera and much lower proportions of other prey items such as Brachycera, Lepidoptera, Trichoptera, Coleoptera, Heteroptera, Araneae, and Hymenoptera (Barlow 1997, Pithartová 2007, Bartonička et al. 2008). Only one sample set from one individual has been studied from the Middle East so far – it contained Diptera, Hemiptera, Trichoptera, and Lepidoptera (Whitaker & Karataş 2009).

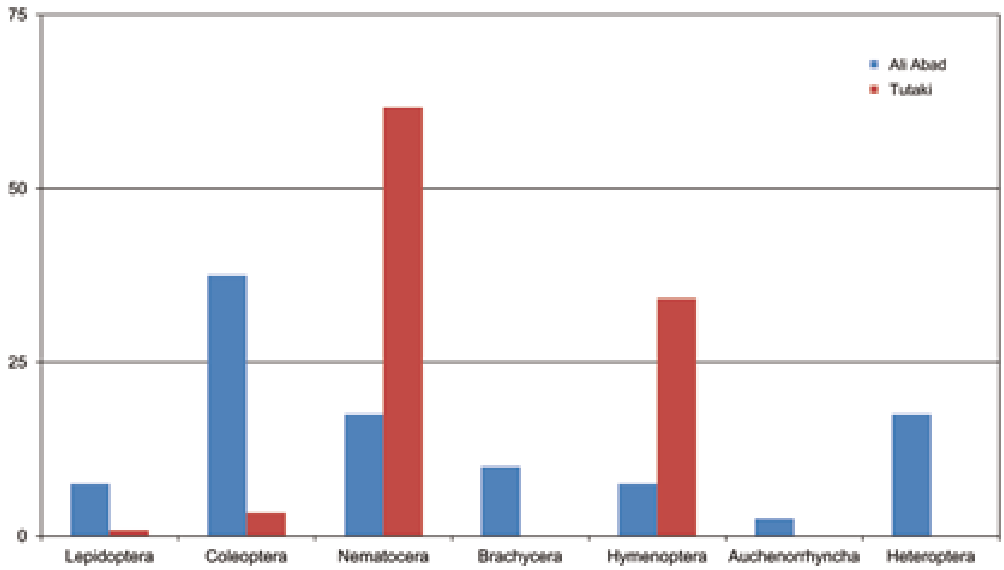


Fig. 168. Percentage volume of particular food items in the diet of *Pipistrellus pygmaeus* (Lach, 1825) in Iran. Material analysed: Ali Abad (20 faecal pellets / from nine animals), Tutaki (15 / 5).

In Iran, we collected two sets of faeces of *P. pygmaeus*, twenty pellets from Ali Abad (Golestan) and fifteen pellets from Tutaki (Gilan). The analyses of these samples showed relatively different results (Fig. 168). The diet composition from Ali Abad was dominated by Coleoptera (small Carabidae and small Curculionidae), nematoceran Diptera represented only some 17.5% volume – a similar amount as Heteroptera. The most important food item in the *P. pygmaeus* diet from Tutaki was nematoceran Diptera, followed by ants (Formicoidea) (Fig. 168).

The high proportion of nematocerans in the samples from Tutaki resembles the results of diet analyses of *P. pygmaeus* from Europe (see above). Higher proportion of ants seems to be characteristic for more arid regions of the Middle East. The high proportion of beetles in the samples from Ali Abad is unusual for *P. pygmaeus*.

Records of ectoparasites. **Original data**: A r g a s i d a e: *Argas vespertilionis*: 1 larva (CMŠ [P]) from 9 inds. (NMP 90873–90881), Ali Abad (Golestan Prov.), 28 May 2006.

Comments on ectoparasites. The soft tick *Argas vespertilionis* Koch, 1844 is a species parasitic almost exclusively on bats of the genus *Pipistrellus* (Dusbábek 1972), its finding on *Pipistrellus pygmaeus* from Iran cannot be considered unusual. It is the only ectoparasite species recorded from *P. pygmaeus* in the country. In Iran, it was collected also from *Rhinolophus ferrumequinum*, *Pipistrellus pipistrellus*, and *Miniopterus pallidus* (see under these species).

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

Records. **Original data**: A r d a b i l: Narkor near Pârs Âbâd [1], 4 March 2005: coll. 1 ma (HMNH 2007.30.7.; leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari). – Â z a r b â i j a n - e G h a r b i: Bastam [2], 6 km W of Qarah Ziya'oddin, 30 September 1998: net. 1 ma (NMP 48121; cf. Benda et al. 2006). – B u s h e h r: Bouchir [= Bushehr], Brazjan [Borazjan] [3], June 1968: coll. 1 mj, 1 fj (MHNG 1905.1A, 1905.1B; leg. A. Arata). – C h a h â r M a h â l v a B a k h t i â r i: Katak [4], 30 km WNW Shahr-e Kord, under rest of a street lamp on wooden pylon, 13 August 2010: obs. 1 ind. (cf. Faizolahi et al. 2011). – E s f a h â n: Deh Zireh [5], 35 km SE of Kashan, deserted house, 26 April 1996: net. 2 fa (CUP I-1, I-2; leg. J. Sádlová), 27 April 1996: remnants of 2 inds. in *Athene noctua* pellets (cf. Obuch & Krištín 2004); – Khafr [6], 50 km S of Semirom, under roof of an abandoned house, 11 September 2010: obs. a colony of ca. 50 inds. between timbers, exam. 8 inds. (cf. Faizolahi et al. 2011). – F â r s: Firuz Abad [7], ruins of Atas Kade mosque, 20 April 2000: remnants of 2 inds. (2 right mandibles, fragments of 1 skull) found in *Athene noctua* pellets; – Kâzerun [8], at a hotel in the city centre, 6 October 2011: det. & rec. calls of 1 foraging ind.; – valley 11 km SE of Sarvestan [9], 80 km SE of Shiraz, above a dam, 20 April 2000: net. 2 ma, 1 fa (NMP 48455–48457; cf. Benda et al. 2006), remnants of 1 ind. (2 rostrum fragments) found in *Athene noctua* pellets; – valley 10 km NW of Hesar [10], 66 km NW of Marv Dasht, above a stream, 5 October 2011: net. 10 ma, 6 ms, 18 fa, 10 fs, coll. 1 m (NMP 93871; Fig. 170), det. & rec. calls of numerous foraging inds. – G i l â n: Bandar Anzali [11], 2007: remnants of 3 inds. found in *Tyto alba* pellets (leg. A. Khaleghizadeh; cf. Obuch & Khaleghizadeh 2011). – G o l e s t a n: wadi 4 km SE of Suzesh [12], 18 km W of Maraveh Tappeh, above a dry wadi, 27 May 2006: net. 3 ma (NMP 90845–90847; cf. Benda et al. 2011c). – H o r m o z g â n: Podonu [13], 10 km E of Dehbârez, palm oasis, 10 October 2011: det. & rec. calls of several foraging inds.; – valley of the Radul river [14], 5 km SW of Kuchandar, 11 October 2011: det. & rec. calls of several foraging inds.; – wadi 6 km E of Tujak [15], 53 km SSE of Sirik, at a pool, 15 April 2000: det. calls of 1+ ind.; – Zangârd [16], 25 km E of Bastak, at a reservoir in the village and in palm oasis, 9 October 2011: det. & rec. calls of several foraging inds. – I l â m: Abdanan river 15 km SW of Mormori [17], 25 km E of Dehlorân, above the river, 16 October 2011: det. & rec. calls of several foraging inds. – K e r m â n: Arg-e Bam [18], Bam, ruined fortress town, 6 May 1997: coll. 1 fG (NMP 48116; cf. Benda et al. 2006), 8 April 2000: coll. 4 ma, 1 fa, 1 fs (NMP 48369–48374; cf. Benda et al. 2006); – valley 5 km SE of Chah Reza [19], 74 km E of Manujan, above a pool, 16 April 2000: net. 5 ma, 6 fL (NMP 48425– 48435; cf. Benda et al. 2006). – K e r m â n s h a h: Bisotun [20], 28 km E of Kermânshah, 7 October 1998: remnant of 1 ind. (left mandible fragment) found in *Tyto alba* pellets (cf. Obuch & Khaleghizadeh 2011); – Zap. Persiâ, Kurdistan, Kasre-Širin [= western Iran, Kordestân, Qasr-e Shirin] [21], 9 May [= 22 May NS] 1914: coll. 1 ind. (ZIN 5000; leg. P. V. Nesterov). – K h o r a s â n - e J a n u b i: V. Persiâ, Harasan [= eastern Iran, Khorasân] = Bumrudskij aryk' [Bamrud channel, Zirkuh country, see Zarudnyj 1902] [22], 21 July [= 4 August NS] 1901: coll. 1 ind. (ZIN 9252; leg. N. A. Zarudnyj). – K h o r a s â n - e R a z a w i: Rubat-e Sharaf caravanserai [23], 54 km SW of Sarakhs, ruins, 11 May 1997: remnants of 1 ind. found in *Athene noctua* pellets (cf. Obuch & Krištín 2004); – Shurlaq [24], 53 km WSW of Sarakhs, above a stream, 18 May 2006: net. 1 fG (NMP 90792). – K h u z e s t â n: valley 2 km NE of Si Mili [25], 26 km SSE of Masjed Soleyman, above a river, 11 October 1998: net. 2 ma (NMP 48160, 48161; cf. Benda et al. 2006); – valley at Valiabad [26], 15 km SE of Behbahan, at a stream, 14 October 2011: det. & rec. calls of 1 ind.; – Choqâzanbil [27], 30 km SE of Shush, above the Karkheh river oxbow, 15 October 1998: net. 1 ma, 1 fs (NMP 48190, 48191; cf. Benda et al. 2006); – Haft Tappeh [28], 20 km SSE of Shush, 18 October 2002: remnants of 7 inds. (6 right and 7 left mandibles, 6 skull fragments) found in *Tyto alba* pellets (cf. Obuch & Khaleghizadeh 2011); – Persiâ, Al'horšir' [= Iran, Ala Khworshid, 6 km NW of Bagh-e Malek] [29], 29 January [= 11 February NS] 1904: coll. 1 m (ZIN 2094; leg. N. A. Zarudnyj; Zarudnyj (1905) mentioned a visit at this site on 30 December 1903 [12 January 1904 NS]). – K o h g i l u y e v a B o y e r A h m a d: valley 3 km N of Meymand [30], 24 km N of Pataveh, above a river, 4 October 2011: det. & rec. calls of numerous foraging inds. – L o r e s t a n: 3 km S of Lenje Abad [31], 9 km SW of Dorud, 1 October 2011: det. & rec. calls of numerous inds. – S i s t â n v a B a l u c h e s t â n: Pir Sohrab [32], 54 km NE of Chabahar, above a pool, 12 April 2000: net. 1 ma (NMP 48403; cf. Benda et al. 2006); – Vost. Iran, Beludžistan [= eastern Iran, Baluchestan], 1901 [= between 1 January (= 14 January NS) and 26 February (= 11 March NS), see Zarudnyj (1902)]: coll. 1 m, 1 f, 1 ind. (ZIN 5922, 5923, 5883; leg. N. A. Zarudnyj). – Z a n j â n: oasis 2 km SE of Garmab [33], above a pool, 30 September 2011: net. 1 ma (NMP 93862). – Iran (undef.): Persiâ [= Iran], 1896 [= between 23 March (= 4 April NS) and 28 July (= 9 August NS), see Zarudnyj (1896)]: coll. 2 inds. (ZIN 5430, 5431; leg. N. A. Zarudnyj; according to Zarudnyj [1896], the specimens should originate from the teritorry of north-eastern, eastern or south-eastern Khorasân [Khorasân-e Razawi and Khorasân-e Janubi Provs.] or Sistân [Sistân va Baluchestân Prov.]). – Iran (undef.): V. Persiâ [= eastern Iran], 1901 [= between 1 January (= 13 January NS) and 19 August (= 1 September NS) 1901, see Zarudnyj (1902)]: coll. 1 ind. (ZIN 5817; leg. N. A. Zarudnyj; according to Zarudnyj [1902], the specimen should originate from the teritorry of north-eastern, eastern or south-eastern Khorasân [Khorasân-e Razawi and Khorasân-e Janubi provinces] or the Sistân va Baluchestân province). – Iran (undef.): Persiâ [= Iran], coll. 1 f (ZIN 8060; leg. N. A. Zarudnyj). – **Published data**: A r d a b i l: Âqâ Mohammad Beglu [34], 35 km SSE Aslânduz, ceiling of water channel under road, 13 November 2007: coll. 1 m (Sheikh-Jabbâri 2008); – SE Bilasavâr [35], crevice in wall of an abandoned brick stove, 14 November 2006: coll. 1 m, 1 f (Sheikh-Jabbâri 2008); – Eyvâzlu [36], 3 km S Aslânduz, crevice in a thatch wall, 14 November 2007: coll. 1 m, 1 f (Sheikh-Jabbâri 2008); – Gug Tappeh [37], 20 km SE Bilasavâr, ceiling of water channel under road, 13 November 2006: coll. 2 f (Sheikh-Jabbâri 2008); – Jabdaragh [38], 15 km NW Meshginshahr, crevice in a wall, 26 October 2006: coll. 1 m, 1 f (Sheikh-Jabbâri 2008); – Jomâyrân [39], 40 km E Meshginshahr, 10 September 2006: coll. 1 f (Sheikh-Jabbâri 2008); – Moqân [40], 20 km SW Pârs Âbâd, crevice in a thatch wall near a farm, 13 November 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Tâzeh Kand [41], 15 km SE Pârs Âbâd, crevice in wall of a school, 4 February 2006: coll. 3 m (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: "Khoy area" [42] (Vereŝagin 1959). – Â z a r b â i j a n - e S h a r q i: Quyon Daghi [= Kabudan] Island [43], Lake Rezaiyeh [= Oromiyeh], 14 September 1969: 1 f, MMTT (DeBlase 1980), Quyun Dâqi Island, 1 f (Etemâd 1984); – Tabriz [44], Fall 1970: 1 m, SMF (DeBlase 1980, Benda et al. 2006). – B u s h e h r: Ahram [45], in a village and at a date grove, 9 and 11 January 1963: 2 m, 1 f, FMNH (Lay 1967, DeBlase 1980). – F â r s: 3.2 km. W Jahrom [46], over a road, 8 November 1968: shot 3 m, 4 f, FMNH (DeBlase 1980); – 4 miles N Lar [47], 28 July 1965: 1 m, 1 f, USMN (DeBlase 1980); – 5 km. southeast of Pol-i-Abgineh [48], Lake Famur, small caves, 27–29 December 1962: 31 inds. resp. 6 m, FMNH (Lay 1967, DeBlase 1980); – 13 km. SE Shiraz [49], 3 July 1965: 1 m, USNM (DeBlase 1980); – Bandamir [50], 1 July 1920: 1 f, BMNH (Lay 1967, Etemad 1969, DeBlase 1980); – Fereshteh Jân [51], 50 km SE Jahrom, fissures in a wall (Farâsat 2003); – Jahrom [52], crack in plaster of mosque garden walls, 8 November 1968: obs. ca. 20 inds., coll. 3 m, 7 f, 1 ind., FMNH (DeBlase 1980), garden, 9/11 November 1968: shot 1 m, FMNH (DeBlase 1980); – Jarghun [= Zarqan] [53], 3 and 4 July 1920: 1 ind., resp. 2 f, BMNH (Lay 1967, DeBlase 1980); – Kamarij [54], Dashistan, 17 June 1902: 1 f, BMNH (Cheesman 1921, DeBlase 1980); – Konâr Takhteh [55], 30 km SW Kâzerun, Spring 1965: 1 f (Etemâd 1969), Konar--Takhteh, Spring 1966: 1 f (DeBlase 1980); – Lâr [56], an old builging, 20 May 2001: obs. several inds. (Farâsat 2003); – Niriz [57], east of Shiraz, 5000['], 1872: 1 f, BMNH (Blanford 1876 [as *Vesperugo leucotis*], DeBlase 1980); – Persepolis [58], garden adjacent to ruins, over a fountain, 3/4 October 1968: shot 1 m, 5 f, FMNH (DeBlase 1980); – Shahpur Cave [59], hot chamber, 29 December 1962: 3 m, FMNH (Lay 1967, DeBlase 1980); – near Shiraz [60], 4,750 feet, 1 ind. (Dobson 1871 [as *P. marginatus*], cf. Kuzâkin 1950), Shiráz (Blanford 1876 [as *Vesperugo marginatus*]), Shiraz, Persia, 1871: 1 ind., IMC (Dobson 1876), 1871: 1 ma, 1 ind. ad, IMC (Anderson 1881), 3 May 1902: 1 f, BMNH (Cheesman

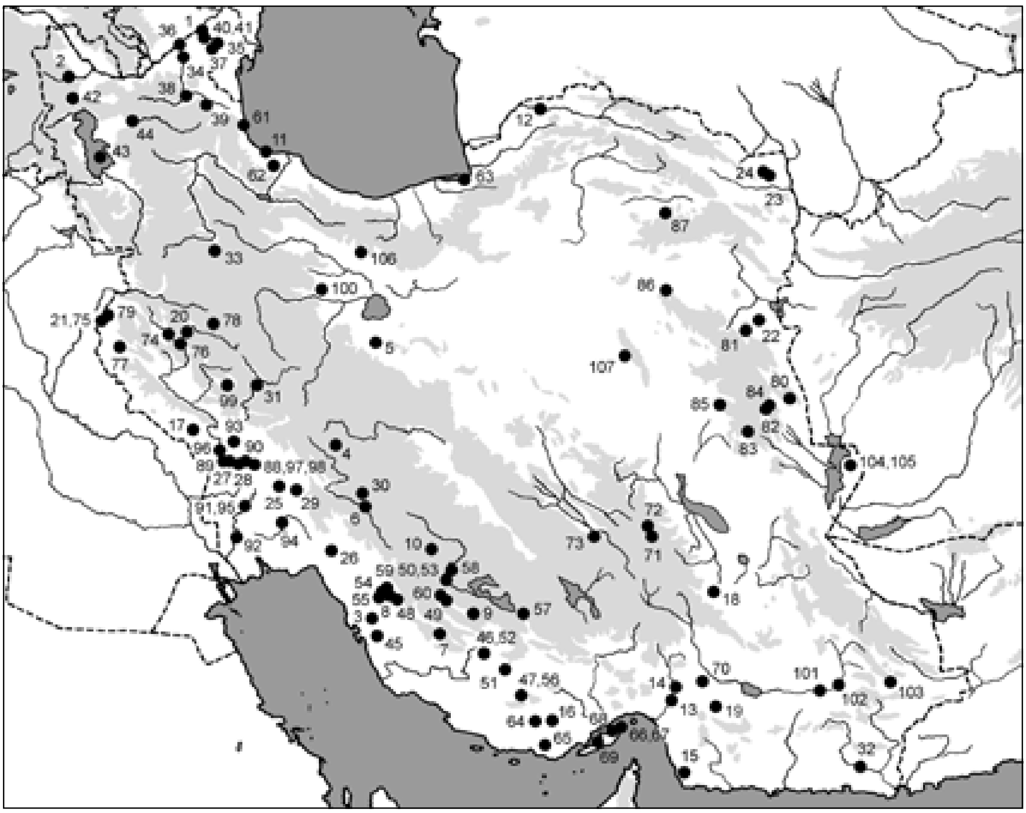


Fig. 169. Records of *Pipistrellus kuhlii* (Kuhl, 1817) in Iran.

1921, Gaisler 1970, DeBlase 1980), 16 April – 21 July 1919: 14 f, BMNH (Cheesman 1921, DeBlase 1980), Shiraz, 18 June 1920: 1 f, BMNH (DeBlase 1980), Shiraz area, 6–7 October 1968: 1 m, 3 f, 1 ind., FMNH (DeBlase 1980). – G i l â n: Bandar-e-Pahlavi [= Bandar-e Anzali] [11], in street, 10 May 1974: coll. 1 f, MMTT (DeBlase 1980); – Leisâr [61], 20 km N Hashtpar, a crevice between wall and window of a house, 1 m, 3 f (Etemâd 1984); – Rasht [62], roof of a house in town, 29 July 1968: 11 fa, 7 fj (Steiner & Gaisler 1994) = Rasht, 29 July 1968 (Peus 1976 [as *Pipistrellus* sp.]). – G o l e s t a n: Foot of Elburz, SE of Caspian [= vicinity of Bandar-e Gaz] [63], 2 m, BMNH (DeBlase 1980). – H o r m o z g â n: Bastak [64], garden, 20–21 October 1968: shot 2 f, FMNH (DeBlase 1980); – Chah Moslem [65], over barren fields, 21–25 November 1968: shot 2 m, 4 f, 1 ind., FMNH (DeBlase 1980); – Dafâri Pool [66], Qeshm Island, 30 July 2001: net. some inds., 11 April 2002: net. some inds. [coll. 1 ma, 5 fa, HMNH] (Zohoori 2002); – Kâboli Pool [67], Qeshm Island, 31 July 2001: net. some inds., 23 March 2002: net. some inds., 26 March 2002: net. 3 inds. (Zohoori 2002); – Kuveh'i Pool [68], Qeshm Island, 1 May 2002: net. 20 inds. (Zohoori 2002); – Maleki Pool [69], Qeshm Island, 19 April 2002: one pup and one adult drowned in water (Zohoori 2002). – K e r m â n: Jiroft [70], 5 May 1956: 1 mj, 1 fj, SMNS (Lay 1967, DeBlase 1980); – Karmán [71], S. E. Persia, 5000['], 2 inds. (Blanford 1876 [as *Vesperugo leucotis*]), Karmán, South-East Persia, 1872: 1 fa, IMC (Anderson 1881); – Kerman, Kerman Agricultural College (8 km NNW Kerman, 1742 m) [72], June 1999 (Morshed & Patton 2002); – Rafsanjan [73], 21 April 1974: 1 f, SMF (DeBlase 1980, Benda et al. 2006). – K e r m â n s h a h: 6.4 km. N Kermanshah [74], 20 August 1968: shot 1 f, FMNH (DeBlase 1980); – 8 km. E Qasr-e Shirim [75], 15 and 16 April 1964: 2 m, 1 f, USNM (DeBlase 1980); – Faraman [76], in a room, 23 January 1963: 1 m, FMNH (Lay 1967, DeBlase 1980); – Gilân-e Qarb [77], an old building under re-construction, 22 & 27 October 2003: obs. (Akmali 2004); – Kangâvar [78], 3 September 1965: 2 f (Etemâd 1984); – Kilasefid cave [79], 30 km NE Qasr-e Shirin, 2002: obs. (Akmali 2004); – Qasr-e Shirin, resp. Ghassre Shirin [21], an old building under reconstruction, 15 December 2000: obs. 15 inds., in deep topor, coll. 2 f, RUBC (Hemmati 2001, Akmali 2004, Sharifi et al. 2004a), Ghassre Shirin (Sharifi et al. 2004b), Qasr-e Shirin, above a channel, 11 October 2003: net. 2 m, 2 f (Akmali 2004), Qasr-e Shirin, above a fish pond, 22 & 27 October 2003: net. (Akmali 2004). – K h o r a s â n - e J a n u b i: 3 km. N Durna [80], 26 August 1962: 1 f, USNM (DeBlase 1980); – 5 km. NE Isfehdeh [81], 8 and 9 November 1962: 1 f, 4 f, USNM (DeBlase 1980); – Izmail-abad', str. Nè-i-bendun', Kirman' [= Esma'ilabad, Nehbandan country, Kerman] [82], 12 June [= 24 June NS] 1896: 4 inds., ZIN (Satunin 1910, cf. Kuzâkin 1950) [2 m, 2 f (ZIN 5805–5808; leg. N. A. Zarudnyj)]; – Mejgun' (sel.), str. Nè-i-bendun', Kirman' [= Meighun (village), Nehbandan country, Kerman] [83], 16 May [= 28 May NS] 1896: 1 ind., ZIN (Satunin 1910, cf. Kuzâkin 1950) [1 f (ZIN 5938; leg. N. A. Zarudnyj)]; – Salehabad [84], 130 km. S Birjand, 28 October 1970: 12 inds., IPHR (Farhang-Azad 1971 ex DeBlase 1980); – Tagi-a-bad [85], 1 ind. (Werner 1929). – K h o r a s â n - e R a z a w i: Badžistan' (gor.), Horasan', V. Persiâ [= Bajestan (town), Khorasân, eastern Iran] [86], 17 April [= 29 April NS] 1896: 1 ind., ZIN (Satunin 1910); – Nusi (sel.), Horasan', V. Persiâ [= Nusi (village), Khorasân, eastern Iran] [87], 13 April [= 25 April NS] 1896: 6 inds., ZIN (Satunin 1910, Strelkov et al. 1978), 6 July [= 18 July NS] 1899: 2 inds., ZIN [29 April 1896 (NS): coll. 1 m, 2 f, 5 inds. (ZIN 3432, 3433, 5801–5804, 5885, 6061; leg. N. A. Zarudnyj; see Zarudnyj (1896)] (Satunin 1910, cf. Kuzâkin 1950). – K h u z e s t â n: 3 km to Shushtar [88], 10 and 12 September 1970: 2 m, IPHR (Farhang-Azad 1971 ex DeBlase 1980); – 19.3 km. south of Shush [89], at the Karkheh river, 17 January 1963: 1 m, FMNH (Lay 1967, DeBlase 1980); – 26 km. E Haft Tappeh [90], barn roof, 15 May 1969: coll. 1 f (DeBlase 1980), over wheat field near village, 17 May 1969: shot 1 mj, MMTT (DeBlase 1980); – Ahwaz [91], Karun R., 220', 28 February, 1 March and 28 March 1905: shot 5 m, BMNH (Thomas 1905, Lay 1967, Etemad 1969, DeBlase 1980); – Darkhwein [92], 45 km. N Abadan, 15 September 1970: 2 f, IPHR (Farhang-Azad 1971 ex DeBlase 1980); – Dizful [93], near Ahwaz, by a house near the river, 11 March 1905: shot 1 f, BMNH (Thomas 1905, Gaisler 1970, DeBlase 1980), Dezful, 19 June 1973: 1 f, DET (DeBlase 1980); – Meshrageh [94], Jahari River, over a river, 19 October 1968: shot 1 m, FMNH (DeBlase 1980); – Nasriè (okrest. sel.), Arabistan', Û. Persiâ [= Ahwaz (vicinity of the village), Khuzestân, southern Iran] [95], 8–9 January [= 21–22 January NS] 1904: 1 ind., ZIN (Satunin 1910); – Shush [96], flour mill, from roof straw, 24 October 1968: obs. a colony of 250 inds., coll. 8 m, 33 f, FMNH (DeBlase 1980), Shush, 21–24 September 1957: 4 m, SMF (Benda et al. 2006); – Shushter [97], S. Persia, alt. 500 ft., 21 January 1918: 1 ind. (Cheesman 1920, DeBlase 1980); – Tak Takâb [98], 5 km SE Shushtar, 9 July 2002: 1 ind. (Farâsat 2003). – L o r e s t a n: 1.6 km. S Khurramabad [99], poplar grove and Kashkan River, 9 and 10 September 1968: net. & shot 2 m, FMNH (DeBlase 1980). – M a r k a z i: Sâveh [100], 1 m, 1 f (Etemâd 1984). – S i s t â n v a B a l u c h e s t â n: Bampúr [101], Balúchistán, 1800['], 1 ind. (Blanford 1876 [as *Vesperugo leucotis*]), Bampúr, Balúchistán, 1872: 1 fa, IMC (Anderson 1881); – Iranshahr [102], 21 April 1951: 1 f, BMNH (Lay 1967, Etemad 1969, DeBlase 1980); – Nag [103], 2 ms, 1 fs, BMNH (Wroughton 1920, cf. Kuzâkin 1950), 1 m (Gaisler 1970); – Seistan [104], 1 ind., BMNH (Lay 1967); – Zabol [105], winter 1967: 1 m (Etemad 1969, DeBlase 1980); – Persia, Belutchistan (Trouessart 1897), Belûčistan, prov. Kirman, V. Persiâ [= Baluchestân (undef.), Kermân province, eastern Iran], 1901: 4 inds., ZIN (Satunin 1910). – T e h r â n: Teheran [106], 4600', 15 April 1907: 1 m, BMNH (Thomas 1907, DeBlase 1980, cf. Kuzâkin 1944, 1950), 1906: 1 f, 1 ind., BMNH (DeBlase 1980), Tehrân, 1 m (Etemâd 1984). – Y a z d: 20 km. W Tabus [107], 24 October 1970: 1 m, IPHR (Farhang-Azad 1971 ex DeBlase 1980). – Iran (undef.): Persia meridionale, MZST (De Filippi 1865 [as *Vespertilio marginatus*]), Southern Persia (Blanford 1876 [as *Vesperugo leucotis*]), Perse (Trouessart 1879), South-East Persia, 1872: 3 fa, IMC (Anderson 1881).

Distribution. *Pipistrellus kuhlii* is a very common species in Iran, at least 107 record sites are known from the country (Fig. 169). This species is the most widespread bat in Iran and concerning the number of records, it is also the most common bat species of the country. Such a ratio is valid also for the review by DeBlase (1980), although this author reported only a half of the currently known record sites (Table 1). *P. kuhlii* is a bat species which has been changing dramatically its distribution range in the last decades, an increase of the occurrence area has been documented mainly in certain parts of Europe (Strelkov et al. 1985, Sachanowicz et al. 2006). It cannot be excluded that the current status of *P. kuhlii* as the most widespread Iranian bat is a consequence of these range size dynamics in other parts of the range.

The findings of *P. kuhlii* were made in all parts of Iran, some of them are available also from margins of the central deserts. Most abundant records come from the southern areas of the country, i.e. from the deserts and arid steppes and the areas closely ajacent to them, from the provinces of Khuzestan, Fars, Hormozgan, Kerman, and Sistan va Baluchestan; 54% of the known localities of this bat come from this narrow belt along the sea shore. On the other hand, from the northern provinces, namely Zanjan, Gilan, Tehran, Golestan, and Khorasan-e Razawi, only few scattered localities were registered, making up some 12% of the localities available from the country. In some other northern provinces (Mazandaran, Alborz, Qazvin, Qom, Khorasan-e Shomali), no records of *P. kuhlii* have been documented so far. The species is the most common bat in eastern Iran, 70% of all bat records from the province of Khorasan-e Janubi are represented by those of *P. kuhlii*.

The distribution of *P. kuhlii* in the Middle East has an unusual pattern, this species is common in lowland deserts (e.g. in Mesopotamia of Syria and Iraq; Benda et al. 2006) but also in the

Fig. 170. *Pipistrellus kuhlii* (Kuhl, 1817) from Hesar (Fars). Photo by A. Reiter.

Mediterranean habitats (e.g. in Turkey or Transcaucasia; Benda & Horáček 1998, Rahmatulina 2005). In the west, the Iranian range of the species continues from both these environment types; the south-Iranian abundant occurrence continues from the widespread distribution in Iraq, while the range in north-western Iran (Azarbaijan, Ardabil) continues from Azerbaijan and Armenia. In the east of Iran, different situations appear. Only few records of *P. kuhlii* are available from West Turkestan (only few sites in its western part, see Strelkov et al. 1978), which conforms to its rare occurrence in the Golestan and northern Khorasan provinces of Iran. In southern Afghanistan, and namely in lowland Pakistan (the eastern margin of the species range), numerous records are available (Bates & Harrison 1997), which is in accordance with the abundant records in Iranian Baluchestan (Fig. 169).

DeBlase (1980: 304) reported a finding of a *P. kuhlii* individual in a street of Bandar-e Anzali (Gilan) in 1974; he concluded: "This is not a locality from which this bat is to be expected, and it is quite likely that the specimen was carried into the area by a truck or other vehicle." However, considering the range expansion documented in *P. kuhlii* in western Asia in the second half of the twentieth century (Strelkov 1973, Strelkov et al. 1985) as well as the current knowledge of the species distribution in north-western Iran (Fig. 169), the record most probably indicated an initial stage of spreading of this bat to the areas adjacent to Transcaucasia. (In the lowlands of Azerbaijan, *P. kuhlii* is now the most common species; see Rahmatulina 2005). Such conclusion rather than that by DeBlase (1980) is also supported by the record of a nursery colony in Rasht near to Bandar-e Anzali in 1968 (Steiner & Gaisler 1994).

Field notes. *Pipistrellus kuhlii* was recorded in Iran predominantly in its foraging habitats, only about one quarter of the records represent findings in roosts. At seven sites, osteological remains of *P. kuhlii* from owl pellets were collected.

However, considering the proportion of records for which any data describing the collection conditions are available (only ca. 65%), the proportion of the findings from roosts is relatively high, representing more than a third of the specified records (36.6%). Such a high proportion is perhaps caused by the high abundance of *P. kuhlii* in Iran and by a high level of synathropisation in this species; both these phenomena make *P. kuhlii* relatively easier to be found in its roosts than other bats, although it is still more frequently found at its foraging grounds. With three exceptions of cave roosts, all other roost findings were made in artificial conditions.

Only one record of a *P. kuhlii* roost undoubtedly represents a finding of a maternity aggregation; it was reported by Steiner & Gaisler (1994) who collected eleven adult females with seven female juveniles in a roof of a house in Rasht (Gilan) on 29 July 1968. Since these authors gave dimensional data only for the adults, there is no evidence available on the development stage of the juveniles.

Several other records indicate indirectly presence of maternity roosts. One such record is available from the ruined fortress town of Arg-e Bam (Kerman; Fig. 130); one pregnant female was discovered there on 6 May 1997 and four adult males and one adult and one subadult females on 8 April 2000. Solitary bats occupied various fissures and holes in walls and ceilings (if present) of soil-constructed houses and their ruins in the town fortress complex and the fortress itself. Since the males dominated the record, the community perhaps did not represent a dispersed nursery colony; on the other hand, the discovery of a pregnant female indicates existence of maternity colony in the close surroundings, including the fortress complex itself. Other similar findings are even less accurate, they only indicate existence of a maternity aggregation in the area. Zohoori (2002) reported on a finding of a dead adult individual and a very young juvenile in water of the Maleki pool on the Qeshm island (Hormozgan) on 19 April 2002. Cheesman (1921) reported on 14 females of *P. kuhlii* collected in Shiraz (Fars) between 16 April and 21 July 1919 and Lay

(1967) mentioned two juvenile SMNS specimens collected in Jiroft (Kerman) on 5 May 1956. Both findings were perhaps made in maternity roosts, considering the number and sex of bats and the season in the former record and the age of the collected bats in the latter record.

DeBlase (1980) reported on two findings of *P. kuhlii* aggregations in their roosts in the autumn period that did not represent nursery colonies, considering the season, but rather remaining groups from these colonies. DeBlase (1980: 227–228) described one of them as follows: "On 24 October [1968 … we] located a colony of approximately 250 *P. kuhli* in the straw "under roof" of a high-ceilinged, rather dark room in a flour mill at Shush [Khuzestan]. We used aerosol cans of insecticide to drive the bats out of the straw and collected 40 specimens with large butterfly nets as the bats flew around the room. This sample included 33 females but only seven [or eight, respectively, on page 322] males." Another similar record from Jahrom (Fars) was described by DeBlase (1980: 225) as follows: "On 8 November we visited a Moslem seminary, where we found *P. kuhli* inhabiting the spaces behind loose chunks of plaster in the walls around the central courtyard […]. We collected 10 of these with forceps and handnets and saw at least 10 more that we were unable to catch." Sharifi et al. (2004a) mentioned a record of 15 bats in deep torpor in an old building under reconstruction at Qasr-e Shirin (Kermanshah) on 15 December 2000; two of these bats were females. This was perhaps a record of a hibernating group. A new record of a non--reproducing group was made in Khafr near Semirom (Esfahan), a colony of ca. 50 individuals was found between timbers under a roof of an abandoned house on 11 September 2010.

A completely different type of roosting aggregation of *P. kuhlii* was described by DeBlase (1980: 228) from a village near Shiraz (Fars): "On 7 October [1968 … we] visited a village just south of Shiraz where numerous holes under the eaves of buildings were pointed out as harboring bats. Just before dusk (5:40 P.M.) the sky above the village became filled with small bats that could be observed flying out of holes and cracks in nearly every building. We used an aerosol can of insecticide to flush three specimens out of one of these holes and into a hand net, and we found a mummified specimen above the door frame of another house. All four of these are females." The description suggests a former colony or more colonies dispersed into a lot of smaller shelters in which one bat or a small number of bats roost. It may also be an alternative type of roosting of aggregations of this species – including the maternity ones as it was shown by the record in the Arg-e Bam fortress town.

Other roost records of *P. kuhlii* from Iran represent findings of solitary bats or very small groups of bats. DeBlase (1980: 226) reported one female to be "taken from barn roof" of a house near Haft Tappeh (Khuzestan) on 15 May 1969. Etemâd (1984) found four individuals in a crevice between a wall and a window of a house in Leisar near Hashtpar (Gilan). Farâsat (2003) reported two roost records of *P. kuhlii* from the Fars province, he observed this species in a fissure in a wall at Fereshteh Jan near Jahrom (no date given) and several bats in an old building in Lar on 20 May 2001. Akmali (2004) observed *P. kuhlii* to roost in an old building under construction in Gilan-e Qarb (Kermanshah) in October 2003. Sheikh-Jabbâri (2008) reported a series of records of roosting *P. kuhlii* in artificial shelters in the Ardabil province and some of these records most probably represent hibernating bats. At two sites the bats roosted in fissures of ceilings of water channels under roads; two females at Gug Tappeh near Bilasavar on 13 November 2006 and one male at Aqa Mohammad Beglu near Aslanduz on 13 November 2007. At five sites the bats were found in crevices in various walls, three males in a wall of the school at Tazeh Kand near Pars Abad on 4 February 2006, two bats in a wall at Jabdaraq near Meshginshahr on 26 October 2006, two bats in a wall of an abandoned brick stove near Bilasavar on 14 November 2006, one male in a thatch wall at Moqan near Pars Abad on 13 November 2006, and two bats in a thatch wall at Eyvazlu near Aslanduz on 14 November 2007. One individual of *P. kuhlii* was observed to roost under the rest of a street lamp on a wooden pylon in Katak near Shahr-e Kord (Chahar Mahal va Bakhtiari) on 13 August 2010.

All the above mentioned records of *P. kuhlii* represent findings solely from artificial roosts, only three records from natural shelters are available from Iran. Lay (1967: 143) found "Six or eight [bats that] hung separately in the hot chamber of Sahpur cave [near Bishapur (Fars)] loosely associated with *Myotis capaccinii*" on 29 December 1962 (for description of the cave see under *Rhinolophus ferrumequinum*); he examined three of these bats and found all to be males. This finding of *P. kuhlii* in the deep of a large cave undoubtedly represents a hibernation evidence. However, at the same time, on 27–29 December 1962, Lay (1967: 143) observed foraging bats in the nearby area of the Famur lake near Kazerun (Fars) and their closely situated day roosts, he described this observation very briefly as follows: "These small bats were common at Lake Famur where they fed on insects at dusk. By day they took refuge in small caves in the surrounding mountains, where rarely more than one or two individuals occupied the same recess." Lay collected altogether 31 individuals (perhaps both by shooting of flying bats and by collecting from roosts) including six males (cf. DeBlase 1980). Another cave record of *P. kuhlii* was reported by Akmali (2004) from the Kilasefid cave near Qasr-e Shirin (Kermanshah); the author observed this species in the cave in 2002, however, he did not specify the number and condition of bats nor the date of observation.

P. kuhlii was the only bat species recorded in most of its documented shelters, it was found to share its roost with other species only in a few cases. Besides the above mentioned co-roosting with *Myotis capaccinii* in one chamber of the Shahpur cave observed in December 1962 (when also *Rhinolophus mehelyi* and *Miniopterus pallidus* were found in other parts of the cave), *P. kuhlii* was found only together with *M. capaccinii* in small caves at the Famur lake (Lay 1967, DeBlase 1980), however, it is not clear whether only witin the same complex of caves or even in the same spaces. *P. kuhlii* was found to inhabit various sites in the ruined fortress town of Arg-e Bam along with *Eptesicus bottae* during two visits, in 1997 and 2000, however, all the collected individuals occupied different holes or crevices.

At numerous sites, foraging individuals of *P. kuhlii* were recorded. The first such record was published by Thomas (1905: 521) who mentioned the collector's (= R. B. Wosnam) note concerning the report of five male *P. kuhlii* from Ahwaz (Khuzestan) collected between 28 February and 28 March 1905: "Shot close to the town of Ahwaz"; DeBlase (1980: 222) added the notes perhaps from the labels of the respective BMNH specimens "Shot flying over the river" and "Common in the town." A similar record from Dizful near Ahwaz (Khuzestan) published also by Thomas (1905) represents a female "shot … by a house near the river", as specified by DeBlase (1980: 222) perhaps also on the basis of the specimen label. Although not specified accurately, Lay (1967) collected three *P. kuhlii* most probably by shooting at Ahram (Bushehr) in January 1963; concerning this record, Lay (1967: 52) noted only as follows: "*Pipistrellus kuhli* frequented the villages and date groves at twilight." Another record by Lay (1967), a male collected at the Karkheh river south of Shush (Khuzestan) on 17 January 1963 was perhaps also a shot foraging bat; Lay (1967: 85) described it as follows: "Several bats made daily crepuscular rounds over a shallow […] ox-bow lake surrounded by poplars. We collected *Pipistrellus kuhli* here." The last record by Lay (1967) undoubtedly represents a foraging bat, a male was collected at Faraman (Kermanshah) on 23 January 1963; Lay (1967: 143) described it as follows: "The Faraman specimen flew into our preparation room via an open window and lit on the wall shortly after nightfall." Considering this record, DeBlase (1980: 314) concluded: "a male *Pipistrellus kuhli*, virtually volunteered to be collected by flying into an open window of a room being used as a specimen preparation area […]."

DeBlase (1980) reported on some ten records of *P. kuhlii* in their foraging habitats of western and southern Iran made in 1968; at all sites the bats were shot on wings, only at one site a specimen was taken into a net additionally stretched nearby the shooting area. A record of a female collected near Kermanshah (Kermanshah) on 20 August, was described by DeBlase (1980: 314) as follows: "Between 19 and 24 August 1968 [… we] camped next to a stream and poplar grove 6.4 km. north of Kermanshah. […] Mistnets were set at several locations across the stream and along the edge of the relatively lush riparian vegetation in an open field. These nets and some shooting yielded one *Myotis mystacinus*, four *Pipistrellus pipistrellus*, and one *P. kuhli*." Two males of *P. kuhlii* were collected by DeBlase (1980: 330) in the Lorestan province under the following circumstances: "[… We] camped in a poplar grove along the Ab-i-khurramabad River [= Kashkan River in the p. 225] about 1.6 km. S Khurramabad. Several bats were seen flying among the poplar trees and over the river each evening. We set several mistnets in these areas but took only two bats, one *Pipistrellus khuli* [= *kuhlii*] and one *P. pipistrellus*, from the nets. Both these were taken on 9 September. On 10 September one of our party shot another *P. kuhli* that was flying along the river." DeBlase (1980) shot six bats above a fountain and/or pond in the garden adjacent to the ruins of Persepolis (Fars) on 3 October. Another individual of *P. kuhlii* was collected by DeBlase (1980: 294) at Shiraz (Fars): "On the evening of 6 October [1968] we shot a *P. kuhli* from among the many bats observed flying over an open field on the northeast edge of the city adjacent to the municipal campground. The bats had begun to fly at about 5:50 P.M. while it was still quite light." A male was: "shot over and along the Jahari River" at Meshrageh (Khuzestan) on 19 October (DeBlase 1980: 225). Four males and four females were collected by DeBlase (1980: 295) near Jahrom (Fars) on two occasions: "On the evening of 8 November we saw many bats flying over the road about 3.2 km. W Jahrom. We shot seven, all of which proved to be *P. kuhli*. […] On the evening of 9 November we shot one [male] *P. kuhli* as it flew over the garden in which we camped on the southeast edge of Jahrom." Finally, DeBlase (1980: 335) reported on the shot of two males, six females and one unsexed bat in the Hormozgan province on two occasions as follows: "From 17 to 20 November [… we …] camped in a garden northwest of Bastak […]. During this time we shot two [females] of many *Pipistrellus kuhli* seen flying in the garden at dusk. […] From 21 to 25 November [… we …] camped at the southwest edge of the village of Chah Moslem […] on the narrow coastal strip just north of Bandar-e Lengeh. Numerous bats could be seen and heard flying over the barren fields around camp each evening. Shooting yielded one *Taphozous perforatus*, seven *Pipistrellus kuhli* and two *Tadarida* [= *Nyctinomus*] *aegyptiaca*."

DeBlase (1980: 322, 226) reported also: "[…] a barely volant *P. kuhli* shot on 15 May 1969, 26 km. E Haft Tappeh [Khuzestan]," "near village over wheat field." Akmali (2004) netted *P. kuhlii* above water bodies at Qasr-e Shirin (Kermanshah) on two occasions, four bats above a channel on 11 October 2003 and an undefined number above a fish pond on 22 and 27 October 2003. Zohoori (2002) netted an undefined number of *P. kuhlii* at three sites in the Qeshm island in the Strait of Hormuz (Hormozgan); several individuals above the Dafari pool on 30 July 2001 and at least six individuals (according to the HMNH specimens) on 11 April 2002, some bats above the Kaboli pool on 31 July 2001, 23 and 26 March 2002 (three bats on the last occasion); and twenty bats above the Kuveh'i pool on 1 May 2002.

Two females of *P. kuhlii* were netted within an abandoned house at Deh Zireh near Kashan (Esfahan) on 26 April 1996. An adult male was netted above a river at Bastam among mountain steppes near Qarah Ziya'oddin (Azarbaijan) on 30 September 1998. Two adult males of *P. kuhlii* were caught into a net installed over a river passing through a dry steppe landscape at Si Mili near Masjed Soleyman (Khuzestan) on 11 October 1998. An adult male and a subadult female were netted above an oxbow of the Karkheh river near the ziqqurat of Choqazanbil (Khuzestan) on 15 October 1998 (Fig. 68). One male was netted above a pool of remaining water in the dry bed of the Kaju river at Pir Sohrab near Chabahar (Baluchestan) on 12 April 2000 (Fig. 148). Eleven bats were caught into a net stretched above a pool in a water hole in the barren steppe at Chah Reza near Manujan (Kerman) on 16 April 2000; this catch indirectly indicated an existence of a maternity colony in the area, since six bats were lactating females. However, only a tent camp of local people was situated there, so a roosting opportunity of the colony should be located at a certain distance from the netting site. Three *P. kuhlii* were netted above a dam near Sarvestan (Fars), in a relatively fertile hilly area east of Shiraz on 20 April. An adult female was caught above a stream below the village of Shurlaq at the southern margin of the Karakum desert near Sarakhs (Khorasan) on 18 May 2006 (Fig. 189). Three adult males were netted in a broad dry wadi at Suzesh near Maraveh Tappeh (Golestan) on 27 May 2006; this catch represents the first evidence of *P. kuhlii* in the Iranian part of the Turkmen steppe. One male was netted at a pool at the oasis near Garmab (Zanjan) on 30 September 2011 (Fig. 105); this bat represents the first record of the species in the mountain plateau in the north of western Iran. A large number of *P. kuhlii*, altogether 44 bats were caught into a net installed above a small stream in a pasture valley near Hesar (Fars) on 5 October 2011 and calls of other numerous foraging individuals were recorded around (Fig. 143).

At several sites, echolocation calls of foraging *P. kuhlii* were detected, mostly during netting sessions when other bat species were caught. At least one foraging individual was detected at a pool in a dry wadi passing through the stony desert near Tujak (Hormozgan) on 15 April 2000. Calls of numerous foraging individuals of *P. kuhlii* were recorded in alluvial vegetation in the broad valley of the Dez river at Lenje Abad near Dorud (Lorestan; Fig. 40) on 1 October 2011. Numerous foraging bats were detected at a river in the valley near Meymand (Kohgiluye va Boyer Ahmad) on 4 October 2011, in a fertile hilly area of the central Zagros Mts. (Fig. 48). Echolocation calls of one foraging *P. kuhlii* were recorded in the city centre of Kazerun (Fars) on 6 October 2011. On 9 October 2011, calls of several foraging individuals were recorded at a water reservoir in the village of Zangard near Bastak (Hormozgan) and in a small palm oasis near the village (Fig. 7); the village and the oasis were situated in an open area of stone desert at the foothills of an arid rocky range. Calls of several foraging *P. kuhlii* were recorded in a small palm oasis at Podonu near Dehbarez (Hormozgan) on 10 October 2011 (Fig. 183); this small oasis was situated in a narrow and rather deep valley, surrounded by a rocky desert steppe. Calls of several foraging individuals were recorded also in the valley of the Radul river near Kuchandar several kilometres from the former site on 11 October 2011. At a stream passing through the agricultural landscape at Valiabad near Behbahan (Khuzestan), calls of one *P. kuhlii* were detected on 14 October 2011. Calls of several foraging individuals were detected above the Abdanan river at Mormori near Dehloran (Ilam) on 16 October 2011; the river there passes through a very arid rocky landscape with only a few traces of vegetation (Fig. 205).

In the majority of the above reported foraging sites, solely *P. kuhlii* was documented. Only in less than a half of these sites, *P. kuhlii* was found along with some other species, however, due to an extremely wide ecological valence of this bat demonstrated in Iran (see Distribution), *P. kuhlii* was found as a part of communities composed of a wide range of species – both Mediterranean and eremic faunal elements. Besides the above mentioned catches from near Kermanshah (where also *Myotis* cf. *mystacinus* and *Pipistrellus pipistrellus* were collected simultaneously), from Khoramabad (where also *P. pipistrellus* was netted) and Chah Moslem (where also *Taphozous perforatus* and *Nyctinomus aegyptiacus* were shot), DeBlase (1980) additionally reported two simultaneous catches of *P. kuhlii* with other species; it was found along with *Myotis capaccinii* at Persepolis and with *Rhinopoma microphyllum*, *R. muscatellum*, *R. hardwickii*, and *Rhyneptesicus nasutus* at Meshrageh. However, also at some other sites *P. kuhlii* was netted or detected simultaneously with other bats. It was netted together with *Myotis davidii* at Bastam, with *Myotis* *capaccinii* at Si Mili, with *Rhyneptesicus nasutus*, *Hypsugo arabicus*, *Otonycteris hemprichii*, and *Nyctinomus aegyptiacus* at Pir Sohrab, with *Eptesicus ognevi*, *Pipistrellus pipistrellus*, *Otonycteris leucophaea*, and *Tadarida teniotis* at Shurlaq, and with *Myotis blythii*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Miniopterus pallidus*, and *Tadarida teniotis* at Hesar. At Garmab, where one *P. kuhlii* was netted, echolocation calls of *M. capaccinii* and *P. pipistrellus* were detected. On the other hand, at the sites where only the calls of *P. kuhlii* were detected, a series of other species were recorded; additionally to *P. kuhlii* calls, *Otonycteris hemprichii* was netted at Tujak, *Pipistrellus pipistrellus* netted and *Rhinolophus ferrumequium*, *R. hipposideros*, *Asellia tridens*, *Miniopterus pallidus*, and *Tadarida teniotis* detected at Lenje Abad, *P. pipistrellus* and *M. pallidus* netted at Meymand, *Rousettus aegyptiacus* netted and *Asellia tridens* and *Rhyneptesicus nasutus* detected at Zangard, *R. aegyptiacus* and *O. hemprichii* netted at Podonu, *R. nasutus* detected at Kuchandar, *T. teniotis* detected at Valiabad, and *M. pallidus* netted at Mormori.

Concerning the general ecological characteristics of *P. kuhlii* in Iran, DeBlase (1980: 228) concluded: "Although more specimens of *P. kuhli* are known from more localities in Iran than any other bat species, little is known of its ecology in this area. Most specimens have been shot as they flew about towns in the southern part of the country. They have been collected on the wing in this region in all seasons of the year. Several samples have greatly disproportionate sex ratios. Except for Lay's (1967 […]) observations of scattered individuals in "small caves" near Lake Famur and his record of the species from Sahpur Cave, *P. kuhli* has not been reported from caves in Iran. Barely volant specimens are known from Nag (21 June), Jiroft (5 May), and Haft Tappeh (15 May)." Using the above reviewed data, it is possible to complement DeBlase's (1980) conclusions by the following information; direct observation of a maternity colony is available from a house roof, while an indirect observation of such aggregation comes from a ruined fortress town; a hibernation/lethargy aggregation was observed in an old building; an aggregation between timbers of a house roof was observed in the transient period of the year; small groups and individuals were found to roost (or even hibernate) in fissures in house walls and bridge ceilings as well as under a rest of a street lamp year-round; foraging bats were observed year-round (including the winter months, XI–III).

Only few accurate data are available on the reproduction of *P. kuhlii* in Iran. Sharifi et al. (2004b: 325–326) described morphological observations of the annual cycle of reproductive organs in captive bats as follows: "Testicular activity in *Pipistrellus kuhlii* was renewed in early July when both sampled males showed a dramatic increase in weight of testes. By the end of summer testicular activity was further promoted with both captured males having maximally enlarged testis. This increase in testis mass was mainly due to the development of spermatogenic cells up to the spermatid stage because males collected from the end of April to September had relatively large numbers of spermatids in the seminiferous tubules but few spermatozoa. During this period no spermatozoa were released into epididymides. This was clearly illustrated by the decrease in testicular mass and concomitant increase in epididymal mass by the end of summer. Comparison between enlarged testes in August and the recessed testes in winter time and early spring demonstrated an approximate twelve fold increase in the mean weight of the testes. By early autumn the proportion of bats with enlarged testis declined until no male showed signs of testis enlargement. By the same time male bats began to have enlarged epididymides. In contrast with testis mass, epididymal volume peaked in November. The lowest weight of epididymides was recorded in May. The maximum weight of epididymides occurred during September and November coinciding with maximum sperm volume in the uterus of females. […] Few spermatozoa were recorded in testes during November, while at the same time considerable volume of sperm existed in the cauda epididymides […]." Sharifi et al. (2004a: 3–5) added observations of sperm storage in female uteri with the main message encompassed in the following sentences: "The reproductive tracts of *Pipistrellus kuhlii* captured in mid-December 2000 were massively distended with spermatozoa […]. Examination of sections through the uterus revealed that it was densely packed with spermatozoa […]. […] It is evident that the line up of spermatozoa is most evident in the apical parts of the uterus. […] Considerable numbers of follicles are present in the ovary of *Pipistrellus kuhlii* collected in mid-December […]. […] Since there is inadequate information regarding the time of mating and parturition of *P. kuhlii* in western Iran, it is not possible to give an exact estimate of the duration of fertilizing life of the stored spermatozoa."

At two sites, pregnant females of *P. kuhlii* were newly collected. One female containing two foeti of the the crown-rump length 12.0 mm was collected in the ruined fortress town of Arg-e Bam on 6 May, another female with one foetus of the length 13.8 mm was netted at Shurlaq on 18 May. Six lactating females were netted near Chah Reza near Manujan on 16 April. These data suggest a relatively long period of parturitions despite the geographical position of the female – in the southern part of Iran (Kerman), large foeti were observed in mid-May, while lactating females already in mid-April; in northern Iran (Khorasan), large foeti were observed in early May. This suggests the births in Iran to occur in a month period from early April to late May.

Osteological remains of *P. kuhlii* were found in pellets of two owl species originating from seven sites in various parts of Iran (Table 40). *P. kuhlii* was most frequently found in the pellets of *Athene noctua*, remains of altogether six individuals were found at four sites (Obuch & Kristín 2004), viz. two bats at Deh Zireh (Esfahan), two bats at Firuz Abad, one bat at Sarvestan (Fars), and one bat in the Rubat-e Sharaf caravanserai (Khorasan). These remains made up 1.09–3.51% per sample volume of all prey items (and 5.3–18.2% of mammal items, respectively) in the respective samples and 0.31% of all prey items (and 2.14% of mammal items) in the whole analysed spotted owlet diet from Iran. At three sites in Iran, osteological remains of *P. kuhlii* were documented in the pellets of *Tyto alba* (Obuch & Khaleghizadeh 2011); bones of three bats at Bandar Anzali (Gilan), one bat at Bisotun (Kermanshah), and seven bats at Haft Tappeh (Khuzestan). These bones represented 0.36–7.29% per sample volume of all prey items (and 0.40–7.95% of mammal items, respectively) in the respective samples and 0.50% of all prey items (and 0.65% of mammal items) in the whole analysed barn owl diet from Iran. From the Middle East, evidence of *P. kuhlii* in owl diet was previously available from Turkey, Syria, Jordan, Israel, and Iraq (Dor 1947, Nader 1969, Benda & Horáček 1998, Shehab et al. 2004, 2007, Benda et al. 2006, 2010, Obuch & Benda 2009, Obuch 2011).

Material examined. 1 ♀ (NMP 48116 [S+A]), Arg-e Bam (Kerman Prov.), 4 May 1997, leg. P. Benda; – 4 ♂♂, 2 ♀♀ (NMP 48369–48374 [S+A]), Arg-e Bam (Kerman Prov.), 8 April 2000, leg. P. Benda & A. Reiter; – 1 ♂ (NMP 48121 [S+A]), Bastam (Azarbaijan-e Gharbi Prov.), 30 September 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ind. (JOC unnumbered [Sf]), Bisotun (Kermanshah Prov.), 7 October 1998, leg. J. Obuch; – 1 ♂, 1 ♀ (MHNG 1905.1A, 1905.1B [A]), Bouchir, Brazjan [Bushehr Prov.], June 1968, leg. A. Arata; – 5 ♂♂, 6 ♀♀ (NMP 48427–48431, 48433 [S+A], NMP 48425, 48426, 48432, 48434, 48435 [A]), Chah Reza (Kerman Prov.), 16 April 2000, leg. P. Benda & A. Reiter; – 1 ♂, 1 ♀ (NMP 48190, 48191 [S+A]), Choqazanbil (Khuzestan Prov.), 15 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 5 ♀♀ (HMNH 2007.3.7., 2007.3.8. [S+A], HMNH 2007.3.9.–2007.3.11., 2007.3.24. [A]), Dafari Pool, Qeshm Island [Hormozgan Prov.], 11 April 2002, leg. H. Zohoori; – 2 inds. (JOC unnumbered [Sf]), Firuz Abad (Fars Prov.), 20 April 2000, leg. J. Obuch; – 1 ♂ (NMP 93862 [S+A]), Garmab (Zanjan Prov.), 30 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 7 inds. (JOC unnumbered [Sf]), Haft Tappeh (Khuzestan Prov.), 18 October 2002, leg. J. Obuch; – 1 ♂ (NMP 93871 [S+A]), Hesar (Fars Prov.), 5 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 ♀♀ (CUP I-1, I-2 [S+B]), Deh Zireh (Esfahan Prov.), 26 April 1996, leg. J. Sádlová; – 1 ♂ (HMNH 2007.30.7. [S]), Narkor near Pars Abad [Ardabil Prov.], 4 March 2005, leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari; – 1 ♂ (NMP 48403 [S+A]), Pir Sohrab (Sistan va Baluchestan Prov.), 12 April 2000, leg. P. Benda & A. Reiter; – 1 ♀ (SMF 46398 [S+B]), Rafsanjan [Kerman Prov.], 21 April 1974, leg. H. Felten & K. Walch; – 2 ♂♂, 1 ♀ (NMP 48455–48457 [S+A]), Sarvestan (Fars Prov.), 20 April 2000, leg. P. Benda & A. Reiter; – 1 ind. (JOC unnumbered [Sf]), Sarvestan (Fars Prov.), 20 April 2000, leg. J. Obuch; – 1 ♀ (NMP 90792 [S+A]), Shurlaq (Khorasan-e Razawi Prov.), 18 May 2006, leg. P. Benda & A. Reiter; – 4 ♂♂ (SMF 34355–34357, 34362 [S+B]), Shush [Khuzestan Prov.], 21 September 1957, collector unlisted; – 2 ♂♂ (NMP 48160, 48161 [S+A]), Si Mili (Khuzestan Prov.), 11 October 1998, leg. M. Andreas,

Table 31. Comparison of biometric data on the sample sets of *Pipistrellus kuhlii* (Kuhl, 1817) from the northern and southern parts of Iran. For abbreviations see p. 171

	northern Iran					southern Iran				
	n	**M**	min	max	SD	n	**M**	min	max	SD
LAt	7	**35.76**	34.5	37.2	1.139	49	**33.75**	30.4	36.2	1.199
LCr	8	**13.28**	12.64	13.71	0.353	29	**12.76**	12.11	13.48	0.333
LCb	8	**12.84**	12.07	13.36	0.419	29	**12.28**	11.74	12.88	0.296
LaZ	6	**8.58**	8.21	8.76	0.208	26	**8.30**	7.88	8.62	0.201
LaI	8	**3.36**	3.23	3.53	0.104	31	**3.24**	3.06	3.52	0.115
LaInf	8	**3.92**	3.73	4.07	0.116	31	**3.78**	3.55	4.15	0.134
LaN	8	**6.63**	6.37	6.83	0.157	31	**6.45**	6.14	6.96	0.180
LaM	7	**7.76**	7.31	7.95	0.226	25	**7.37**	7.02	7.74	0.225
ANc	8	**4.76**	4.53	5.08	0.178	29	**4.50**	4.32	4.85	0.136
LBT	7	**3.03**	2.86	3.27	0.145	26	**2.92**	2.71	3.19	0.136
CC	8	**4.16**	4.02	4.43	0.140	31	**4.00**	3.68	4.28	0.135
M^3M^3	8	**5.64**	5.48	5.83	0.118	30	**5.40**	4.98	5.68	0.158
CM^3	8	**4.94**	4.83	5.15	0.114	31	**4.72**	4.48	5.02	0.137
LMd	8	**9.55**	9.08	9.93	0.302	30	**9.18**	8.73	9.75	0.291
ACo	8	**2.94**	2.78	3.13	0.128	31	**2.81**	2.58	3.07	0.111
CM_3	8	**5.30**	5.19	5.50	0.102	31	**5.07**	4.83	5.39	0.147

P. Benda, A. Reiter & M. Uhrin; – 3 ♂♂ (NMP 90845–90847 [S+A]), Suzesh (Golestan Prov.), 27 May 2006, leg. P. Benda & A. Reiter; – 1 ♂ (SMF 47843 [S+B]), Tabriz, 1970 [Azarbaijan-e Gharbi Prov.], leg. Herbst.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Pipistrellus kuhlii* are shown in Table 28. For the material examined see above.

The ranges of skull dimensions of *P. kuhlii* from Iran are shifted below the ranges of the populations living in the circum-Mediterranean area (see Table 28 and Benda et al. 2004d: 30, Table 2, and Benda et al. 2006: 207, Table 29). For example, while in the bats from southern Europe, North Africa and the Levant, the greatest lengths of skull (LCr) lie in the range 12.3–13.9 mm (n=306), in Iranian bats in the range 12.1–13.7 mm (n=37). Although both LCr ranges are almost identical, roughly 1.6 mm, the minimum and maximum values are 0.2 mm smaller in the Iranian bats and overlap with the range known in *P. deserti* Thomas, 1902, a desert vicariant of *P. kuhlii* from the Sahara, in which the LCr range is 11.4–12.3 mm (n=38; Benda et al. 2004d). This difference between Mediterranean and Iranian bats is observable also in other skull dimensions. Thus, the Iranian representatives of *P. kuhlii* are the smallest within the whole species range.

The shift in dimensions towards lower values is even more apparent when the Iranian samples are separated according to their origin; the bats from the southern more arid areas of Iran (Khuzestan, Esfahan, Fars, Hormozgan, Kerman, Beluchestan) are smaller than bats from the northern part of Iran (Table 31, Fig 171). The absolutely smallest bats (LCr<12.3 mm) were found among the bats from Bam (Kerman) and the Qeshm Island (Hormozgan). This phenomenon is perhaps a parallel to the situation in the central belt of the Sahara with the most harsh desert environment, where *P. kuhlii* is replaced by its smaller relative *P. deserti*. Although the change in body size in arid areas is not so extensive in Iran, the tendency to reduce the size of body in these habitats is clearly apparent.

P. kuhlii has recently been re-considered to be restricted mostly to the Palaearctic (Kock 2001, Simmons 2005), i.e. to the Mediterranean and Middle East and to some adjacent areas. Taxonomy of this species in this range has not yet been assessed properly and three to four subspecies are recognised (Koopman 1994, Simmons 2005); *P. k. kuhlii* (Kuhl, 1817), *P. k. marginatus* (Cretzschmar, 1830), *P. k. lepidus* (Blyth, 1845), and *P. k. ikhwanius* Cheesman et Hinton, 1924. Traditionally, the pelage and membrane colouration is considered as the main/only character distinguishing these subspecies; all four above-mentioned subspecies of *P. kuhlii* have been reported to occur in the Middle East (see the review by Benda et al. 2006). *P. k. kuhlii* of Europe is described to be relatively dark and with a narrow pale rim of the wing membrane, while in *P. k. lepidus* of Iran and Afghanistan and *P. k. ikhwanius* of Iraq and Arabia the colouration is much paler and the pale rim of the membranes is broader. However, Lewis & Harrison (1962: 483) found a geographical cline in pelage and wing colouration between the dark-coloured morph of *P. k. kuhlii* in Europe and the desert pale-coloured morph of *P. k. ikhwanius* in eastern Arabia. They concluded concerning the Levantine populations: "It seems more reasonable, in view of the cline here demonstrated, to regard the populations of *P. kuhli* in Lebanon and Palestine, where the shade of colour of the pelage is rather variable, as being intermediate between *P. k. kuhli* and *P. k. ikhwanius* and certainly nothing would be gained by any attempt to separate any of these ill defined intermediate stages of the cline taxonomically." This conclusion was presented also by Corbet (1978), who considered all populations of *P. kuhlii* to belong to the nominotypical subspecies, although quite variable in colouration. Anyway, such a conception has not been followed widely. On the other hand, several recent studies have revealed a hidden genetic diversity in *P. kuhlii* populations in the Mediterranean (Ibáñez et al. 2006, Mayer et al. 2007, García-Mudarra et al. 2009), suggesting cryptic taxonomic division; however, it perhaps does not reflect the diversity in pelage colouration. Moreover, this genetic diversity concerns the Iranian populations only marginally, see below.

Considering the colouration of Iranian populations of *P. kuhlii*, Etemad (1969) assigned the bats from the more humid areas of northern and western Iran to the nominotypical form, while the

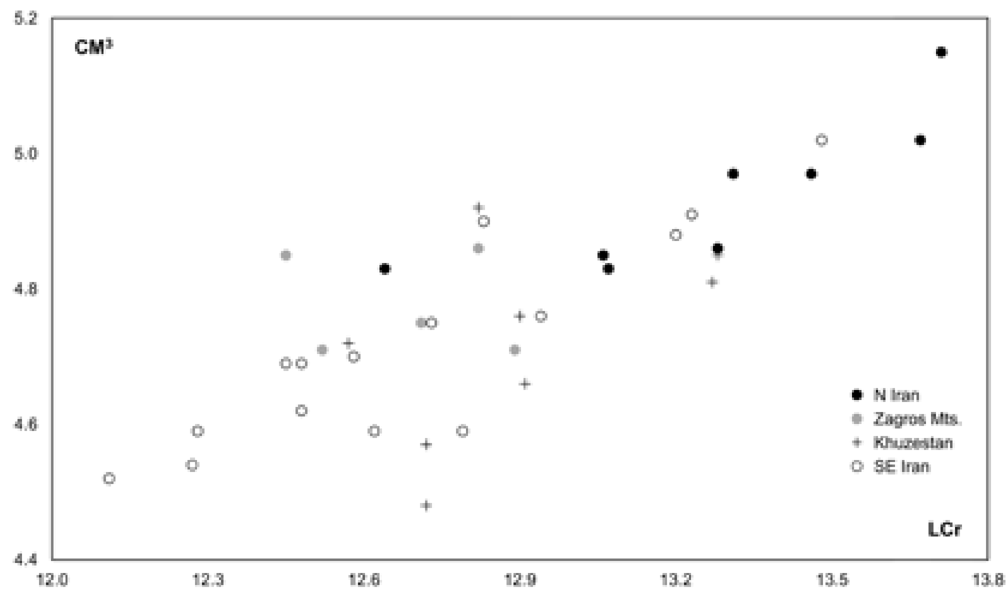


Fig. 171. Bivariate plot of the examined Iranian samples of *Pipistrellus kuhlii* (Kuhl, 1817): greatest length of skull (LCr) against the length of upper tooth-row (CM^3).

populations inhabiting the arid areas of the south and east of the country to *P. k. lepidus*. Gaisler (1970) reported the form *lepidus* from Iraq, Iran, Afghanistan and West Pakistan and this opinion was accepted tentatively by DeBlase (1980) concerning the Iranian populations of the species. According to various authors, *P. k. lepidus* is reported to occur in Pakistan, Afghanistan, Iran, Transcaucasia, eastern Europe (Russia, Ukraine), and West Turkestan (see Benda et al. 2006). However, in all colouration-based taxonomic divisions of *P. kuhlii*, the assignations of populations from Iran are different from those of the Levant.

Benda & Ruedi (2004) only preliminarily published results of a molecular genetic analysis of *P. kuhlii*, whose sampling covered most of the species range including the Middle East. This comparison showed an apparent genetic uniformity among the populations of the Middle East from Syria to Iranian Baluchestan. In this belt of rather arid regions, over 2000 km long, only two unique haplotypes of the mitochondrial gene (complete cytochrome *b* gene) were found, differing in 0.16% of the uncorrected *p* distance. In the specimens from Mesopotamia (from Syria and Iran, i.e. ca. 1000 km away), an identical haplotype was detected. On the other hand, the genetic distances between the Middle Eastern and the Mediterranean (European and African) samples were 3.23–4.03% (mean 3.51%). These tentative results suggest a relatively fast history of spreading of *P. kuhlii* within the Middle East and thus indicate a rather simple intraspecific taxonomy within this whole region.

Very similar conclusions resulting from a comparison of sequences of the ND1 gene were briefly presented also by Mayer et al. (2007: 10): they found a group of samples of *P. kuhlii* from the Middle East (originating from Israel, Syria and Iran) to form a common lineage differing "on average by 5.2% from western representatives" of *P. kuhlii* (of Europe and north-western Africa). Considering this relatively deep divergence, the authors suggested to regard the Middle Eastern lineage that occurs in the wide area covering Turkey, Levant, Mesopotamia and Iran, incl. Baluchestan, as a separate species, tentatively named *P.* cf. *lepidus* (see also Benda et al. 2006).

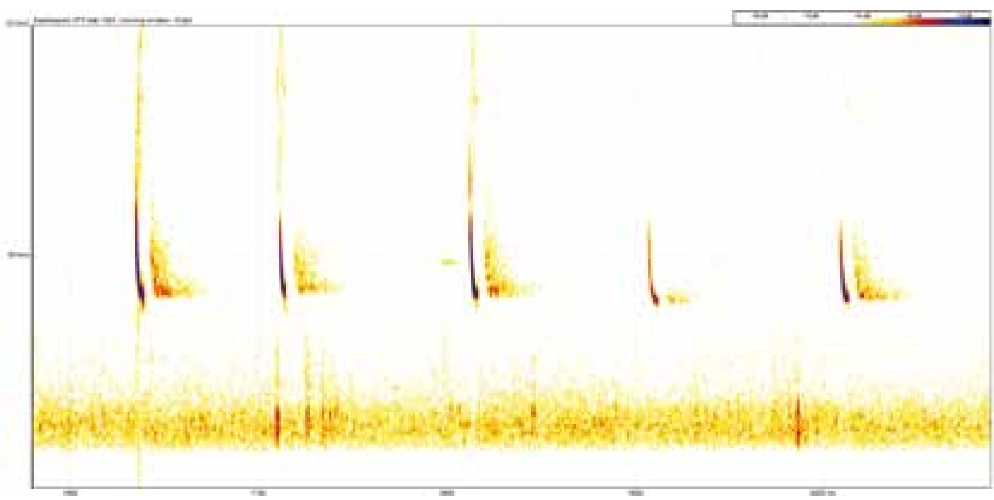


Fig. 172. Spectrogram of echolocation calls of *Pipistrellus kuhlii* (Kuhl, 1817); an individual foraging in the valley near Meymand (Kohgiluye va Boyer Ahmad).

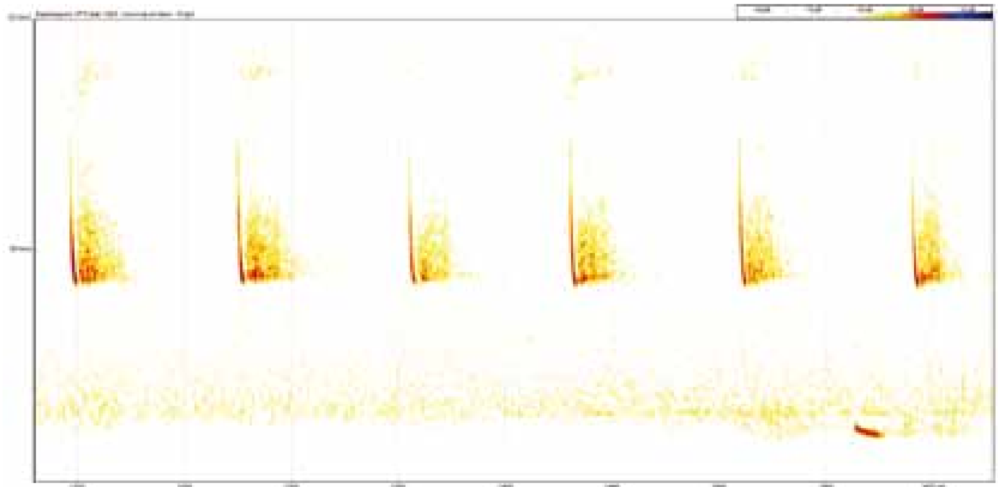


Fig. 173. Spectrogram of echolocation calls of *Pipistrellus kuhlii* (Kuhl, 1817) and *Tadarida teniotis* (Rafinesque, 1814); individuals foraging in the river valley near Hesar (Fars).

Pipistrellus lepidus Blyth, 1845 is a species described from southern Afghanistan (type locality: Candahar [Afghanistan]; Hutton 1845: 340). This name was traditionally assigned to the easternmost *P. kuhlii* populations (see above) and it certainly represents the oldest synonym within the *P. kuhlii* rank described from Asia (Ellerman & Morrison-Scott 1951, Bates & Harrison 1997). However, the distance of 5.2% in the ND1 reported by Mayer et al. (2007) is rather low to regard this lineage a separate species (a significantly lower value was found in cyt *b*, see above). The subspecific position of the Middle Eastern populations is perhaps well supported and for the time being, the name *lepidus* seems to be appropriate for designation of the respective taxon. However, the relationship of Egyptian populations to the Middle Eastern form still remains to be elucidated, since the name *Vespertilio marginatus* Cretzschmar, 1830 originates from this country (type locality: Egypt; Anderson 1902: 127) and if the Egyptian bats belong to the Middle Eastern lineage, the latter name is the oldest synonym for it (see Qumsiyeh 1985). Another open question is the position of the Caucasian, east-European and West Turkestani populations, considered a part of *P. k. lepidus* in the traditional view (e.g. Strelkov et al. 1978, 1985, Rahmatulina 2005, etc.).

It should be also noted here, that Lay (1967) suggested the name *Pipistrellus aladdin* Thomas, 1905, originating from Iran (type locality: Derbent, 50 mi. W. of Isfahan, 6,500' [Esfahan, Iran]; Thomas 1905: 521), to be regarded a synonym of *P. kuhlii* (Kuhl, 1817). However, Neuhauser & DeBlase (1971) showed the former name to be rather a junior synonym of *P. pipistrellus* (Schreber, 1774), see also above.

ECHOLOCATION. *Pipistrellus kuhlii* produces frequency-modulated calls with a quasi-constant part at the end of the signal. The call drops from the start frequency at ca. 60–70 kHz to the end frequency between 36–46 kHz (Schnitzler et al. 1987, Russo & Jones 2002, Jahelková 2003, Papadatou et al. 2008, Benda et al. 2008) and the parameters of the calls differ significantly according to the flight situation (Berger-Tal et al. 2008). We made an analysis of 37 calls from seven sequencies of *P. kuhlii* in Iran (Figs. 164, 172, 173); basic values of echolocation parameters are given in Table 3.

As already concluded by Benda et al. (2010), echolocation characteristics of *P. kuhlii* are quite uniform within the species range and the Iranian data fully conform to this opinion.

Feeding ecology. *Pipistrellus kuhlii* is a small bat that applies the aerial hawking foraging strategy (Norberg & Rayner 1987). The diet of this species is very variable, Diptera, Lepidoptera, Hymenoptera (particularly Formicoidea), Auchenorrhyncha, Coleoptera, and Heteroptera comprised a major part of the diet in different regions of its distribution range (Rahmatulina 1983, 2005, Whitaker et al. 1994, Beck 1995, Feldman et al. 2000, Goiti et al. 2003, Benda et al 2006, 2010, Whitaker & Karataş 2009).

From Iran, we studied six sample sets of the diet of *P. kuhlii* (Figs. 174, 146). The diet composition was quite variable and Coleoptera, Heteroptera, and Auchenorrhyncha were the most important food items. Presence of Araneae and brachyceran Diptera might indicate hunting very close to vegetation or even foliage gleaning, but the proportions of these items were very low (0.2–4.2% of volume). Hence, we do not expect *P. kuhlii* to apply such foraging strategies at the studied sites, more probably the respective bats caught passively flying spiders and relatively late flying flies in an open space.

High seasonal and regional variability indicates an opportunistic foraging strategy in *P. kuhlii*. Very high proportion of one main item, which dominates a particular diet sample set, suggests selective traits in foraging in this species. *P. kuhlii* is able to feed on a wide range of prey items and to select the most profitable items, exploiting local aggregations of swarming and/or emerging insects. The results of diet analyses from Iran correspond well with previous studies of the diet of *P. kuhlii* (see above).

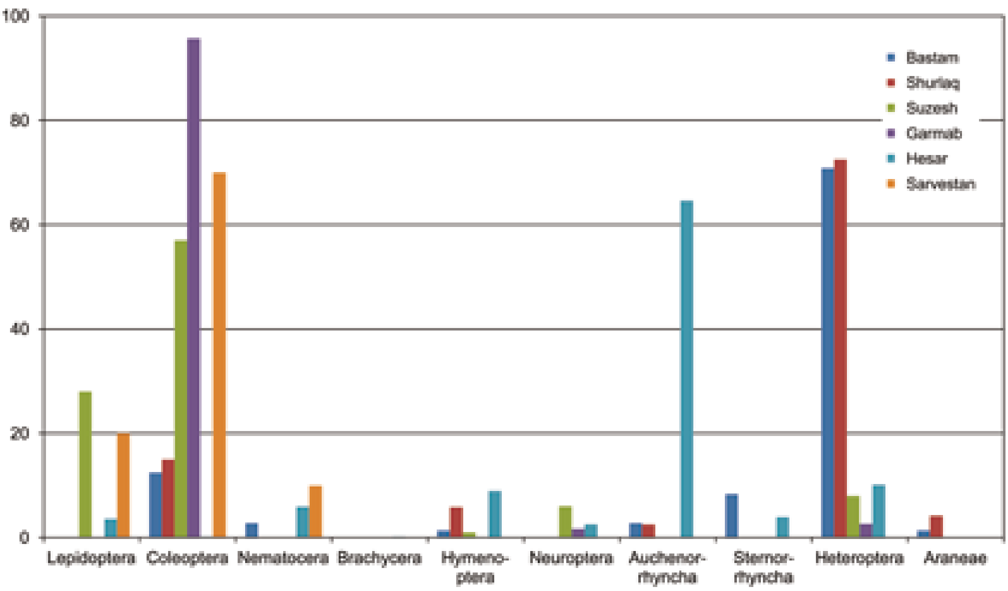


Fig. 174. Percentage volume of particular food items in the diet of *Pipistrellus kuhlii* (Kuhl, 1817) in Iran. Material analysed: Bastam (55 faecal pellets / from one bat), Shurlaq (12 / 1), Suzesh (20 / 3), Garmab (21 / 1), Hesar (123 / 10), Sarvestan (three digestive tracts).

RECORDS OF ECTOPARASITES. **Original data**: S p i n t u r n i c i d a e: *Spinturnix* sp.: 3 ma, 2 fa, 4 nymphal stage specimens (CMŠ [P]) from 2 fa, Hesar (Fars Prov.), 5 October 2011. – *Meristaspis lateralis*: 1 ma (CMŠ [P]) from 1 ind., Hesar (Fars Prov.), 5 October 2011. – M a c r o n y s s i d a e: *Steatonyssus periblepharus*: 1 fa (CMŠ [P]) from 1 ind., Hesar (Fars Prov.), 5 October 2011. – **Published data**: I s c h n o p s y l l i d a e: *Ischnopsyllus octactenus*: 1 ma, 3 fa from unknown number of hosts [as *Pipistrellus* sp., but see Steiner & Gaisler 1994.], Rasht [Gilan Prov.], 29 July 1968 (Peus 1976).

COMMENTS ON ECTOPARASITES. The finding of the mite *Meristaspis lateralis* Kolenati, 1857 on *Pipistrellus kuhlii* is rather unusual, this spinturnicid genus is considered to be an obligatory parasite of the fruit bat family (Dusbábek 1969; see under *Rousettus aegyptiacus*). Its presence on *P. kuhlii* could be explained as an accidental lateral transfer from *R. aegyptiacus*, e.g. in a common roost. The here presented record, representing the first evidence of this parasite from Iran, comes from the region inhabited by *R. aegyptiacus* (Fars province).

The recorded specimen of *Spinturnix* sp. belongs to a species of the *S. acuminata* group; its taxonomic status will be solved elsewhere, after all necessary comparisons are carried out. The record of the macronyssid mite *Steatonyssus periblepharus* Kolenati, 1858 does not seem to be unusual, this species was collected from *P. kuhlii* in Algeria (Till & Evans 1964, Radovsky 1967) and Jordan (Benda et al. 2010); from Iran, it is here reported for the first time. From this family, Radovsky (1967) mentioned also *Macronyssus kolenatii* (Oudemans, 1902) parasitic on *P. kuhlii* in Egypt.

The bat flea *Ischnopsyllus octactenus* (Kolenati, 1856) is a species parasitic on bats of the genus *Pipistrellus*, its distribution range corresponds to the range of its principal host, *P. pipistrellus*, see Hůrka (1963); in Iran, it was registered also in this host species (Klein et al. 1963, Farhang-Azad 1969b). From *P. kuhlii*, it was collected also in Afghanistan (Lewis 1973).

However, no other insect ectoparasites were documented from *P. kuhlii* in Iran, although a lot of records are available from other parts of the Middle East. The bat fly *Basilia daganiae* Theodor et Moscona, 1954 is parasitic mainly on *P. kuhlii*, its records were reported also from the Levant (see the review by Kock 1984). The bat flea *Ischnopsyllus consimilis* (Wahlgren, 1904) was found to parasitise this bat in Egypt, Israel and Lebanon (Theodor & Moscona 1954, Lewis 1962, Haas & Tomich 1973). The bed bug *Cimex lectularius* Linnaeus, 1758 was registered from *P. kuhlii* in Iraq (Abul-Hab & Shihab 1990) and *Cacodmus vicinus* Horváth, 1934 in several parts of the Mediterranean region, including Cyprus, Syria, Israel, Jordan, and Egypt (Benda et al. 2010, Quetglas et al. 2012).

Pipistrellus sp.

RECORDS. **Published data**: F â r s: near Shiraz, 4,750 feet, several spirit specimens (Dobson 1871 [as *P. Coromandelicus*], Blanford 1876 [as *Vesperugo Coromandelicus*]), Shiraz, Persia, 1871: 5 ms, 2 fs, IMC (Dobson 1876 [as *Vesperugo abramus*]), Shiráz, Persia, 1871: 4 mj, 1 ms, 1 fa, 1 fs, IMC (Anderson 1881 [as *V. abramus*]). – Bagh Mizathahami, Shiraz, 12 m, 81 f (Cheesman 1921 [as *Pipistrellus mimus glaucilus*]. – Iran (undef.): Perse (Trouessart 1879 [as *Vesperus abramus micropus*]).

COMMENTS. Dobson (1871) and some subsequent authors reported a record of several bats (at least seven specimens) originating from near Shiraz (Fars) under some of the temporal synonyms of *Pipistrellus coromandra* (Gray, 1838); as *Pipistrellus Coromandelicus* [Blyth, 1851] by Dobson (1871), *Vesperugo abramus* [Temminck, 1838] by Dobson (1876) and Anderson (1881), *Vesperus abramus micropus* [Peters, 1872] by Trouessart (1879), and finally as *Pipistrellus coromandra* by Cheesman (1921). The present whereabouts of these specimens is unknown (DeBlase 1980).

However, Dobson's (1871, 1876) reports indicate *Pipistrellus coromandra* (senior synonym of *P. coromandelicus*) and/or *Pipistrellus nathusii* (Keyserling et Blasius, 1839) (formerly considered a junior synonym of *P. abramus*) to be considered as members of the Iranian bat fauna (Trouessart

1879, Cheesman 1921, Ognev 1928, Ellerman & Morrison-Scott 1951, Missone 1959, Lay 1967, Etemad 1969). However, central Fars (Shiraz and surroundings) is – both geographically and ecologically – far away from the distribution ranges of these species (see e.g. Dietz et al. 2007, Bates & Harrison 1997) and DeBlase (1980) did not consider these reports relevant for consideration of *P. coromandra* and *P. nathusii* as members of the fauna of Iran. We agree with this opinion.

DeBlase (1980: 257) examined three badly preserved BMNH specimens labelled "*Pips. coromandra*, G. E. Dobson, T. G. Jerdon", which he was not able to identify to species; he only stated that these bats did not belong to one of the three species of pipistrelle bats known from Iran at that time, i.e. "*P. pipistrellus*, *P. kuhli*, or *P.* [= *Hypsugo*] *savii*." DeBlase (1980) speculated that these bats might be a part of the series described by Dobson (1871) as *Pipistrellus Coromandelicus*; however, according to the label data, he was not able to confirm this assumption for sure.

Cheesman (1921) reported another pipistrelle species from near Shiraz, unknown to be a part of the Iranian fauna, *Pipistrellus mimus* Wroughton, 1899 (currently considered a junior synonym of the Indian *Pipistrellus tenuis* (Temminck, 1840), see Simmons 2005). However, Neuhauser & DeBlase (1971) suggested this record to rather belong to *Pipistrellus pipistrellus*.

We consider such conclusion appropriate also for the previous enigmatic report of *P. coromandra*. In the second half of 19th century, the knowledge of the Asian bat fauna and biogeography was very poor and the authors of that time considered more it plausible to find some Indian species in Iran than a representative of the European fauna; perhaps due to that, some of them reported *P. coromandra* (incl. *P. abramus*) and/or *P. mimus* instead of *P. pipistrellus* or *P. kuhlii* that are very common in the area (see Figs. 157, 169).

Nyctalus noctula (Schreber, 1774)

Records. **Original data**: B u s h e h r: Bouchir [= Bushehr], Brazjan [Borazjan] [1], June 1968: coll. 5 ma (MHNG 1905.5A–1905.5E; leg. A. Arata). – **Published data**: G i l â n: Resht [= Rasht] [2], S. coast of Caspian, 21 May 1907: 2 m, BMNH (Thomas 1907, DeBlase 1980, cf. Kuzâkin 1944, 1950); – Siahkal [3], mid-June 1969: 1 fa, 48 inds., IPHR (Farhang-Azad 1970a ex DeBlase 1980), 3 km SW of Lahijan town, 14–19 June 1969 (Filippova et al. 1976). – G o l e s t a n: Gorgan [4], ZIN (Strelkov et al. 1978). – M â z a n d a r a n: Ašref' k' ûgu ot' Astrabadskago zaliva [= Behshahr, to the south of the Gorgan Bay] [5], 1 ind., ZIN (Bianki 1917, cf. Kuzâkin 1944, 1950, Strelkov et al. 1978); – Shahsavâr (= Tonekâbon) [6], Summer 1965, resp. 19 June 1968: 1 m, 1 f, resp. 10 inds. (incl. 1 m, 2–4 f), IPHR (Etemad 1969, DeBlase 1980, cf. Etemad 1967), Shahsavar, old school room, August 1965: 28 inds. (Farhang-Azad 1969b).

Distribution. *Nyctalus noctula* is a rare bat in Iran, five localities are available from the northern part of the country and one record was made in the south-western coastal area (Fig. 134).

All northern records come from a limited area of the zone of the Hyrcanian mixed forests covering the lowlands along the Caspian shore and adjacent mountain slopes. All these records were made a relatively long time ago, three at the beginning of the 20th century (Thomas 1907, Bianki 1917, Strelkov et al. 1978) and two in the second half of the 1960s (Etemad 1967, DeBlase 1980). This suggests that the occurrence of *N. noctula* in Iran is limited geographically and temporally. On the other hand, the circumstances of the two younger records from the north of country indicate evidences of maternity colonies (see below) and thus, presence of sedentary and perhaps stable populations. However, this species certainly ranks among quite exceptionally documented bats in Iran, unlike its more common but ecologically very similar congener *N. leisleri* (see below). Anyway, concerning the number of records, the knowledge of distribution of the dendrophilous forest bat fauna of Iran (and namely the genus *Nyctalus*) is undervalued compared e.g. to the fauna of cave-dwelling bat species.

The MHNG series of five adult males collected at Borazjan (Bushehr) represents an extremely extraordinary record, far beyond the margin of the continuous range of distribution of *N. noctula*, both in geographical and ecological views. The number, age and the date of collection of the specimens suggest a finding from or near a common roost, indicating permanent occurrence. However, regular occurrence of *N. noctula*, a tree-dwelling forest bat, in the lowland strip of a harsh desert between the Persian Gulf shore and the dry western slopes of the Zagros Mts. is hard to imagine, considering the local ecological conditions. If the labelling concerning the site of collection of the respective museum specimens is correct, the finding represents one of big enigmas of the Iranian bat fauna. We do not consider this record to suggest continuous occurrence of *N. noctula* over a large part of the country with margins delimited by the available records, as it is in other bat species of Iran (see e.g. *Myotis schaubi*, *M. emarginatus*, *Eptesicus serotinus*, *Hypsugo savii*, or *Nyctalus leisleri*). The most plausible explanation is that the finding is related to a group of stray migrating individuals, similarly as the record of an individual from Oman (Harrison & Jennings 1980, see below).

The occurrence area of *N. noctula* in northern Iran seems to belong to the eastern extension of the continuous Euro-Caucasian part of the species distribution range (cf. Kuzâkin 1965: pl. 22). It continues from Iran to Turkmenistan by only two records in the western part of the latter country (Strelkov et al. 1978), creating an easternmost part of this sub-range. On the other hand, the Turkmenistani record from the Karakum desert suggest the migration connection of the Golestani populations of Iran with the extreme northwest-Kazakhstani populations of the Ural river basin (Strelkov 1980). However, such a connection is more probable (concerning the environmental conditions) with the populations of Transcaucasia, where *N. noctula* does not belong to rare faunal elements – 18 record sites were reviewed by Rahmatulina (2005) from Azerbaijan.

However, it should be noted that the Iranian area of occurrence of *N. noctula*, although it actually creates a margin of the continuous west-Palaearctic sub-range of the species in the north of the country, does not represent an extreme extension of the species range as a whole. The southernmost record, apparently of a stray migrating individual, was documented from the Masirah island, south-eastern Oman (Harrison & Jennings 1980). The southernmost existence of a regular population is known from the Mediterranean Levant (see the review by Benda et al. 2006) and the easternmost populations of *N. noctula* s.str. are known from the eastern part of West Turkestan (see Strelkov & Šajmardanov 1983). However, all these localities are isolated from the continuous Euro-Caucasian sub-range (incl. their Transcaucasian, Iranian and Turkmenistani sections) by at least 1000 km.

Field notes. Very few data are available on the records of *Nyctalus noctula* from Iran. DeBlase (1980) added some details on three previously published records that were originally not complemeted by any additional information (cf. Thomas 1907, Etemad 1969, Farhang-Azad 1970a).

Two BMNH specimens originating from Rasht (Gilan) were males (Thomas 1907) and, according to the attached labels, they were collected “from old houses on the coast” on 21 May 1907 (DeBlase 1980: 211). The only bat examined by DeBlase (1980) from the series of 49 IPHR specimens collected by Farhang-Azad (1970a) in Siahkal (Gilan) in mid-June, was an adult female with enlarged nipples; the number of collected bats, the date/season of the collection, and the condition of the female clearly indicates a record of a nursery colony (see the annual cycle of this bat as reviewed in detail by Gebhard & Bogdanowicz 2004). Perhaps, another record of a nursery colony could be represented by Etemad’s (1969) set of ten IPHR specimens collected in Shahsavar (Mazandaran) on 19 June 1968 (cf. DeBlase 1980), considering the date of collection and the larger number of bats in which females prevailed, originating from one site.

Material examined. 5 ♂♂ (MHNG 1905.5A–1905.5E [S+A]), Bouchir, Brazjan [Bushehr Prov.], June 1968, leg. A. Arata.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Nyctalus noctula* are shown in Table 32. For the material examined see above.

Table 32. Basic biometric data on the examined Iranian samples of *Nyctalus noctula* (Schreber, 1774) and *N. leisleri* (Kuhl, 1817), and on *N. lasiopterus* (Schreber, 1780) from Iran, reported by Etemad (1970) from a dried specimen. For abbreviations see p. 171

	Nyctalus noctula					*Nyctalus leisleri*					*Nyctalus lasiopterus*
	n	**M**	min	max	SD	n	**M**	min	max	SD	Etemad (1970)
LC	–	–	–	–	–	10	**69.7**	66	74	2.830	–
LCd	–	–	–	–	–	10	**46.9**	40	54	4.358	45.3
LAt	5	**53.24**	51.2	54.6	1.367	12	**44.47**	40.8	46.8	1.887	64.2
LA	–	–	–	–	–	10	**18.65**	18.2	19.1	0.395	14.5
LT	–	–	–	–	–	10	**6.64**	6.1	7.2	0.381	–
LCr	5	**18.61**	18.32	18.94	0.291	9	**15.46**	14.58	15.98	0.439	–
LCb	5	**18.69**	18.37	18.94	0.237	9	**15.56**	14.77	16.02	0.405	–
LaZ	5	**13.21**	12.97	13.31	0.140	8	**10.45**	10.02	11.02	0.339	–
LaI	5	**5.01**	4.85	5.21	0.154	9	**4.69**	4.49	4.99	0.150	–
LaInf	5	**7.56**	7.36	7.74	0.140	9	**5.83**	5.45	6.06	0.192	–
LaN	5	**9.84**	9.51	10.05	0.213	9	**8.22**	7.96	8.62	0.235	–
LaM	5	**11.96**	11.81	12.09	0.131	9	**9.65**	9.36	9.98	0.216	–
ANc	5	**6.87**	6.68	6.98	0.122	9	**5.45**	5.01	5.70	0.202	–
LBT	5	**4.77**	4.58	5.02	0.192	9	**3.83**	3.68	4.08	0.134	–
CC	5	**7.33**	7.18	7.39	0.085	9	**5.66**	5.43	5.82	0.130	–
M^3M^3	5	**8.58**	8.39	8.81	0.206	9	**7.09**	6.73	7.37	0.207	–
CM^3	5	**7.20**	6.96	7.39	0.155	9	**5.79**	5.42	6.03	0.173	–
LMd	5	**14.29**	13.88	14.61	0.268	9	**11.51**	10.94	11.97	0.308	–
ACo	5	**4.57**	4.32	4.84	0.191	9	**3.29**	3.06	3.44	0.152	–
CM_3	5	**7.66**	7.43	7.88	0.185	9	**6.17**	5.93	6.36	0.139	–

N. noctula is regarded a polytypic species, six subspecies are mostly recognised within its distribution range, although the systematic position of some of them remains unclear (Ryberg 1947, Ellerman & Morrison-Scott 1951, Corbet 1978, Koopman 1994, Horáček et al. 2000, Gebhard & Bogdanowicz 2004, Simmons 2005, Benda et al. 2006, 2011c). In the western Palaearctic, three subspecies are regularly distinguished in their separate ranges, viz. *N. n. noctula* (Schreber, 1774) in Europe and the Caucasus, *N. n. meklenburzevi* Kuzâkin, 1934 in the eastern part of West Turkestan, and *N. n. lebanoticus* Harrison, 1962 in the Levant.

Based solely on the comparison of pelage colouration, Harrison (1962) referred the Iranian populations of *N. noctula* to the nominotypical subspecies. This conclusion was accepted by other authors (Strelkov et al. 1978, DeBlase 1980, Koopman 1994, Benda et al. 2006). However, DeBlase (1980) took also another form in consideration, *N. n. princeps* Ognev, 1923 (type locality: Hrenovoe, Bobrovskij Uezd, Voronežskaâ Guberniâ [Khrenovoe, Bobrov Distr., Voronež Prov., Russia]; Ognev 1928: 508). Although some older authors recognised this subspecies as valid, this taxon was created on the basis of incorrectly gathered and compared data (Kuzâkin 1950) and most of the recent authors regard it a synonym of the nominotypical subspecies (Strelkov 1981a, Corbet 1978, Strelkov et al. 1978, 2002, Koopman 1994, Horáček et al. 2000, Gebhard & Bogdanowicz 2004, Simmons 2005); for details see the review by Benda et al. (2006).

However, although separated from Iran by huge areas of desert habitats of Turkmenistan and Uzbekistan (see Distribution), the Turkestani subspecies *N. n. meklenburzevi* (type locality: Taškent [= Toškent, Uzbekistan]; Kuzâkin 1934: 323) certainly should be considered as a potential candidate for labelling of the Iranian populations of *N. noctula*. This form was originally described on the basis of its pale colouration (Kuzâkin 1934), later on, it was confirmed to occur in the eastern part of West Turkestan and in western Siberia, being represented by both dark and pale morphs, larger in size than individuals of the European samples (Strelkov et al. 2002, Benda et al. 2011c). However, both the north-Iranian (DeBlase 1980: 402–403) and the south-Iranian bats (Table 32) conform in size to each other as well as to the European and Levantine samples and are clearly small-sized in comparison to the Turkestani samples of *N. n. meklenburzevi* (Benda et al. 2011c: 198, Table 14).

The Levantine form *N. n. lebanoticus* (type locality: Natural Bridge, Faraya, Lebanon; Harrison 1962: 337) that occurs in a small range along the eastern shore of the Mediterranean Sea (Turkish Cilicia, western Syria, Lebanon, northern Israel, and West Bank; see the review by Benda et al. 2006), isolated from the European range of the nominotypical subspecies, was described solely on the grounds of darker colouration of its pelage, both dorsal and ventral (Harrison 1962); its existence was accepted by a series of other authors (Harrison & Bates 1991, Koopman 1994, Mendelssohn & Yom-Tov 1999, Simmons 2005, etc.). However, since the pelage colouration in *N. noctula* shows remarkable age and seasonal variations, it seems to be an insufficient character for a separation of a unique taxon within this species; on the other hand, due to the geographic isolation from the rest of the species range, a separate position of this population is possible (for broader discussion see Benda et al. 2006).

Anyway, DeBlase (1980) did not mention the tinge of colouration of the examined north-Iranian samples of *N. noctula* and we were not able to examine the MHNG specimens from southern Iran properly due to their submersion in alcohol. Although we consider the colouration as a problematic character in this species (see also Strelkov et al. 2002), the Levantine range may represent a separate lineage within *N. noctula*. However, this question should be probably answered only with the help of a genetic analysis. On the morphological and geographic grounds, the Iranian populations of *N. noctula* can be only tentatively assigned to the nominotypical subspecies, similarly as reported for the Transcaucasian populations (Rahmatulina 2005).

Echolocation. *Nyctalus noctula* produces two different types of calls, however, they both have a long duration (13–28 ms). The first type is a frequency-modulated call of a usually high frequency, the other type is an almost constant-frequency call with a low frequency (Jones 1995, Dietz et al. 2007). The range of frequency of maximum energy is between 18–28 kHz in the European populations (Parsons & Jones 2000, Russo & Jones 2002, Obrist et al. 2004, Papadatou et al. 2008). Echolocation characteristics of *N. noctula* have not yet been studied in the Asian part of the species range.

Feeding ecology. *Nyctalus noctula* is a large bat flying and foraging in fast flight in open spaces (Norberg & Rayner 1987, Gebhard & Bogdanowicz 2004), it also searches for its prey frequently above water (Gloor et al. 1995). The main items in the diet of *N. noctula* in Europe include Trichoptera, Diptera, Lepidoptera, and Coleoptera (Beck 1995, Gloor et al. 1995, Mackenzie & Oxford 1995, Rydell & Petersons 1998, Gebhard & Bogdanowicz 2004). Concerning the Middle East, Benda et al. (2006) recorded Heteroptera to prevail in the diet at one site in Syria, which is somewhat beyond the results of previous analyses (see above). Rahmatulina (2005) reported Coleoptera and large Lepidoptera as the most important prey in Azerbaijan. The diet of *N. noctula* in Iran has not yet been studied.

Records of ectoparasites. **Published data**: I s c h n o p s y l l i d a e: *Ischnopsyllus elongatus*: 2 ma, 9 fa from 28 inds., Shahsavar [Mazandaran Prov.], August 1965 (Farhang-Azad 1969b). – I x o d i d a e: *Haemaphysalis erinacei* [= *H. numidiana*]: 7 nymphs from 1 ind., 3 km SW of Lahijan town, 14–19 June 1969 (Filippova et al. 1976)

Comments on ectoparasites. Only one insect ectoparasite was found on *Nyctalus noctula* in Iran, the bat flea *Ischnopsyllus elongatus* (Curtis, 1832). *I. elongatus* is a parasite of tree-dwelling bats. Throughout its distribution range, it was recorded most frequently from this host species (Hůrka 1963).

Haemaphysalis erinacei Pavesi, 1884 s.l. is a tick distributed in North Africa, southern Europe and in the Middle East (Kolonin 2009), it is parasitic on small burrowing and/or cave-dwelling mammals. From Iran it was documented also from *Otonycteris leucophaea* (Filippova et al. 1976). Morozova et al. (1964) reported this tick from *N. noctula* (as well as from *Pipistrellus pipistrellus*) also from Kazakhstan. From the latter species this tick was collected also in Afghanistan (Dusbábek 1970). Considering the above noted host preference in this tick, all these findings from bats should be regarded as quite exceptional.

Nyctalus lasiopterus (Schreber, 1780)

Records. **Published data**: G i l â n: Roudsar, resp. Rudsar [1], northern part of Iran, near 37° N latitude, 11 October 1969: 1 ind. (Etemâd 1970, 1984, DeBlase 1980).

Distribution. *Nyctalus lasiopterus* is a very rare bat species in Iran – only one verified record is available from the northern part of the country, in the zone of the Hyrcanian mixed forests of Gilan

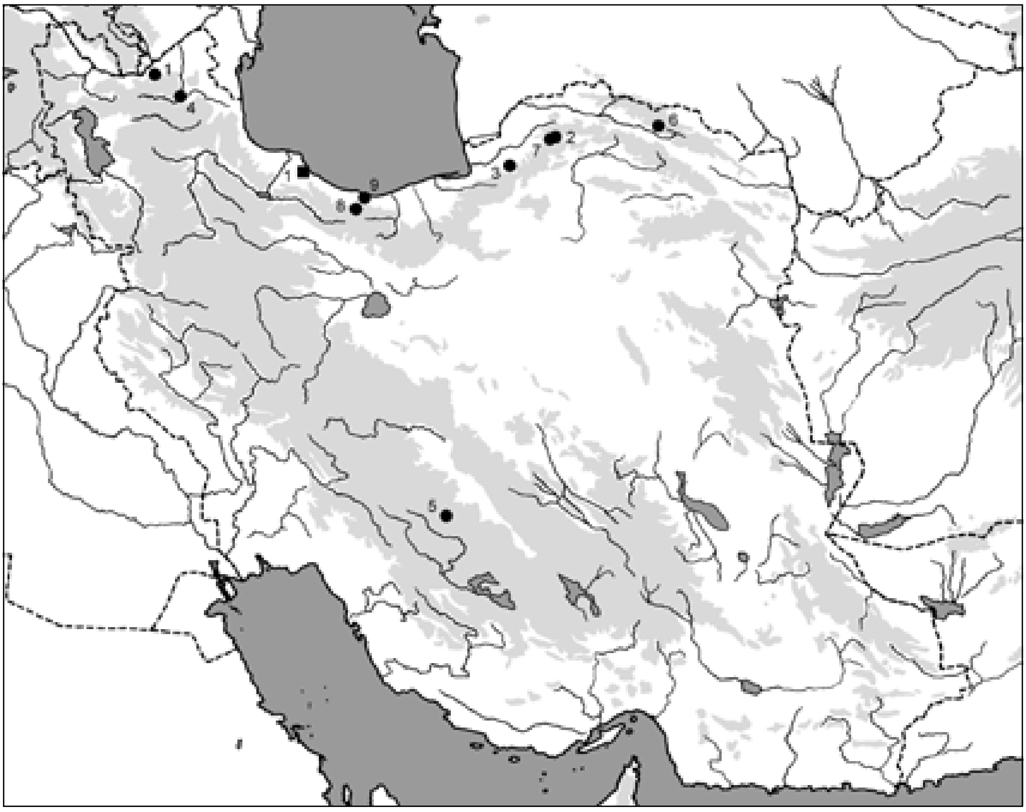


Fig. 175. Records of *Nyctalus lasiopterus* (Schreber, 1780) (square) and *N. leisleri* (Kuhl, 1817) (circles) in Iran.

(Etemad 1970; Fig. 175). The evidence in Iran represents an extreme south-eastern extension of the species distribution range and a question exists whether it indicates a natural margin of the regular species range or rather a finding of a stray (migrating) individual. The date of collection of the individual certainly indicates the migration season of a year.

The Iranian locality is rather isolated from the continuous range of *N. lasiopterus*, geographically closest findings are available from western parts of Georgia and the Russian Caucasus (Cyculina 1998, Buhnikašvili et al. 2004) and from Cyprus (Benda et al. 2007); but these records are situated at least some 900 km from the Golestani site. Although a record of *N. lasiopterus* from West Turkestan is available (western Karakalpakstan; Borovskij & Voroncov 1970), a mummified individual found in a desert that undoubtedly represents a stray individual (Strelkov 1980). Most probably, it originated from the Volga region of European Russia, where breeding populations occur (Strelkov & Il'in 1990).

Etemad (1970: 547) mentioned the Iranian record of *N. lasiopterus* as "the farthest south locality in which this rare bat has been recorded" and also DeBlase (1980: 212) added that it is "the southernmost point for this species". However, these statements are not valid anymore. The latitude of 37° N, where the Golestani site lies, roughly conforms to latitudes of the records from Cyprus, southern Turkey, Spain, and Morocco (Palmeirim 1982, Ibañez et al. 1992, Benda et al. 2007, Yiğit et al. 2008, Paksuz & Özkan 2011), but currently the absolutely southernmost localities of *N. lasiopterus* are known from Cyrenaica, Libya, between ca. 32° 40' and 33° 00' N (Qumsiyeh & Schlitter 1982, Spitzenberger 1982, own unpubl. data).

Field notes. Etemad (1970) gave no details concerning the collection of the only specimen of *Nyctalus lasiopterus* recorded from Iran. The only data available are as follows (Etemad 1970: 547): "The Iranian specimen was collected from Roudsar, northern part of Iran, near 37° N latitude, on 11th October 1969". Although neither the sex nor age of the specimen were determined, considering the date of collection and the distance from the continuous range of the species (see above), the bat could rather represent a stray migratory individual than a member of resident population.

Echolocation. *Nyctalus lasiopterus* produces rather variable calls according to the foraging habitat – the calls emitted in a cluttered environment differ from the calls from an open environment. In a closed habitat, it emits short frequency-modulated calls while in an open habitat it produces long (up to 28 ms) quasi-constant-frequency calls (Dietz et al. 2009, Estók & Siemers 2009). Values of frequency of maximum energy varied between 14–23 kHz in the European populations, depending on type of habitat and foraging situation (Weid & von Helversen 1987, Barataud 2001, Ibáñez et al. 2001, 2004, Dietz et al. 2007, Haquart & Disca 2007, Bec et al. 2008). Echolocation patterns of *N. lasiopterus* have not yet been studied in the Asian part of the species range.

Feeding ecology. *Nyctalus lasiopterus* is a large bat hunting in fast flight in open spaces, sometimes at great heights (Ibáñez et al. 2004, Dietz et al. 2007). The species is insectivorous and partially also carnivorous – bird feathers were discovered in the diet of *N. lasiopterus* in the Mediterranean (Dondini & Vergari 2000, Ibáñez et al. 2001). However, some other diet analyses showed no records of feathers or other evidence of carnivory in this species. The diet of *N. lasiopterus* studied in Slovakia contained mainly moths, dipterans and lacewings (Uhrin et al. 2006). Digestive tracts from five bats collected in Cyrenaica, Libya, contained moths, carabid beetles, heteropterans, neuropterans, and cockroaches (Andreas 2010). The absence of bird remains in some diet material indicates that birds are not the main food resource of *N. lasiopterus* and the carnivory is probably a local and/or seasonal phenomenon, perhaps during bird migration. The diet of *N. lasiopterus* in Iran has not yet been studied.

Nyctalus leisleri (Kuhl, 1817)

Records. **Original data**: Â z a r b â i j a n - e S h a r q i: Chope Darag [1], ca. 30 km W of Kalibar, alluvium grove, 28 September 2011: net. 2 ma, 4 fa, coll. 2 m, 2 f (NMP 94099–94102; Fig. 176), det. & rec. calls of several foraging inds. – G o l e s t a n: oak forest 5 km E of Tunel-e Golestan [2], 44 km E of Kalaleh, 26 May 2006: det. calls of min. 1 ind.; – valley 2 km SSE of Ali Abad [3], beech forest, above a stream, 28 May 2006: net. 2 ms, 1 fa, 3 fG (NMP 90867–90872). – **Published data**: A r d a b i l: Kulyâr [4], in remains of a street lamp, 19 July 2006: coll. 2 m (Sheikh-Jabbâri 2008). – F â r s: Chelzari [5], 40 km. SE Abadeh, 2 inds., IPHR (Farhang-Azad 1970a ex DeBlase 1980). – K h o r a s â n - e R a z a w i: Chelmir [6], 1 ind., IPHR (Farhang-Azad 1970a ex DeBlase 1980). – K h o r a s â n - e S h o m â l i: 3 km. S of the Tangeh Road at Mohammed Reza Shah National Park [7], 29 June 1969: net. 1 m, 1 f, MMTT (DeBlase 1980). – M â z a n d a r a n: Sama [8], above a stream, 18 August 1962: net. 1 fa, 1 fs, 20 August 1962: net. 1 fa, FMNH (Lay 1967 [as *N. noctula*], Neuhauser & DeBlase 1974, DeBlase 1980); – Weyser [9], south of Nowshar, deep in a forest, 6 August 1968: net. 1 ma (Steiner & Gaisler 1994).

Distribution. *Nyctalus leisleri* is an infrequent bat species in Iran, nine record sites are available from the country (Fig. 175). Most of the records come from the northernmost part of Iran, from the belt of mountains stretching from Azarbaijan to Khorasan, only one locality originates from a different region, from the Zagros Mts. of the northern part of the Fars province. Although De-Blase (1980) reported only four records of *N. leisleri* from Iran, these findings geographically well delineated the currently known range in the country. The records come from relatively temperate areas of Iran, more than a half of them from the humid zone of mixed forests in lowlands and adjacent mountain slopes stretching along the Caspian shore, other sites lie in the Mediterranean (forested) upland areas of northern and central Iran. This type of occurrence conforms to that known from the western part of the Middle East (Benda & Horáček 1998, Benda et al. 2007).

The Iranian range of *N. leisleri* continues in the west and northwest to eastern Turkey and Transcaucasia (Benda & Horáček 1998, Albayrak 2003, Buhnikašvili et al. 2004) and this range

Fig. 176. *Nyctalus leisleri* (Kuhl, 1817) from Chope Darag (Azarbaijan). Photo by A. Reiter.

Fig. 177. Alluvial poplar grove at Chope Darag (Azarbaijan), a foraging habitat of *Pipistrellus pipistrellus* and *Nyctalus leisleri*. Photo by A. Reiter.

is connected with the regular European occurrence of the species (Horáček et al. 2000). In the east of Iran, the species range continues to the north-western part of the Indian subcontinent (from eastern Afghanistan to Uttar Pradesh), where the eastern margin of the whole distribution range of the species lies (Bates & Harrison 1997). However, this area of occurrence is separated from the Middle Eastern range by more than 1100 km over the Afghanistani mountains. The Iranian distribution thus represents the eastern margin of the continuous European and Middle Eastern range. Moreover, the Iranian record from the Fars province represents the southernmost point of occurrence in the species distribution range in Asia.

N. leisleri remains unknown from West Turkestan so far (Strelkov et al. 1978, Strelkov & Šajmardanov 1983), however, considering the occurrence in the Iranian part of the Kopetdagh Mts., its presence in south-western Turkmenistan is quite likely.

Field notes. In Iran, *Nyctalus leisleri* was recorded predominantly at its foraging grounds. Only one record of this bat from its roost is available, Sheikh-Jabbâri (2008) found two males hidden under a rest of a street lamp remaining on a wooden pylon in the small town of Kulyar (Ardabil) on 19 July 2006.

Lay (1967: 144) reported on a collection of three females of *N. leisleri* (originally erroneously indentified as *N. noctula*, but see Neuhauser & DeBlase 1974) in the forest at Sama (Mazandaran) on 18 and 20 August 1962: "All these bats were caught in a mist net placed across a pool behind a jube diversion dam in the mountain stream […]." For details on the site, see under *Eptesicus nilssonii*; the latter species and *Pipistrellus pipistrellus* were collected there along with *N. leisleri* (Lay 1967). DeBlase (1980: 209) found two specimens of *N. leisleri* in the MMTT collection and these bats: "are a male and a female mistnetted on 29 June [1969] over a river at night" at the Tangeh road at Mohammed Reza Shah National Park (= Golestan NP). Steiner & Gaisler (1994) reported an adult male collected at Weyser near Nowshar (Mazandaran) on 6 August 1968; they added (p. 20): "The Iranian specimen was mist-netted (14 net-nights) in a closed humid forest with beeches and maples, at the elevation of 1150 m." The site is characterised as follows (p. 7): "Weyser lies in the Elbourz Mountains, south of Nowshar, […]. Netting was done on the very wet luff side, deep in a forest."

DeBlase (1980) also mentioned two records from the unpublished report by Farhang-Azad (1970a), one individual caught at Chelmir (Khorasan) and two bats collected at Chelzari (Fars). With a certain probability, these records also represent bats netted at their foraging grounds. This is namely true for the Chelmir specimen, which was captured at the same site as 78 other bats belonging to eight species, all of which were netted over a stream in July 1969 (cf. Farhang-Azad 1970a ex DeBlase 1980); this way of collection was also reported for the bats caught there by Farhang-Azad (1969a) in July 1968. Anyway, no direct information on these two records other than locality is available.

Six adult *N. leisleri*, two males and four females, were netted above a creek and in an adjacent alluvial poplar grove in the valley at Chope Darag near Kalibar (Azarbaijan) on 28 September 2011. The site is a vegetation-rich valley among hills with pastures and fields (Figs. 177, 178) neighbouring the Araxes river valley in the south; along with these individuals of *N. leisleri*, numerous echolocation calls of the species and of *Pipistrellus pipistrellus* were also detected and recorded at this locality. Other six *N. leisleri*, also two males and four females, were netted above a stream passing through the beech forest near Ali Abad (Golestan). In this exploited lowland forest, used also as a recreation area by the locals, altogether eight bat species were netted during one evening on 28 May 2006 (Fig. 76); besides *N. leisleri* also *Myotis blythii*, *M. bechsteinii*, *M. nattereri*, *M. emarginatus*, *M. hyrcanicus* sp. n., *Vespertilio murinus*, *Eptesicus serotinus* and *Pipistrellus pygmaeus*. Echolocation calls of *N. leisleri* (at least of one foraging individual) were detected in the oak forest at Tunel-e Golestan near Kalaleh (Golestan) on 26 May 2006, on the same evening when also *Myotis bechsteinii*, *Pipistrellus pipistrellus* and *Barbastella barbastellus* were netted there and calls of *Tadarida teniotis* detected.

Fig. 178. Hills above the valley at Chope Darag (Azarbaijan) facing the Araxes river valley and Armenian and Azerbaijani mountains (in the background). Photo by A. Reiter.

From one site in Iran, a direct evidence of reproduction of *N. leisleri* is available. Three pregnant females were caught at Ali Abad on 28 May, each contained two phoeti of the crown-rump length 12.1–18.2 mm (mean 15.63 mm). This record suggests the occurrence of parturitions in northern Iran in June, similarly as it was reported for the European populations (see the review by Bogdanowicz & Ruprecht 2004).

MATERIAL EXAMINED. 2 ♂♂, 4 ♀♀ (NMP 90867–90871 [S+A], NMP 90872 [A]), Ali Abad (Golestan Prov.), 28 May 2006, leg. P. Benda & A. Reiter; – 2 ♂♂, 2 ♀♀ (NMP 94099–94102 [S+A]), Chope Darag (Azarbaijan-e Sharqi Prov.), 28 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

MORPHOLOGY AND VARIATION. External and cranial dimensions of the Iranian specimens of *Nyctalus leisleri* are shown in Table 32. For the material examined see above.

DeBlase (1980) and Steiner & Gaisler (1994) considered the Iranian populations of *N. leisleri* as a part of the nominotypical subspecies. This species is considered monotypic in its continental western Palaearctic range of distribution (Europe, North Africa, Mediterranean and British islands, south-western Asia), only the nominotypical subspecies is recognised in this area (Ellerman & Morrison-Scott 1951, Corbet 1978, Palmeirim 1991, Koopman 1994, Horáček et al. 2000, Bogdanowicz & Ruprecht 2004, Simmons 2005). This is in accordance with the migratory habits of these populations. Other subspecies of *N. leisleri* are known from the Atlantic islands, *N. l. verrucosus* Bowdich, 1825 occurring in Madeira and *N. l. azoreum* (Thomas, 1901) in the Azores. Some authors (Ellerman & Morrison-Scott 1951, Palmeirim 1991, Koopman 1993, Horáček et al. 2000, Bogdanowicz & Ruprecht 2004, Simmons 2005) recognised the Azorean form as a separate species, while others (Corbet 1978, Koopman 1994) gave it only a subspecific rank.

The molecular genetic analyses of the *leisleri-azoreum* complex (Salguiero et al. 2004, 2007) revealed very shallow divergence among particular populations in mitochondrial DNA that do not support division of the complex into more than one species, *N. leisleri*. However, the sampling covered by these analyses did not concern the Iranian populations, as the only Asian sample included in the latter analysis (Salguiero et al. 2007) originated from western Anatolia. This specimen was found to possess an identical haplotype based on the partial sequences of the ND1 gene and of the mitochondrial control region (CR) with the samples from the Azores, Madeira, Morocco, Portugal, Switzerland, Czech Republic, Montenegro, and Greece (ND1), and from Morocco, Portugal, and the Czech Republic (CR), respectively. These results suggest an extremely low geographic variability in the whole species rank of *N. leisleri* and thus, its monotypy in the range from Morocco to India (besides the Atlantic insular populations, which significantly differ in morphology, see Palmeirim 1991).

Thus, the Iranian populations of *N. leisleri* most probably belong to the nominotypical form. Such a conclusion is also supported by a comparison of dimensions of the Iranian samples with bats from other populations (see Table 32 and the limited data by Palmeirim 1991 and Bogdanowicz & Ruprecht 2004).

ECHOLOCATION. *Nyctalus leisleri* produces almost constant-frequency signals, the start frequency is ca. 50 kHz and the end frequency ca. 27 kHz. The peak frequency ranges between 27–34 kHz in the Mediterranean populations (Russo & Jones 2002, Papadatou et al. 2008), while slightly lower values were observed in the westernmost part of the species range (UK, Ireland, Madeira; Waters et al. 1995, Buckley et al. 2011). We recorded calls of *N. leisleri* at a single site in north-western Iran, Chope Darag (Azarbaijan; Fig. 179). The species foraged above and around a small stream running through a poplar grove. Basic characteristics of the echolocation calls are given in Table 3; the observed values of most parameters conform to previously published data. No other data on echolocation of *N. leisleri* are available from the Asian part of the species range.

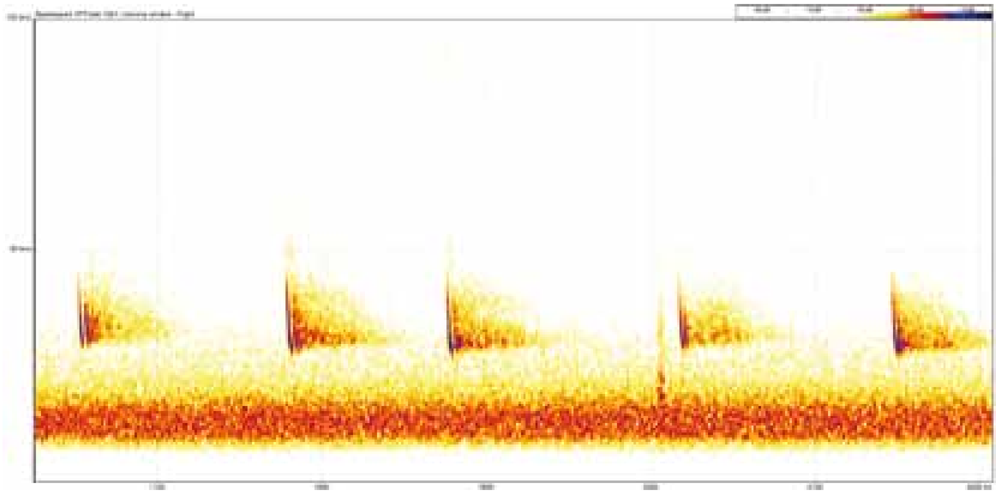


Fig. 179. Spectrogram of echolocation calls of *Nyctalus leisleri* (Kuhl, 1817); an individual foraging in the forest at Chope Darag (Azarbaijan).

Feeding ecology. *Nyctalus leisleri* is a medium-sized aerial hawker (Bogdanowicz & Ruprecht 2004). The studies in Europe showed its diet to be relatively variable depending on foraging habitat. While in the forested areas the diet of *N. leisleri* was dominated by Lepidoptera and

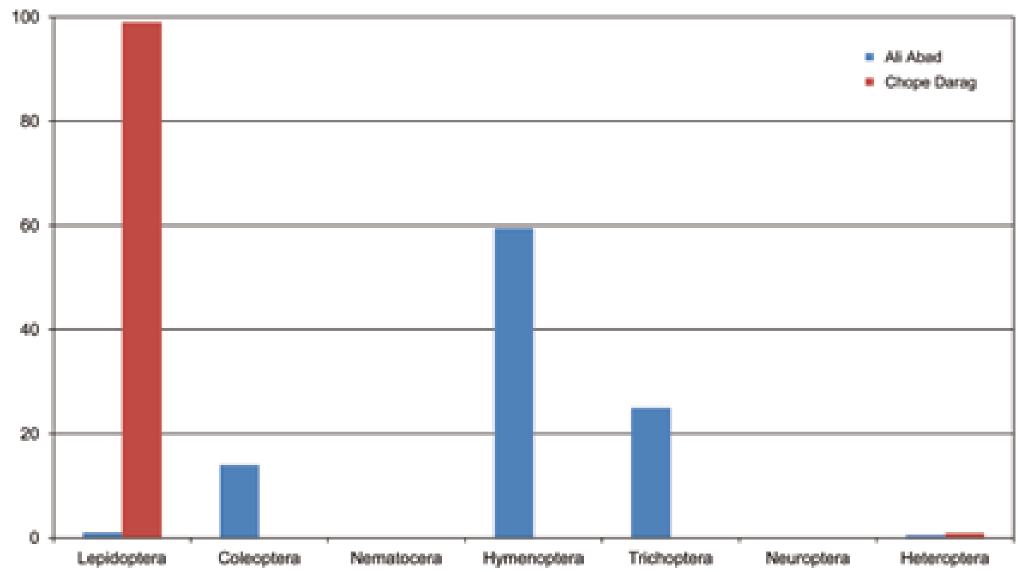


Fig. 180. Percentage volume of particular food items in the diet of *Nyctalus leisleri* (Kuhl, 1817) in Iran. Material analysed: Ali Abad (20 faecal pellets from five bats), Chope Darag (94 pellets from six bats).

nematoceran Diptera, in the landscapes with a larger proportion of pastures the dung flies (Scatophagidae) and scarabaeid beetles were more significantly represented; other taxa composing its diet were Trichoptera, Neuroptera, and Hymenoptera (Sullivan et al. 1993, Shiel et al. 1998, Kaňuch et al. 2005).

In Iran, we collected two relatively large sets of faeces (Fig. 180), 20 faecal pellets from Ali Abad (Golestan) and 94 faecal pellets from Chope Darag (Azarbaijan). The analysed sample sets differed markedly in their composition. The diet from Chope Darag was dominated by Lepidoptera (wingspan ca. 35 mm), while only a minimum proportion of other prey taxa was recorded. The diet of *N. leisleri* from Ali Abad contained mostly Hymenoptera (Formicoidea), Trichoptera, and Coleoptera (namely Carabidae and Curculionidae). The latter diet composition resembles the results of a diet analysis from Cyprus, which showed an overwhelming majority of ants (own unpubl. data).

The results of diet analysis from Iran support the opinion that *N. leisleri* is a relatively flexible bat species with variable diet composition. The above mentioned dominance of certain items in the diet from pasture landscape and from forested areas (Sullivan et al. 1993, Shiel et al. 1998, Kaňuch et al. 2005) is complemented with the dominance of ants in more arid habitats of the Middle East.

Otonycteris hemprichii Peters, 1859

Records. **Original data**: B u s h e h r: Chahak [1], 8 km NW of Bandar Genaveh, 14 October 1998: remains of 1 ind. (part of skull) found in *Tyto alba* pellets (cf. Obuch & Khaleghizadeh 2011). – E s f a h â n: valley 2 km S of Nasran [at Espidan] [2], 12 km ESE of Natanz, in a cervice of loess wall of a wadi, 2 May 1997: coll. 1 fa (NMP 48111; cf. Benda et al. 2006, Benda & Gvoždík 2010); – Chel Taghâr [3], Siâhkuh Protected Area, 90 km NE of Ardakân, man-made trough, June 2009: exam. 1 ind. (leg. M. Azizi); – Emamzadeh [4], 15 km W of Kashan, wadi, 1 May 1997: remnant of 1 ind. (left mandible) found in *Bubo bubo* pellets; – Deh Zireh [5], 35 km SE of Kashan, 27 April 1996: remnants of 2 inds. (2 pairs of mandibles, 1 rostrum fragment) found in *Bubo bubo* pellets. – F â r s: Shehrenjân (at the Lake Parishân) [6], 15 km SE of Kâzerun, Gap spring, water-hole, August 2010: 1 fa found being stuck in the mudd (leg. M. Sufi & T. Ghadiriân). – H o r m o z g â n: wadi 6 km E of Tujak [7], 53 km SSE of Sirik, above a pool, 15 April 2000: net. 1 fG (NMP 48424; cf. Benda et al. 2006, Benda & Gvoždík 2010); – Chahâr Dahaneh [8], 12 km ENE of Dehbârez, above a pool, 17 April 2000: net. 3 fL (NMP 48440–48442; cf. Benda et al. 2006, Benda & Gvoždík 2010); – river valley 12 km NNE of Chah Mosallam [9], 42 km NE of Bandar Lengeh, 12 October 2011: det. & rec. calls of several foraging inds.; – Podonu [10], 10 km E of Dehbârez, palm oasis, 10 October 2011: net. 1 fa (NMP 93903; Fig. 182), det. & rec. calls of foraging inds. – K e r m â n s h a h: Taq-e Bostan [11], Kermanshah, 6 October 1998: remnants of 1 ind. (fragments of mandibles) found in *Bubo bubo* pellets. – S i s t â n v a B a l u c h e s t â n: semi-desert 4 km S of Espakeh [12], 68 km SW of Irânshahr, 10 April 2000: obs. 1 flying ind.; – small oasis 13 km NW of Masjed Hazrat Abolfazl [13], stone hut, between stones, 9 April 2000: mummy (NMP 48376; cf. Benda et al. 2006, Benda & Gvoždík 2010); – Pir Sohrab [14], 54 km NE of Chabahar, above a pool, 12 April 2000: net. 2 ma, 2 fa (NMP 48396–48399; cf. Benda et al. 2006, Benda & Gvoždík 2010). – **Published data**: S i s t â n v a B a l u c h e s t â n: s. Nukedžaga, strana Gè [15a], Pers. Belûčistan' [= Niku-e Jahan village, Geh country, Iranian Baluchestân], 23 March (= 5 April NS) 1901: 1 ind., ZIN (Satunin 1910 [as *O. cinereus*]) × K h o r a s â n - e J a n u b i: strana Zirkuh [15b], bl. Bamrudskogo aryka v Horasane [= Zirkuh country, near the Bamrud channel in Khorasân], 21 July [= 3 August NS] 1901: 1 f, ZIN (Ognev 1928 [as *O. cinereus*], Etemad 1969), Zirkuh, Horasan, vost. Iran [= Zirkuh, Khorasân, eastern Iran], 21 July [= 3 August NS] 1901: 1 f (Strelkov 1981b).

Distribution. *Otonycteris hemprichii* is a rather uncommon bat species in Iran, 15 record sites are available from the southern and central parts of the country (Fig. 181). The localities are scattered along the slopes of the Zagros Mts., both on the north-eastern side, opened to the Dasht-e Kavir desert, and on the south-western side, opened to arid lands of Mesopotamia and adjacent shore of the Persian Gulf; another group of localities comes from the arid mountainous region of south-eastern Iran, in the southern parts of Baluchestan, the Kerman province and from the hilly landscape of Hormozgan. Only one record has been reported out of this range, from eastern Iran close to the Afghanistani border (Ognev 1928; but see below). On the other hand, the records from north-eastern Khorasan (including those reported by Farhang-Azad 1969a and DeBlase 1980) belong exclusivelly to a sister species, *O. leucophaea* (see below and Fig. 181). Iran is thus the only country where both species are known to occur (Benda & Gvoždík 2010). In comparison with the Iranian range of *Otonycteris* bats described by DeBlase (1980), comprising two sites only, the number of records increased almost ten times (18 sites are available for the genus) and the range covers almost the whole country with the exception of the Mediterranean habitats of the north and north-west (Fig. 181).

O. hemprichii s.str. is a Saharo-Arabian faunal element that reaches the north-eastern margin of its distribution range in Iran. The species occurs in the arid parts of northern Africa adjacent to the Sahara and in steppes and deserts of the Middle East from Turkish and Syrian Mesopotamia to southern Saudi Arabia and Oman (see the reviews by Benda et al. 2006 and Benda & Gvoždík 2010). The records in Iranian Baluchestan represents the easternmost extension of the species range, although occurrence is also expected in its Pakistani part (Roberts 1997).

Although most of the localities of *O. hemprichii* s.str. lie in a broad belt of the south-Iranian mountains from the Kermanshah and Esfahan provinces to the Kerman and Sistan va Baluchestan

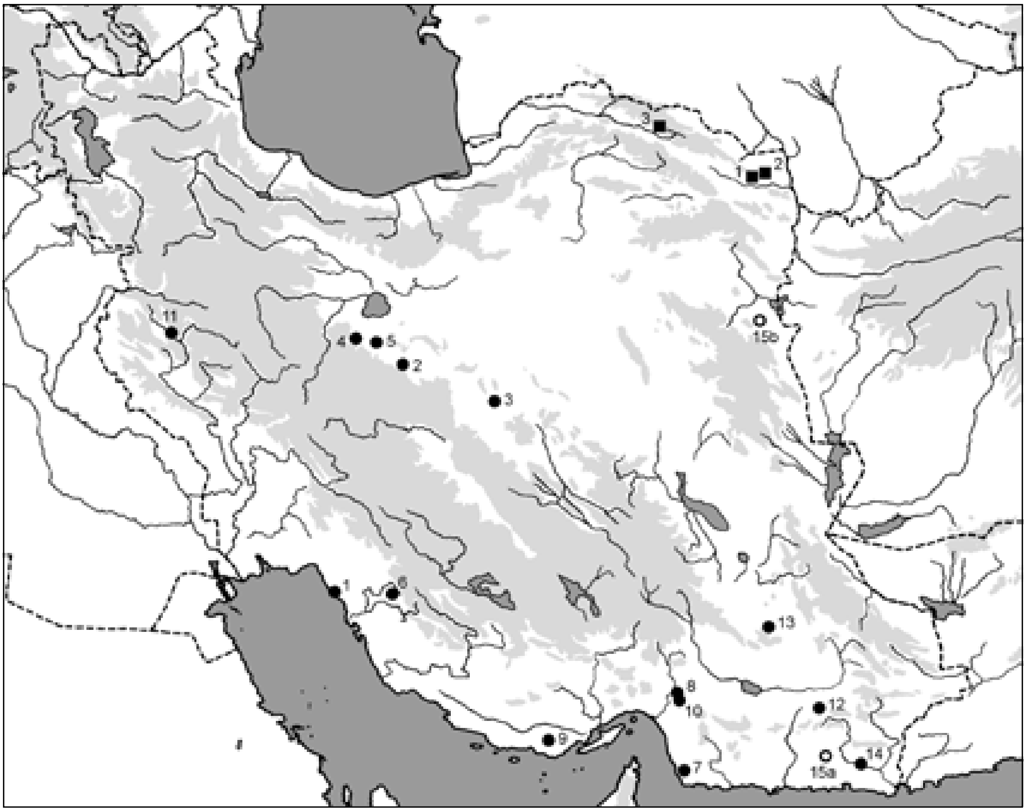


Fig. 181. Records of *Otonycteris hemprichii* Peters, 1859 (circles) and *O. leucophaea* (Severcov, 1873) (squares) in Iran. Open symbols denote uncertain localisations (for details see text).

Fig. 182. Portrait of *Otonycteris hemprichii* Peters, 1859 from Podonu (Hormozgan). Photo by A. Reiter.

provinces (see above), one record has been reported from a different part of Iran, the Zirkuh region of southern Khorasan. This site lies at least 500 km northeast of the belt of regular occurrence given by other records (Fig. 181) and is considered the type locality of *Otonycteris cinereus* Satunin, 1910 (see Records; Ognev 1928) = *O. hemprichii cinerea* (see Morphology and variation). However, the type locality was originally reported by Satunin (1910) as Niku-e Jahan, Geh region, Baluchestan (and accepted by e.g. Ellerman & Morrison Scott 1951, Lay 1967, Corbet & Hill 1992). Ognev (1928), according to the ZIN catalogue record suggested to restrict the type locality to near Bamrud, Zirkuh region, Khorasan-e Janubi prov. (see Records), and this statement was subsequently accepted broadly (see Kuzâkin 1950, Etemad 1969, Corbet 1978, DeBlase 1980, Strelkov 1981b, Nader & Kock 1983a, Benda & Gvoždík 2010, etc.).

So, the Ognev's (1928) supposition considered the museum evidence to be right with a certainty and the Satunin's (1910) definition erroneous, but Ognev did not provide any arguments for his opinion. However, when K. A. Satunin (1863–1915) published his description of *O. cinereus* including the type locality identification, he used the specimen collected by N. A. Zarudnyj (1859–1919) during his trip to eastern Persia in 1901 (see Zarudnyj 1902). It is known that Satunin and Zarudnyj were in (at least correspondence) connection (Zarudnyj described several bird taxa based on specimens collected by Satunin) and thus, it is well possible that Satunin's (1910) statement of the type locality resulted also from personal consultations between the two Russian classical naturalists. Anyway, there is no direct link to indicate that the ZIN museum evidence was made correctly and Satunin's work incorrectly (and vice versa, of course). Concerning the pattern of geographical distribution of *O. hemprichii* in Iran, the Satunin's (1910) locality lies within the known range and seems more likely to be the right one, while Ognev's (1928) locality lies completely out of the range and thus, its certainty is less supported. We thus consider the occurrence of *O. hemprichii* in the Iranian areas north of the central deserts, including the southern Khorasan, to be less probable.

FIELD NOTES. *Otonycteris hemprichii* was recorded in Iran mainly at its foraging grounds and only a minority of records come from roosts, a significant number of findings come also from analyses of osteological remains from owl pellets.

The record of a living individual of *O. hemprichii* in its roost was made only once in Iran; an adult female was discovered in a crevice of loess wall of a valley of the temporarily dried stream between Nasran and Espidan (Esfahan) on 2 May 1997. The wall was some 3–4 m high, the bat was hidden in the crevice (1–2 cm wide) situated ca. 2 m above the valley bottom. The bat presence was localised due to a small number of droppings below the crevice; the bat was collected only after the wall part was destroyed using a stone and the crevice enlarged. Another record, originally representing a roosting bat, was made in an abandoned (or maybe temporarily disused) stone hut in the southernmost part of the Dasht-e Lut desert (Baluchestan), at a small oasis near Masjed Hazrat Abolfazl on 9 April 2000; a mummy of *O. hemprichii* was discovered and collected from an interstice between stones of the hut, not filled by any connecting material (mud, cement). These two roosts, narrow fissures more or less well exposed to outer conditions, belong to very typical roosts of solitary individuals of this species. Identical type of roosts of solitary *O. hemprichii* was recorded in several sites in Jordan and Syria (Atallah 1967, Benda et al. 2006).

Foraging individuals of *O. hemprichii* were recorded at several localities in Iran, all represented by pools of remaining water in dried wadis in the provinces of Hormozgan and Sistan va Baluchestan. Two males and two females were caught into a net stretched over a remnant pool in the dried bed of the Kaju river at Pir Sohrab near Chabahar (Baluchestan) on 12 April 2000 (Fig. 148; for details see under *Hypsugo arabicus*); above this pool also *Rhyneptesicus nasutus*, *Hypsugo arabicus*, *Pipistrellus kuhlii*, and *Nyctinomus aegyptiacus*, were netted. An adult female

Fig. 183. The oasis of Podonu (Hormozgan), a foraging habitat of *Rousettus aegyptiacus*, *Pipistrellus kuhlii*, and *Otonycteris hemprichii*. Photo by A. Reiter.

of *O. hemprichii* was captured into a net above a pool in dry wadi near Tujak (Hormozgan) on 15 April 2000; besides the small pool serving as a camel haunt, some eight metres in diameter, this broad wadi was completely dry in the whole explored length for several hundred metres. The surrounding landscape was a stony desert with very steep rocks with numerous cracks and fissures; a small colony of *Rhinopoma muscatellum* was discovered in one small fissure close to the wadi and calls of *Pipistrellus kuhlii* were detected at the pool. Three adult females of *O. hemprichii* were netted above a pool in a river bed next to a small village of Chahar Dahaneh near Dehbarez (Hormozgan) on 17 April 2000 (for details see under *Eptesicus pachyomus*); at the pool also *Eptesicus pachyomus* and *Rhyneptesicus nasutus* were caught. Another adult female was captured above a pool at a spring in the small date palm oasis of Podonu near Dehbarez, several kilometres from the latter site and adjacent to the same river valley (Fig. 183; for details see under *Rousettus aegyptiacus*). Echolocation calls of several other *Otonycteris* were detected in the oasis, as well as the calls of *Pipistrellus kuhlii*, and four *Rousettus aegyptiacus* were netted at the pool. The echolocation calls of foraging *Otonycteris* were detected in two sites; in the desert at the oasis of Espakeh (Baluchestan; where also several *Rousettus aegyptiacus* were netted) on 10 April 2000, and in the river valley near Chah Mosallam (Hormozgan; along with the calls of *Asellia tridens* and *Tadarida teniotis*) on 12 October 2011 (Fig. 213).

Reproduction of *O. hemprichii* has been recorded at two sites in Iran, both in the Hormozgan province. A pregnant female was netted at Tujak on 15 April, it contained two foeti of the crown--rump lengths 21.9 mm. Two days later, three lactating females were netted at Chahar Dahaneh. These findings from mid-April indicate the parturition period in the species for southern Iran. In the Syrian Desert of Syria and Jordan, lactating females with non-volant juveniles were recorded on 2 May and 16 June (Atallah 1967, Benda et al. 2006), while in the southern Holy Land the end of lactation is suggested to occur from mid-June to mid-July (Mendelssohn & Yom-Tov 1999, Fenton et al. 1999). The summary of the data from all three regions (Iran, Syrian Desert, and southern Holy Land) seems to suggest certain plasticity in timing of parturitions in *O. hemprichii*, when in southern regions of the distribution range the terms occur earlier than in the northern ones.

Osteological remains of *O. hemprichii* were recorded in pellets of two owl species coming from four sites of Iran (Table 40). At three sites this species was found in pellets of *Bubo bubo*; one mandible was documented from pellets collected at Emamzadeh and remains of two individuals in pellets collected at Deh Zireh, both sites lie in a semi-desert plain near Kashan (Esfahan); mandible fragments of one bat were found in *Bubo bubo* pellets collected at Taq-e Bostan in Kermanshah. These remains represented 1.64–2.70% per sample volume of all prey items (and 2.00–7.14% of mammal items) in the respective samples and 0.05% of all prey items (and 0.07% of mammal items) in the whole analysed eagle owl diet from Iran (Table 40). Skull remains of one individual of *O. hemprichii* were recorded from pellets of *Tyto alba* collected at Chahak (Bushehr; Obuch & Khaleghizadeh 2011) representing 0.69% per sample volume of all prey items (and 1.08% of mammal items, respectively) in the respective sample and 0.046% of all prey items (and 0.059% of mammal items) in the whole analysed barn owl diet from Iran (Table 40). In the Middle East, remains of *O. hemprichii* were obtained from owl pellets also in Palestine, Syria and Jordan (Shehab et al. 2004, 2007, Benda et al. 2006, 2010, Obuch & Benda 2009).

Material examined. 1 ind. (JOC unnumbered [Sf]), Chahak (Bushehr Prov.), 14 October 1998, leg. J. Obuch; – 3 ♀♀ (NMP 48440–48442 [S+A]), Chahar Dahaneh (Hormozgan Prov.), 17 April 2000, leg. P. Benda & A. Reiter; – 2 inds. (JOC unnumbered [Sf]), Deh Zireh (Esfahan Prov.), 27 April 1996, leg. J. Obuch; – 1 ind. (NMP 48376 [S+Sk]), Masjed Hazrat Abolfazl (Sistan va Baluchestan Prov.), 9 April 2000, leg. J. Obuch; – 1 ind. (JOC unnumbered [Sf]), Emamzadeh (Esfahan Prov.), 1 May 1997, leg. J. Obuch; – 1 ♀ (NMP 48111 [S+A]), Nasran [at Espidan] (Esfahan Prov.), 2 May 1997, leg. P. Benda & J. Obuch; – 2 ♂♂, 2 ♀♀ (NMP 48397–48399 [S+A], NMP 48396 [A]), Pir Sohrab (Sistan va Baluchestan Prov.), 12 April 2000, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 93903 [S+A]), Podonu (Hormozgan Prov.),

Table 33. Basic biometric data on the examined Iranian samples of *Otonycteris hemprichii* Peters, 1859 and *O. leucophaea* (Severcov, 1873). For abbreviations see p. 171

	Otonycteris hemprichii					*Otonycteris leucophaea*				
	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	10	**80.2**	74	86	3.584	4	**74.5**	73	78	2.380
LCd	10	**63.1**	59	68	2.846	4	**60.8**	58	65	3.403
LAt	11	**65.37**	63.5	67.1	1.270	4	**59.85**	56.8	61.2	2.062
LPl	10	**9.73**	8.9	10.3	0.427	4	**9.58**	9.1	9.9	0.340
LA	10	**41.47**	40.6	42.6	0.596	4	**37.90**	36.8	38.5	0.753
LT	10	**18.78**	17.5	20.9	1.010	4	**15.70**	14.6	16.4	0.775
LCr	10	**23.63**	22.88	24.55	0.563	6	**22.74**	22.18	23.34	0.402
LCb	10	**22.24**	21.47	22.97	0.499	6	**21.35**	20.92	21.75	0.343
LaZ	10	**14.62**	14.15	15.17	0.343	10	**15.04**	14.61	15.37	0.245
LaI	10	**4.08**	3.78	4.28	0.161	10	**4.48**	4.22	4.67	0.142
LaInf	11	**5.91**	5.52	6.48	0.320	11	**5.87**	5.63	6.07	0.142
LaN	10	**9.92**	9.32	10.42	0.341	9	**10.13**	9.93	10.28	0.120
LaM	10	**11.63**	11.21	12.02	0.259	6	**11.30**	10.93	11.65	0.236
ANc	10	**7.57**	7.28	7.84	0.206	6	**7.30**	7.11	7.45	0.121
LBT	10	**5.81**	5.50	6.28	0.231	4	**5.16**	4.82	5.40	0.252
CC	10	**6.10**	5.57	6.62	0.358	4	**6.26**	6.04	6.38	0.158
M^3M^3	10	**9.58**	8.43	10.07	0.471	5	**9.80**	9.64	10.14	0.196
CM^3	10	**8.42**	8.15	8.82	0.178	4	**8.57**	8.44	8.81	0.175
LMd	12	**16.47**	15.63	17.17	0.422	14	**16.21**	15.63	16.75	0.368
ACo	11	**7.39**	6.67	7.88	0.370	14	**6.70**	6.48	7.15	0.207
CM_3	10	**9.48**	8.92	9.77	0.246	4	**9.53**	9.41	9.63	0.109

10 October 2011, leg. M. Andreas, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 1 ind. (JOC unnumbered [Sf]), Taq-e Bostan, Kermanshah (Kermanshah Prov.), 6 October 1998, leg. J. Obuch; – 1 ♀ (NMP 48424 [S+A]), Tujak (Hormozgan Prov.), 15 April 2000, leg. P. Benda & A. Reiter.

MORPHOLOGY AND VARIATION. External and cranial dimensions of the Iranian specimens of *Otonycteris hemprichii* are shown in Table 33. For the material examined see above.

According to the results of a recent taxonomic revision of the genus *Otonycteris* Peters, 1859, combining both morphological and molecular genetic approaches (Benda & Gvoždík 2010), *O. hemprichii* is a polymorphic species comprising three genetic lineages, which correspond to two morphotypes. These three lineages are relatively deeply divergent, 4.3–7.2% of uncorrected *p* distances in the cytochrome *b* gene sequences were found between them. While the most widespread small-sized form lives from Morocco to Mesopotamia (it was co-identified with the nominotypical subspecies, *O. h. hemprichii*; type locality: Nil-Tal in Oberägypten oder Nordsudan (zw. nördlich von Assuan bis Chondek) [= Nile valley between N of Aswan, Egypt, and Khondek, Sudan]; Kock 1969: 184), two large-sized forms occur in smaller distribution ranges in Iran and eastern Arabia. Both eastern forms were found in Iran, however, they are undistinguishable based on their morphological traits (only a very limited number of specimens was examined by Benda & Gvoždík 2010, see also Table 33), but only with the help of a genetic analysis. However, the divergence between sequences of these forms was very deep, 6.7–7.2% (*p* distance, cyt *b*) and thus, these lineages may represent two separate species (for details see Benda & Gvoždík 2010). One of these large-sized forms was detected at two localities in the lowland coastal deserts of south-eastern Iran, Pir Sohrab (Baluchestan; 60 m a. s. l.) and Tujak (Hormozgan; 33 m), while the other one lives in rather elevated sites of central and southern Iran, it was found at Nasran

Table 34. Comparison of biometric data on three sample sets of *Otonyceris hemprichii* Peters, 1859 from Iran and Arabia. For abbreviations see p. 171

	C/S Iran & Oman (cf. *cinerea*)					SE Iran (cf. *jin*)					Saudi Arabia (*jin*)				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LAt	5	**65.60**	63.5	67.0	1.554	5	**65.68**	63.7	67.1	1.264	6	**64.92**	63.6	65.9	0.875
LPl	5	**9.76**	8.9	10.3	0.564	5	**9.70**	9.2	10.0	0.300	6	**8.25**	7.5	9.5	0.819
LCr	5	**23.80**	22.87	24.55	0.644	4	**23.49**	22.88	24.18	0.631	5	**23.66**	23.18	24.01	0.318
LCb	5	**22.29**	21.36	22.97	0.675	4	**22.31**	21.77	22.70	0.434	6	**22.10**	21.38	22.56	0.434
LaZ	5	**14.78**	14.31	15.17	0.316	4	**14.55**	14.38	14.97	0.284	6	**14.67**	14.32	15.07	0.242
LaI	5	**4.10**	4.04	4.28	0.102	4	**4.09**	3.86	4.25	0.170	6	**4.09**	3.88	4.38	0.166
LaInf	5	**6.02**	5.67	6.48	0.384	4	**5.81**	5.52	6.21	0.290	7	**6.12**	5.75	6.41	0.252
LaN	5	**10.08**	9.32	10.42	0.443	4	**9.90**	9.60	10.12	0.218	6	**10.15**	9.98	10.33	0.128
AN	5	**7.59**	7.44	7.86	0.165	4	**7.57**	7.44	7.79	0.159	6	**7.37**	7.18	7.62	0.188
ACr	5	**9.99**	9.74	10.35	0.266	4	**10.02**	9.83	10.25	0.175	4	**9.94**	9.66	10.23	0.302
LBT	5	**5.96**	5.61	6.35	0.347	4	**5.81**	5.67	5.98	0.161	6	**5.87**	5.60	6.08	0.179
CC	5	**6.23**	5.83	6.62	0.342	4	**6.09**	5.90	6.38	0.210	7	**6.26**	5.76	6.51	0.250
P^4P^4	5	**7.06**	6.82	7.44	0.259	4	**7.20**	6.86	7.57	0.305	6	**7.08**	6.67	7.28	0.214
M^3M^3	5	**9.59**	9.09	10.07	0.363	4	**9.75**	9.39	10.05	0.281	6	**9.82**	9.57	10.08	0.164
IM^3	5	**9.56**	9.29	9.78	0.192	4	**9.72**	9.56	9.96	0.172	7	**9.40**	8.95	9.75	0.259
CM^3	5	**8.41**	8.22	8.55	0.145	4	**8.48**	8.31	8.82	0.230	7	**8.44**	8.11	8.75	0.226
P^4M^3	5	**6.65**	6.59	6.70	0.050	4	**6.72**	6.48	6.93	0.185	6	**6.74**	6.54	6.98	0.171
M^1M^3	5	**5.34**	5.22	5.47	0.102	4	**5.26**	5.04	5.56	0.251	7	**5.31**	5.13	5.44	0.110
LMd	5	**16.64**	16.21	17.08	0.382	4	**16.52**	16.10	16.85	0.331	7	**16.38**	15.71	16.64	0.321
ACo	5	**7.66**	7.44	7.83	0.157	4	**7.33**	6.90	7.53	0.288	7	**7.33**	7.18	7.48	0.123
IM_3	5	**10.17**	10.03	10.31	0.116	4	**10.29**	10.23	10.41	0.082	4	**10.15**	9.94	10.32	0.161
CM_3	5	**9.50**	9.27	9.65	0.154	4	**9.59**	9.48	9.69	0.087	6	**9.51**	9.36	9.65	0.130
P_4M_3	5	**7.61**	7.41	7.73	0.124	4	**7.65**	7.53	7.76	0.114	6	**7.58**	7.38	7.68	0.134
M_1M_3	5	**6.15**	6.06	6.23	0.070	4	**6.27**	6.23	6.33	0.047	6	**6.28**	6.21	6.34	0.054
CP_4	5	**3.46**	3.30	3.59	0.117	3	**3.46**	3.38	3.52	0.071	7	**3.36**	3.27	3.47	0.076
LaN/LCb	5	**0.452**	0.436	0.473	0.015	4	**0.444**	0.423	0.465	0.017	6	**0.459**	0.446	0.471	0.010
LBT/LCb	5	**0.267**	0.257	0.279	0.009	4	**0.261**	0.250	0.272	0.010	5	**0.265**	0.256	0.276	0.009
CM^3/LCb	5	**0.377**	0.366	0.385	0.007	4	**0.380**	0.366	0.390	0.011	6	**0.380**	0.375	0.388	0.005
LaM/LCr	5	**0.495**	0.490	0.500	0.005	4	**0.492**	0.469	0.510	0.020	5	**0.482**	0.475	0.495	0.008
ACo/LMd	5	**0.460**	0.458	0.464	0.003	4	**0.443**	0.429	0.458	0.012	7	**0.448**	0.434	0.461	0.011
CP_4/LMd	5	**0.208**	0.200	0.215	0.007	3	**0.207**	0.206	0.211	0.003	7	**0.205**	0.198	0.214	0.006
LA/LAt	5	**0.633**	0.616	0.650	0.015	5	**0.635**	0.613	0.650	0.014	–	–	–	–	–
IM3/LCb	5	**0.429**	0.417	0.435	0.008	4	**0.436**	0.425	0.440	0.007	6	**0.424**	0.406	0.432	0.010
M^3M^3/IM^3	5	**1.003**	0.938	1.051	0.042	4	**1.004**	0.982	1.019	0.015	6	**1.047**	1.001	1.126	0.045

(Esfahan; 1385 m a. s. l.) and at Chahar Dahaneh (Hormozgan; 370 m) as well as at one site in the Hajjar Mts. (780 m) of north-eastern Oman (Benda & Gvoždík 2010). The lowland form was tentatively assigned to the subspecies *O. h. jin* Cheesman et Hinton, 1924 (type locality: Hufuf, Hasa, Arabia [Eastern Province, Saudi Arabia; 150 m a. s l.]; Cheesman & Hinton 1924: 550) and the latter upland form to *O. h. cinerea* Satunin, 1910 (type locality: eastern Iran, for details see Distribution).

Table 34 presents biometric data on the *Otonycteris* specimens allocated to the particular genetic lineages / subspecies (see above) as well as on the specimens from Saudi Arabia (comprising also the type specimen of *Otonycteris jin*). No remarkable differences in the values of absolute and relative dimensions were found, so the identification of the subspecies based on body and/or skull size and shape seems to be impossible and the characters usable to distinguish between the two forms still need to be found.

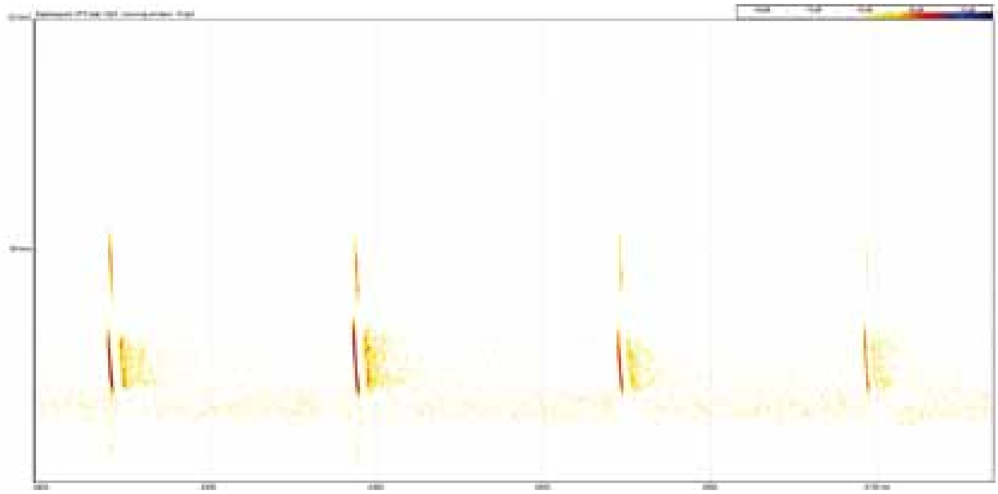


Fig. 184. Spectrogram of echolocation calls of *Otonycteris hemprichii* Peters, 1859; an individual foraging at a rocky wall in the river valley near Chah Mosallam (Hormozgan).

Echolocation. *Otonycteris hemprichii* produces calls with two dominant harmonics (Benda et al. 2008, 2010, Holderied et al. 2011) with a slight geographical variation in SF, EF a FMAX values. Shalmon et al. (1993) and Mendelssohn & Yom-Tov (1999) reported a range of echolocation call frequencies between 20–40 kHz and 20–37 kHz, respectively, for *O. hemprichii* from Israel.

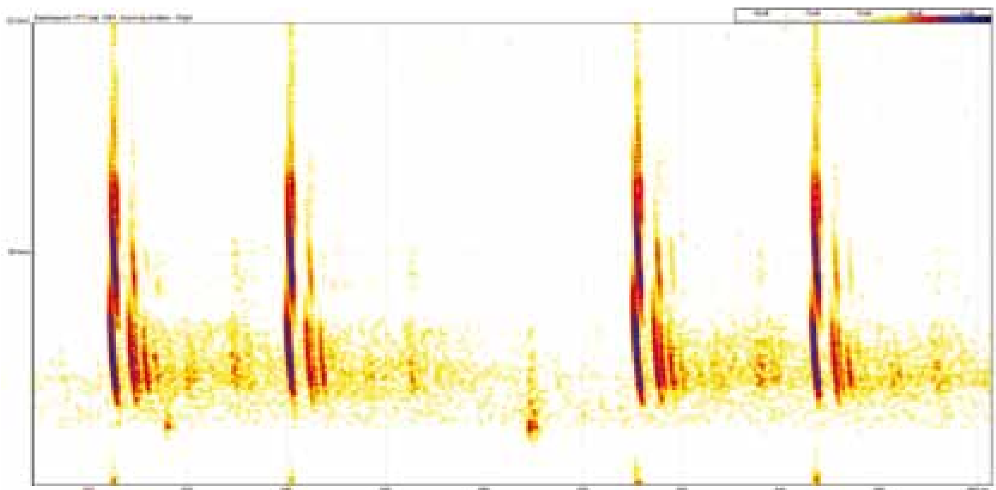


Fig. 185. Spectrogram of echolocation calls of *Otonycteris hemprichii* Peters, 1859; an individual flying in a room (the bat caught at Podonu [Hormozgan] and released in a hotel room).

We analysed four call sequences of *O. hemprichii* from Iran, recorded under two different conditions. Basic values of echolocation parameters are given in Table 3. Animals recorded under natural conditions in the field (Fig. 184) emitted calls with a slightly wider frequency range (ca. 17–30 kHz) than those recorded in a room (ca. 24–33 kHz; Fig. 185). We obtained the frequency of maximum energy of the second harmonic in the ranges between ca. 44–53 kHz and 34–50 kHz, respectively. Our findings fully conform to the published data.

Feeding ecology. *Otonycteris hemprichii* is a rather large bat applying the ground gleaning foraging strategy and detecting its prey by walking noises (Fenton et al. 1999, Holderied et al. 2011); it feeds mostly on larger arthropods. The diet of *O. hemprichii* was studied in several countries of the Middle East (Whitaker et al. 1994, Fenton et al. 1999, Benda et al. 2006, 2008, 2010); the most important prey categories reported for this species were Scorpionida, Solpugida, Coleoptera, Blattodea, Orthoptera, Heteroptera, and Hymenoptera.

From Iran, samples of *O. hemprichii* diet from four sites were analysed (Fig. 186). The diet composition was dominated by larger individuals of arthropods belonging to several taxa; large beetles (Carabidae, Scarabaeidae, Tenebrionidae, Elateridae) dominated the diet from Tujak (Hormozgan), Melolonthinae beetles and Solpugida were major food items at Pir Sohrab (Baluchestan), Orthoptera (Caelifera) at Chahar Dahaneh (Hormozgan), and Scorpionida at Nasran (Esfahan) (Fig. 186).

The diet composition of *O. hemprichii* from different parts of the distribution range is quite variable; however, contents of digestive tracts from one site could be also variable. Two digestive tracts collected at Pir Sohrab contained only the Melolonthinae beetles, while two other tracts from this site contained 100% volume of Solpugida. A high proportion of non-volant prey clearly

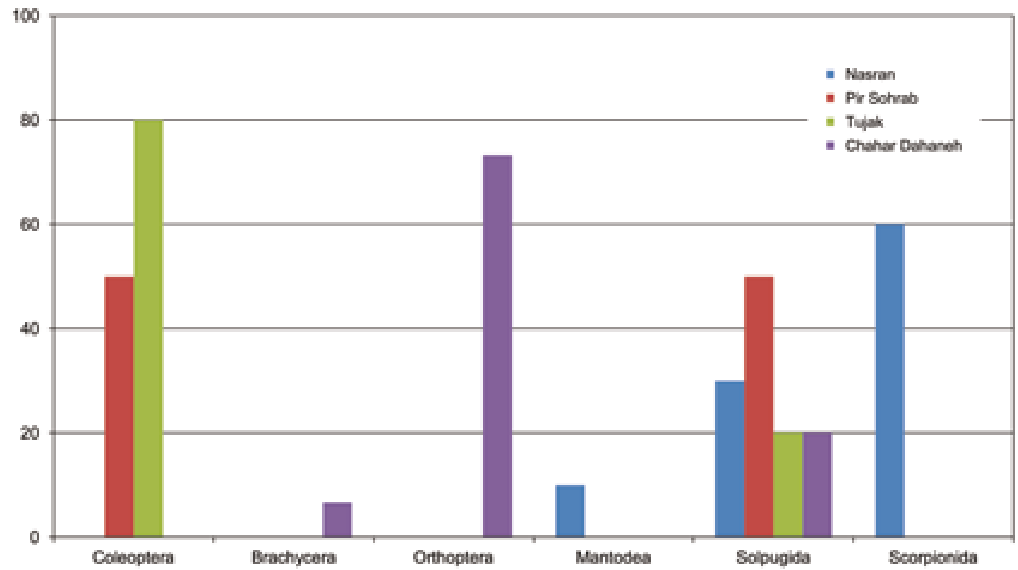


Fig. 186. Percentage volume of particular food items in the diet of *Otonycteris hemprichii* Peters, 1859 in Iran. Material analysed: Nasran (one digestive tract), Pir Sohrab (four digestive tracts), Tujak (one digestive tract), Chahar Dahaneh (three digestive tracts).

indicates ground gleaning in *O. hemprichii*. On the other hand, the hypothesis of feeding on small vertebrates, suggested by Norberg & Fenton (1988) has not been suported (cf. Andreas 2010).

Otonycteris leucophaea (Severcov, 1873)

Records. **Original data**: K h o r a s â n - e R a z a w i: valley 10 km E of Bazangan [1], 14 km N of Mazdavand, 10 May 1997: remnants of 6 inds. (6 left and 3 right mandibles, 6 almost complete skulls) found in *Bubo bubo* pellets (cf. Benda & Gvoždík 2010 [erroneously under *O. hemprichii*]), 8 October 2002: remnants of 3 inds. (3 left and 1 right mandibles, 1 almost complete rostrum) found in *Bubo bubo* pellets; – Shurlaq [2], 53 km WSW of Sarakhs, above a stream, 18 May 2006: net. 4 ma (NMP 90793–90796 [S+A]; Figs. 187, 188; cf. Benda & Gvoždík 2010). – **Published data**: K h o r a s â n - e R a z a w i: Chelmir [3], over a stream, July 1968: net. 2 m, 3 f, IPHR (Farhang-Azad 1969a [as *O. hemprichi*]), 15–17 July 1969: 9 ma, 4 fa, 14 inds. ad, IPHR (Farhang-Azad 1970a ex DeBlase 1980 [as *O. hemprichi*]), 27 km W of Derregaz [= Dargaz] town (Filippova et al. 1976 [as *O. hemprichi*]).

Distribution. *Otonycteris leucophaea* is a rare bat species in Iran, only three records are available from the country (Fig. 181). This species, whose separate taxonomic position has been suggested quite recently (Benda & Gvoždík 2010), is a Turanic biogeographical element in the Iranian fauna, it is distributed in West Turkestan south of 42° N (i.e. southwards from southern Kazakhstan; Strelkov & Šajmardanov 1983) and in Afghanistan, northern Pakistan and Kashmir (Bates & Harrison 1997). The known occurrence in Iran is restricted to a relatively small area in north-eastern Khorasan, so, in Iran there is a small promontory from the continuous range in the Turkestani lowland and foothill deserts. The Khorasani localities of *O. leucophaea* comprise


Figs. 187, 188. *Otonycteris leucophaea* (Severcov, 1873) from Shurlaq (Khorasan). Photo by A. Reiter.

Fig. 189. Valley of a stream at Shurlaq, on the southern margin of the Karakum desert and the northern foot of the Kopetdagh Mts. (Khorasan); a foraging habitat of *Eptesicus ognevi*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Otonycteris leucophaea*, and *Tadarida teniotis*. Photo by P. Benda.

one lowland site on the Karakum desert margin (Shurlaq) and one mountain valley open northwards to this desert (Chelmir; Farhang-Azad 1969a, DeBlase 1980). (The third record from Bazangan is based on findings of osteological remains from owl pellets and does not represent a real locality of occurrence.) With respect to the known occurrence in Turkmenistan (Strelkov et al. 1978), *O. leucophaea* could be registered in bearable arid areas of Iran along most of the Turkmenistani/Iranian border if a sufficient research is carried on.

Field notes. Strelkov et al. (1978: 65) summarised the ecological characterisation of *Otonycteris* in the Turkmenistani part of its distribution range as follows: "it lives in mountain and foothill parts of the country, but it was found also in lowland oases. Its occurrence is connected with rocky outcrops and steep loess slopes, where it finds its roosts in crevices. Secondarily it is adapted to roost in fissures of earth and/or stone buildings. It occurs both in mountain valleys well supplied with water and in the arid region of the Bahyz Mts. as well as at desert foothills of the Kûrendag Mts." [translated from Russian]. Most probably, these general ecological characteristics are valid for *O. leucophaea* also in north-eastern Iran. This species is known there only from three sites; two localities represent the records at foraging grounds, osteological findings from owl pellets are available from one site.

Farhang-Azad (1969a) and Farhang-Azad (1970a ex DeBlase 1980) reported on the netting sessions carried out over a small stream at Chelmir within the main range of the Kopetdagh Mts. (Khorasan) in July 1968 and July 1969, when individuals of *O. leucophaea* were collected (under the name *O. hemprichi*; but see below). However, no information on the netting site nor other details concerning the record are available. During these sessions covering probably more nights, five bats were netted on the first occasion and even 27 individuals of *O. leucophaea* on the second occasion. During both netting sessions, an extremely rich community of bats was documented at the site, composed of nine species in total (additionally also *Myotis blythii*, *M. emarginatus*, *Eptesicus serotinus*, *E. ognevi*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Nyctalus leisleri*, *Miniopterus pallidus*, and *Tadarida teniotis*).

Four adult males of *O. leucophaea* were netted above a stream at Shurlaq near Sarakhs (Khorasan) on 18 May 2006. This site lies at the northern foothill of the Kopetdagh Mts. and on the southern border of the Karakum desert, it is very arid place covered by dry steppe (Fig. 189). At this site also *Eptesicus ognevi*, *Pipistrellus pipistrellus*, *P. kuhlii*, and *Tadarida teniotis*, were netted along with *O. leucophaea*.

No data on the reproduction of *O. leucophaea* are available from Iran. Ognev (1928) collected a pregnant female in Germab on the Turkmenistani side of the Kopetdagh Mts. on 12 June 1925, it contained two foeti. Strelkov et al. (1978) reported collection of a volant juvenile in Turkmenistan on 14 July. This evidence suggests the timing of reproduction also in the Iranian populations of this species.

At one site of Iran, remains of *O. leucophaea* were recorded from owl pellets (Table 40). At Bazangan near Mazdavand (Khorasan) bone material from pellets of *Bubo bubo* was collected at two occasions; fragments from six bats were found in 1997, and from three individuals in 2002. These findings represent 5.08% and 2.05%, respectively, of all prey items (and 7.59% and 2.86% of mammal items) in the respective samples, and 0.11% of all prey items (0.15% of mammal items) in the whole analysed eagle owl diet from Iran (Table 40). Previously, evidence of *O. leucophaea* in owl diet was published from Turkmenistan (Strelkov et al. 1978).

Material examined. 6 inds. (JOC unnumbered [Sf]), Bazangan (Khorasan-e Razawi Prov.), 10 May 1997, leg. J. Obuch; – 3 inds. (JOC unnumbered [Sf]), Bazangan (Khorasan-e Razawi Prov.), 8 October 2002, leg. J. Obuch; – 4 ♂♂ (NMP 90793–90796 [S+A]), Shurlaq (Khorasan-e Razawi Prov.), 18 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Otonycteris leucophaea* are shown in Table 33. For the material examined see above.

Although two Iranian records of *O. leucophaea* were originally reported as of *O. hemprichii* s.l. (Chelmir; Farhang-Azad 1969a, DeBlase 1980) and *O. hemprichii* s.str. (Bazangan; Benda & Gvoždík 2010), the bats from these sites undoubtedly belong to *O. leucophaea*, according to the detailed examination of the available museum material (see also Table 33).

The revised fragmentary specimens extracted from owl pellets collected at Bazangan (see above) showed the ACo/LMd ratio in the range of 0.416–0.429 (mean 0.420). These values conform to those of the samples of *O. leucophaea* from Kirghizstan (range 0.396–0.442, mean 0.413) as well as from Iran (Shurlaq), Afghanistan and Kashmir (range 0.400–0.446, mean 0.413), sensu Benda & Gvoždík (2010: 88–89, Table 1). The coronoid process of mandible is absolutely and relatively smaller in *O. leucophaea* than in *O. hemprichii* s.str. (see Benda & Gvoždík 2010: 90, Fig. 2B).

The dimensions given by DeBlase (1980) for two IPHR specimens collected by Farhang-Azad at Chelmir also indicate their actual affiliation to *O. leucophaea*; the CM^3/LCb ratio of these samples is 0.401 and 0.389, which conforms to the data on *O. leucophaea* from Kirghizstan (range 0.374–0.411, mean 0.396) and from Iran (Shurlaq), Afghanistan and Kashmir (range 0.383–0.412, mean 0.399). According to the skull comparison by Benda & Gvoždík (2010), the relative length of rostrum (and naturally also the upper tooth-row) is larger in *O. leucophaea* than in *O. hemprichii* s.str.

According to the data by Benda & Gvoždík (2010), no remarkable geographic variation in metric traits was detected within the rank of *O. leucophaea*, the Iranian bats conform to those from West Turkestan and adjacent areas.

ECHOLOCATION. Echolocation calls of *Otonycteris leucophaea* were briefly described by Horáček (1991) from the populations of southern Kirghizstan. The species produces frequency-modulated calls with two harmonics, with the starting frequency of the lower harmonic at ca. 40 kHz and ending frequency at 18 kHz; the calls show maximum energy at around 30–32 kHz. No other data on echolocation of *O. leucophaea* are available.

FEEDING ECOLOGY. *Otonycteris leucophaea* is a large ground gleaning bat feeding mostly on Solpugida, Scorpionida, Araneida, Coleoptera, Blattodea, and Orthoptera, as shown by studies from Kirghizstan (Horáček 1991, Arlettaz et al. 1995).

From Iran, we analysed one set of 33 faeces of *O. leucophaea* collected at Shurlaq (Khorasan) (Fig. 190). The diet composition was dominated by large beetles (Scarabaeidae, Carabidae), other important prey items included medium-sized and larger Orthoptera (Ensifera), Solpugida, and Araneae; Hymenoptera were represented by ants (Formicoidea).

Larger prey and a high proportion of prey gleaned from the ground correspond well with the previous studies from West Turkestan (see above). Not surprisingly, the feeding ecology of *O. leucophaea* largely resembles that of *O. hemprichii.* The hypothesis of feeding on small vertebrates, suggested previously by some authors (Norberg & Fenton 1988, Horáček 1991), has not been suported.

RECORDS OF ECTOPARASITES. **Published data**: I x o d i d a e: *Haemaphysalis sulcata*: 10 larvae, 3 animals from unknown number of inds., 27 km W of Derregaz [= Dargaz] town, 12–17 July 1969 (Filippova et al. 1976). – *Haemaphysalis erinacei* [= *H. numidiana*]: 1 nymph from 1 ind., 27 km W of Derregaz [= Dargaz] town, 12–17 July 1969 (Filippova et al. 1976).

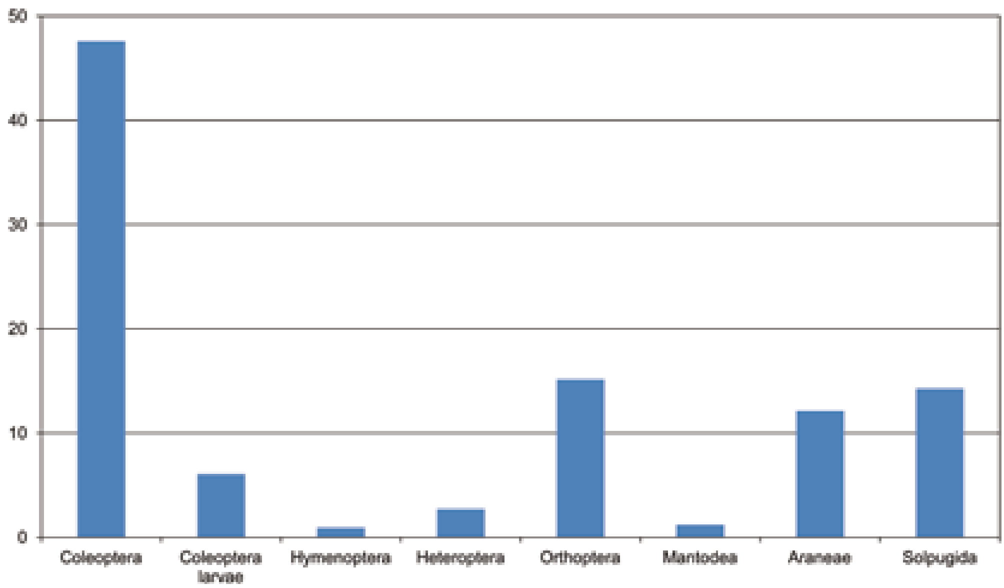


Fig. 190. Percentage volume of particular food items in the diet of *Otonycteris leucophaea* (Severcov, 1873) in Shurlaq, Khorasan, Iran. Thirty-three pellets from four bats were analysed.

Comments on ectoparasites. The occurrence of the ticks *Haemaphysalis sulcata* Canestrini et Fanzago, 1878 and *H. erinacei* Pavesi, 1884 on bats in Iran is considered accidental, both species prefer other groups as hosts, namely small terrestrial mammals, see under *Eptesicus ognevi* and *Nyctalus noctula*.

Barbastella barbastellus (Schreber, 1774)

Records. **Original data**: G o l e s t a n: oak forest 5 km E of Tunel-e Golestan [1], 44 km E of Kalaleh, 26 May 2006: net. 3 fG (NMP 90842–90844 [S+A]; Fig. 192; cf. Benda et al. 2008). – **Published data** [all originally under *B. leucomelas*]: A r d a b i l: Anbarân [2], 10 km NW Namin, under the loose bark of a pear tree, 28 October 2006: coll. 1 m (Sheikh-Jabbâri 2008); – Kazur [3], 50 km S Ardabil, water channel under the road, 5 November 2006: coll. 1 m (Sheikh-Jabbâri 2008). – G o l e s t a n: Mohammed Reza Shah National Park [4], June 1969: net. 1 fa, MMTT (DeBlase 1980).

Distribution. *Barbastella barbastellus* is a rare bat species in Iran, only four record sites are known from the northernmost parts of the country (Fig. 191). The species was first reported from Iran preliminarily by Benda et al. (2008), who also included a specimen mentioned by DeBlase (1980) as *B. leucomelas darjelingensis*, coming from the same area of easternmost Golestan,

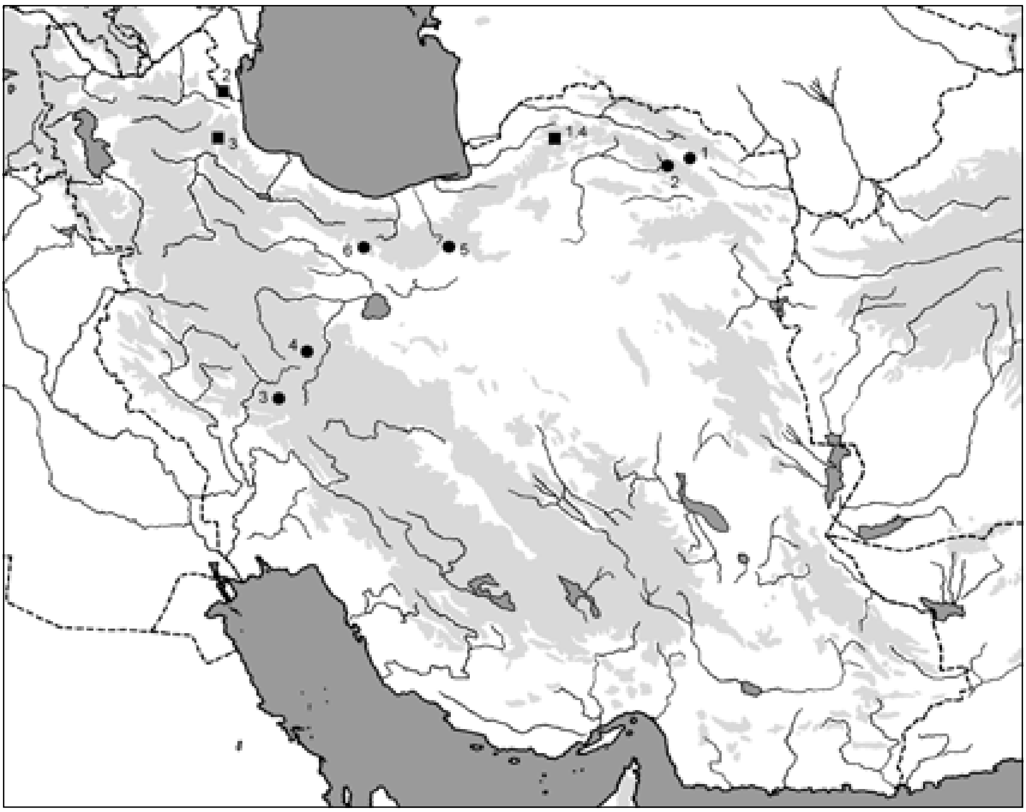


Fig. 191. Records of *Barbastella barbastellus* (Schreber, 1774) (squares) and *B. darjelingensis* (Hodgson, 1855) (circles) in Iran.

Fig. 192. Portrait of *Barbastella barbastellus* (Schreber, 1774) from Tunel-e Golestan (Golestan). Photo by A. Reiter.

Mohammad Reza Shah National Park (= Golestan NP), see below. The known Iranian localities of *B. barbastellus* lie in two widely separated parts of the zone of the Hyrcanian mixed forest, its westernmost edge in the Ardabil province and its easternmost edge in the Golestan province (Fig. 191). However, this species could certainly be awaited to occur in the whole zone along the Caspian coast including its Gilani and Mazandarani parts.

The Hyrcanian region of Iran is the easternmost area of *B. barbastellus* occurrence (cf. Horáček et al. 2000) and the densely forested mountain transition between the Golestan and Khorasan provinces represents the easternmost known spot of the whole distribution range of the species. The Iranian range of *B. barbastellus* continues in the northwest to Transcaucasia, where this bat is not a rare species either (Buhnikašvili et al. 2004, Rahmatulina 2005); close to the Iranian limited range, this species also occurs in north-eastern Turkey, in areas adjacent to the Caucasus biogeographical region (von Helversen 1989, Steiner & Gaisler 1994, Karataş et al. 2004). However, in most of its range *B. barbastellus* is a European forest species, occurring throughout Central and Mediterranean Europe, in the western Maghreb and in the Canary Islands (Horáček et al. 2000, Benda et al. 2008).

Field notes. In Iran, *Barbastella barbastellus* was found both in its roosts and at the foraging grounds. No remains of *B. barbastellus* were found in the osteological material from owl pellets (Table 40).

Sheikh-Jabbâri (2008) reported two records of solitary individuals of *B. barbastellus* from their roosts in the Ardabil province in autumn 2006. One male was found under the loose bark of a pear

Table 35. Basic biometric data on the examined Iranian samples of *Barbastella barbastellus* (Schreber, 1774) and *Plecotus macrobullaris* Kuzâkin, 1965, and on *P. auritus* (Linnaeus, 1758) from Iran, mentioned by Steiner & Gailser (1994). For abbreviations see p. 171

	Barbastella barbastellus					*Plecotus macrobullaris*					*Plecotus auritus*
	n	**M**	min	max	SD	n	**M**	min	max	SD	Steiner & Gaisler (1994)
LC	3	**54.3**	51	56	2.887	20	**53.8**	51	58	2.042	52
LCd	3	**52.3**	51	55	2.309	20	**55.4**	48	62	3.912	45
LAt	3	**41.30**	40.9	41.6	0.361	21	**42.81**	39.6	45.7	1.581	39.0
LPl	3	**5.10**	4.8	5.4	0.300	20	**7.46**	7.1	8.0	0.289	–
LA	3	**18.33**	18.2	18.5	0.153	20	**39.43**	35.0	43.9	2.323	36.3
LT	3	**9.10**	8.7	9.4	0.361	20	**18.05**	16.5	19.6	0.780	–
LCr	3	**14.27**	13.99	14.51	0.263	21	**17.26**	16.59	18.02	0.348	16.3
LCb	3	**13.57**	13.31	13.73	0.229	21	**15.98**	15.41	16.85	0.322	15.2
LaZ	3	**7.30**	7.04	7.44	0.228	19	**8.99**	8.65	9.47	0.244	8.9
LaI	3	**3.49**	3.33	3.59	0.140	21	**3.39**	3.12	3.67	0.146	3.5
LaInf	3	**3.89**	3.83	3.92	0.049	21	**4.23**	3.88	4.57	0.184	–
LaN	3	**7.19**	6.85	7.51	0.330	21	**8.50**	7.71	8.80	0.260	8.2
LaM	3	**8.24**	7.93	8.48	0.282	21	**9.39**	9.09	9.79	0.210	9.1
ANc	3	**5.11**	5.06	5.14	0.046	21	**5.44**	5.28	5.76	0.126	–
LBT	3	**3.14**	3.03	3.23	0.103	21	**4.66**	4.43	4.89	0.140	4.2
CC	3	**3.66**	3.61	3.73	0.064	21	**3.83**	3.66	4.07	0.107	–
M^3M^3	3	**5.37**	5.27	5.54	0.150	21	**6.24**	5.96	6.61	0.150	–
CM^3	3	**4.68**	4.56	4.84	0.144	21	**5.66**	5.41	5.92	0.141	5.5
LMd	3	**9.15**	9.07	9.31	0.139	21	**10.95**	10.48	11.46	0.253	10.9
ACo	3	**2.50**	2.44	2.58	0.072	21	**3.04**	2.72	3.28	0.166	–
CM_3	3	**5.06**	4.89	5.28	0.199	20	**6.19**	5.93	6.75	0.198	5.8

tree at Anbaran near Namin on 28 October and another male in a water channel under the road at Kazur near Ardabil on 5 November. These evidences could represent pre-hibernation or even hibernation roosts, the bats were found alone, not shared the roost with other bat species.

Two netting records of foraging *B. barbastellus* were made in the Golestan province. DeBlase (1980: 334) described the first one as follows: "In late June 1969 Lay and Iran Department of Game and Fish personnel mistnetted bats in Mohammad Reza Shah National Park [= Golestan NP]. They collected one *Myotis bechsteini*, two *E. serotinus*, two *N. leisleri*, and one *Barbastella leucomelas* [= *B. barbastellus*]." At another place (pp. 233–234), he added: "The Mohammed Reza Shah National Park specimen is an adult female collected in June 1969. The specimen tag bears the phrase "old fields"."

Another record was made very close to the former site, in a dense beech forest in a narrow valley of the easternmost extent of the forested area of the Alborz Mts.; three adult females were netted above a stream hidden in an oak forest near Tunel-e Golestan on 26 May 2006. At this site, also individuals of *Myotis bechsteinii* and *Pipistrellus pipistrellus* were netted and echolocation calls of *Nyctalus leisleri* and *Tadarida teniotis* were detected.

The only direct evidence of reproduction in *B. barbastellus* in Iran also comes from the latter site, all three females were pregnant, each contained a single foetus of the crown-rump lengths 7.6 mm, 15.6 mm, and 16.0 mm. This record suggests the term of parturitions in the Iranian populations to occur at the break of May/June. Rahmatulina (2005) reported findings of pregnant females from Azerbaijan in the period 20 April – 8 May, when the females contained very small embrya of the total length of up to 4.2 mm; so, these findings roughly conform to the evidence available from northern Iran.

Material examined. 3 ♀♀ (NMP 90842–90844 [S+A]), Tunel-e Golestan (Golestan Prov.), 26 May 2006, leg. P. Benda & A. Reiter.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Barbastella barbastellus* are shown in Table 35. For the material examined see above.

The Iranian records of *B. barbastellus* published by DeBlase (1980) and Sheikh-Jabbâri (2008) were originally assigned to *B. leucomelas* (Cretzschmar, 1830) [= *B. darjelingensis*, see below]. However, since these authors reported also values of several body and skull dimensions of the respective specimens, there is no doubt about the actual species identification of these bats. *B. barbastellus* differs from *B. darjelingensis* in body and skull size, being markedly smaller (e.g. Kuzâkin 1965, Koopman 1994, Rydell & Bogdanowicz 1997, Benda et al. 2008, etc.). DeBlase (1980) reported the following measurements of the specimen from the Mohammad Reza Shah NP: forearm length (LAt) 41.6 mm, greatest length of skull 14.2 mm, condylobasal length 13.3 mm, zygomatic breadth 7.2 mm, length of upper tooth-row (CM^3) 4.5 mm; Sheikh-Jabbâri (2008) mentioned the following data on the bats from the Ardabil province: the male from Anbaran – LAt 37.9 mm, CM^3 4.66 mm; the male from Kazur – LAt 38.0 mm, CM^3 4.72 mm. These values correspond well with the dimensions of *B. barbastellus* from Golestan, Iran (Table 35), and also with the dimensions of *B. barbastellus* from Europe presented by Benda et al. (2008): LAt 36.9–41.6 mm, CM^3 4.42–4.76 mm (n=54); while the dimensions of *B. darjelingensis* from West Turkestan presented by Benda et al. (2008, 2011c) are as follows: LAt 40.7–44.5 mm, CM^3 4.68–5.02 mm (n=38). The combination of at least two available dimensions (LAt, CM^3) of the Iranian bats published by DeBlase (1980) and Sheikh-Jabbâri (2008) clearly indicates their identification as *B. barbastellus*.

B. barbastellus was for a long time considered a monotypic species, no subspecies were recognised (Ellerman & Morrison-Scott 1951, Corbet 1978, Koopman 1994, Rydell & Bogdanowicz 1997, Horáček et al. 2000, Schober 2004, etc.). However, the analyses by Trujillo et al. (2002) and Juste et al. (2003) resulted in description of a new subspecies from the Canary islands, *B. b. guanchae* Trujillo, Ibáñez et Juste, 2002. Therefore, two subspecies are contemporarily recognised in *B. barbastellus* (see Simmons 2005).

A part of the molecular genetic analysis carried out using partial sequences of the cytochrome *b* gene by Juste et al. (2003) was repeated by Benda et al. (2008) with addition of several new samples from various parts of the genus range, including those of the NMP specimens of *B. barbastellus* from Iran. These bats possessed one identical haplotype, which was diverged from the Euro-Maghrebian samples and from the Canarian samples of this species by 2.9–3.4% and 3.9% of the uncorrected *p* distances, respectively (see also Benda et al. 2008: 55, Fig. 53). These relatively marked genetic distances could be explained either by geographical distances of the Canarian and European populations from the Golestani localities of Iran (cf. Benda et al. 2008), or by separate evolutionary position of the Iranian or Irano-Caucasian populations from the rest of the species content. The latter hypothesis suggests possible existence of a separate taxon of *B. barbastellus* in south-western Asia, including northern Iran. However, for any reliable taxonomic conclusion it is necessary to examine – using both morphological and molecular genetic approaches – also the Caucasian and Transcaucasian populations of *B. barbastellus* as well as a larger number of Iranian samples of this species.

Echolocation. *Barbastella barbastellus* emits two call types, usually alternately. The A type call has a shorter duration and frequency-modulated, with values dropping from 45 kHz to 30 kHz. The B type has a longer duration and convex frequency-time course, with values dropping from ca. 36 kHz to 28 kHz. The latter type has a higher peak frequency but lower intensity than the former type (Denzinger et al. 2001, Dietz et al. 2007). Frequency of maximum energy of *B. bar-*

bastellus in Europe is 29–45 kHz in the A type call and 33–41 kHz in the B type call (Parsons & Jones 2000, Russo & Jones 2002). Echolocation of *B. barbastellus* has not yet been studied in the Asian part of the species range.

Feeding ecology. *Barbastella barbastellus* is a medium-sized aerial hawking bat using specific 'stealth' echolocation (Dietz et al. 2007, Goerlitz et al. 2010), it is an extremely specialised moth-eating species feeding almost exclusively on Lepidoptera with only small proportions of Neuroptera, Diptera, and Araneae (Beck, 1995, Rydell et al. 1996, Sierro & Arlettaz 1997, Zeale et al. 2011, Andreas et al. 2012a). The majority of Lepidoptera in the diet of *B. barbastellus* was reported also from Turkey (Whitaker & Karataş 2009). The diet of *B. barbastellus* in Iran has not yet been studied.

Barbastella darjelingensis (Hodgson, 1855)

Records. **Original data**: K h o r a s â n - e R a z a w i: Jamâb [1], Chenârân, Parde Rostam cave, September 2009: coll. 1 ind. (Fig. 193); – Klidar [2], 65 km NW Neishâbur, Palangi cave, 24 November 2010: net. 1 fa. – L o r e s t a n: valley 5 km W of Arjank [3], 52 km SE of Dorud, at a stream, 2 October 2011: det. & rec. calls of 1 foraging ind. (1 recording). – **Published data** [all originally under *B. leucomelas*]: M a r k a z i: Âzâd-Khân cave near Mahallat (110 kilometers south west Teheran) [= Senje Bâshi, 12 km W of Mahallât] [4], November 1964: 1 ind., resp. 1 m (Etemad 1964, 1969, 1984), April 1966: 1 m (Etemad 1969, 1984). – S e m n â n: 2 km. NE Sang-e-Sar [5], abandoned mine shaft, 16 October 1962: coll. 1 f (Lay 1967, DeBlase 1980). – T e h r â n: Tehran [6], inhabited house, June 1966: 1 m (Etemad 1967, 1969, DeBlase 1980).

Distribution. *Barbastella darjelingensis* is a rather rare bat species in Iran, six record sites are available from the country (Fig. 191). The pattern of distribution resembles somewhat that of *Vespertilio murinus* (Fig. 111), the records of *B. darjelingensis* come from a crescent-shaped belt

Fig. 193. *Barbastella darjelingensis* (Hodgson, 1855) roosting in the Parde Rostam cave (Khorasan). Photo by B. Musavi.

Fig. 194. A valley near Arjank in the Ostoran Mts. (Lorestan), a foraging habitat of *Pipistrellus pipistrellus* and *Barbastella darjelingensis*. Photo by A. Reiter.

of mountains surrounding the northern and north-western margin of the basin of the Dasht-e Kavir desert, stretching from eastern Khorasan to the central Zagros Mts. All localities lie in the zone of arid and semi-arid steppes. DeBlase (1980) reported only three records of this species (under the name *B. leucomelas*) from central areas of the country (records 4–6), the new evidence broadened the species range in Iran significantly, mainly to the east (Fig. 191).

The oldest direct indication of *B. darjelingensis* from the territory of Iran was made by Ryberg (1947) who pointed a record into a map to the approximate area of Tehran, however, we did not localise the original source of such a record. Perhaps the basis for this marking was a mention by Blanford (1876: 23), who enumerated possible members of the Persian (Iranian) fauna and noted: "*Barbastella communis* also, which ranges from Europe to the Himalayas, may occur within Persian limits."

The Iranian occurrence of *B. darjelingensis* represents a part of the western extension of the species distribution range; it stretches in a relatively narrow belt from Transcaucasia via Iran and West Turkestan to eastern Afghanistan and Kashmir, northern India, southern China, Taiwan and Japan (Bates & Harrison 1997). In the Middle East, the species lives solely in Iran, which is the southern margin of the species range in the Palaearctic, while in Armenia and Azerbaijan there is the western margin of the whole species range (Benda et al. 2008). Considering the occurrence of *B. darjelingensis* in Transcaucasia, its presence in north-western mountainous regions of Iran can be also expected, namely in those adjacent to Nakhichevan and the Upper Karabakh (see Rahmatulina 2005).

Field notes. *Barbastella darjelingensis* was recorded in Iran mainly in its roosts, only one record of a foraging individual is available, and no remains were found in the osteological material from owl pellets.

However, only solitary bats were documented in their roosts. *B. darjelingensis* was repeatedly found in the Senje Bashi cave near Mahallat (Markazi). Etemad (1969) collected one male in this cave (under the name Azad-Khan cave) in November 1964 and another male in April 1966. One female was hand-netted (and released) in the Palangi cave at Klidar near Neishabur (Khorasan) on 24 November 2010; the site is a small cave, not deeper than 7 m and modified by local people. All these records probably represent hibernating bats. One male was discovered in the Parde Rostam cave at Jamab (Khorasan) in September 2009 (Fig. 193). The bat was found sitting torpid on the wall in a separate chamber near the entrance of the cave, partially illuminated by day-light. The latter record comes from the transient period of the year and certainly does not represent a hibernating bat but an individual in daytime lethargy.

B. darjelingensis was twice documented in artificial roosts. Lay (1967) found one female in an abandoned mine at Sang-e Sar (Semnan) in mid-October, i.e. probably at the beginning of hibernation; the author described the record as follows (p. 147): "The single specimen of this species, […], roosted alone on the wall of an abandoned mine shaft that opened about 1000 ft. up the side of a steep mountain ridge located about 2 km. northeast of Sang-e-Sar. The animal, collected October 16 [1962], was very fat and contained no embryos. Careful search of the several shafts of this mine complex failed to produce other specimens."; about the site he says (p. 103): "The small town of Sang-e-Sar ("stony place"), […], lay at the southern limits of a series of very high mountain ridges (rising to 2742 m.) of the Elburz range. Several stream valleys, converted into wheatfields and gardens, surrounded this town. […] About 5 km. north of this small town a pronounced vegetation change took place, particularly on the northern slopes of the high ridges. […]. I explored an abandoned mine with many branches, located 3.2 km. north-northwest of Sang-e-Sar roughly 304 m. up the southwest slope of a high, dry mountain ridge." A male of *B. darjelingensis* was found in an inhabited house in Tehran in June 1966 (Etemad 1967, 1989), however, no additional data are avilable on this record.

On 2 October 2011, echolocation calls of one foraging individual of *Barbastella*, most probably *B. darjelingensis*, were detected and recorded at a stream at Arjank near Dorud (Lorestan), where also foraging *Pipistrellus pipistrellus* was recorded. The site is a narrow valley between dry pastures almost free of tree vegetation, situated within high mountains at about 2400 m a. s. l. (Fig. 194). The bats foraged around few trees growing along the stream and along the road on the valley bottom.

No data on the reproduction of *B. darjelingensis* are available from Iran.

Variation. We did not examine any museum material of *Barbastella darjelingensis* from Iran.

B. darjelingensis was for a long time considered a part of another Asian *Barbastella* species, *B. leucomelas* (Cretzschmar, 1830) (see e.g. Ellerman & Morrison-Scott 1951, Etemad 1964, 1967, 1969, 1984, Kuzâkin 1965, Meyer-Oehme 1968, Gaisler 1970, Neuhauser & DeBlase 1974, Roberts 1977, 1997, Corbet 1978, Strelkov et al. 1978, DeBlase 1980, Strelkov 1981a, Butovskij et al. 1985, Harrison & Bates 1991, Corbet & Hill 1992, Habilov 1992, Koopman 1993, 1994, Borisenko & Pavlinov 1995, Bates & Harrison 1997, Rydell & Bogdanowicz 1997, Zhang et al. 1997, Mendelssohn & Yom-Tov 1999, Horáček et al. 2000, Schober 2004, Rahmatulina 2005, Simmons 2005, etc.), and all previous records of the *Barbastella* bats from Iran were assigned to the latter name (Etemad 1964, 1969, 1984, Lay 1967, DeBlase 1980, Sheikh-Jabbâri 2008).

Based on colouration differences, Neuhauser & DeBlase (1974) and DeBlase (1980) recognised two subspecies of '*B. leucomelas*' from Iran and Afghanistan, the paler *B. l. leucomelas* and the darker *B. l. darjelingensis*. DeBlase (1980) assigned the bats collected at Senje Bashi, Sang-e Sar and Tehran to the former subspecies, while the specimen from the Mohammad Reza Shah NP to the latter form. However, these authors looked solely on pelage colouration and did not consider body size of the specimens, which markedly differed between these two forms (see DeBlase 1980: 414).

Bats of the Afro-Arabian populations of *B. leucomelas* s.str. (type locality: Sinaitic peninsula south of the connecting line between the towns of Suez and Aqaba, Egypt; Benda et al. 2008: 53) are very small in their body and skull size, smallest among all species of the genus; according to Benda et al. (2008), their basic metric data are as follows: forearm length (LAt) 37.4–39.9 mm (n=9), greatest length of skull (LCr) 13.9–14.1 mm (n=6), length of upper tooth-row (CM^3) 4.3–4.5 mm (n=8). The bats assigned to *B. l. leucomelas* by DeBlase (1980) are considerably larger (n=4): LAt 42.0–44.4 mm, LCr 15.5–16.0 mm, CM^3 4.8–4.9 mm (DeBlase 1980: 414). Based on comparison of these data, it seems to be clear that these two populations belong to two different species, contra the opinions by Neuhauser & DeBlase (1974) and DeBlase (1980).

Results of the comparison of mtDNA sequences from the genus *Barbastella* (Zhang et al. 2007) demonstrated deep divergence between *B. leucomelas* from Sinai, Egypt, and '*B. leucomelas*' from eastern Asia (China, Taiwan), 17.88–17.94% of the K2p distances in the ND1 gene. This indicates a different taxonomic affiliation of these two '*leucomelas*' lineages, the Sinaitic bats belong to *B. leucomelas* s.str., while the continental Asian specimens to *B. darjelingensis* (Zhang et al. 2007, Benda et al. 2008).

Although the geographic variation in *B. darjelingensis* has not yet been examined properly in its whole distribution range, Benda et al. (2008) found the type specimen of *B. darjelingensis* (type locality: Darjeeling, West Bengal, India; Benda & Mlíkovský 2008: 37) to be very similar in metric traits to the *Barbastella* bats from West Turkestan, which can thus be considered as the nominotypical form of *B. darjelingensis*. Although there are some other names available (*caspica* Satunin, 1908; *blanfordi* Bianki, 1917; *walteri* Bianki, 1917), all represent synonyms of the latter name, see Benda & Mlíkovský (2008) for a review. Metric data on '*B. l. leucomelas*' sensu DeBlase (1980) also conform to these populations (Benda et al. 2008, 2011c, see also under *B. barbastellus*) and the Iranian populations of *B. darjelingensis* can thus be assigned to the identical taxon (the specimen of '*B. l. darjelingensis*' sensu DeBlase 1980 represents *B. barbastellus*, see above).

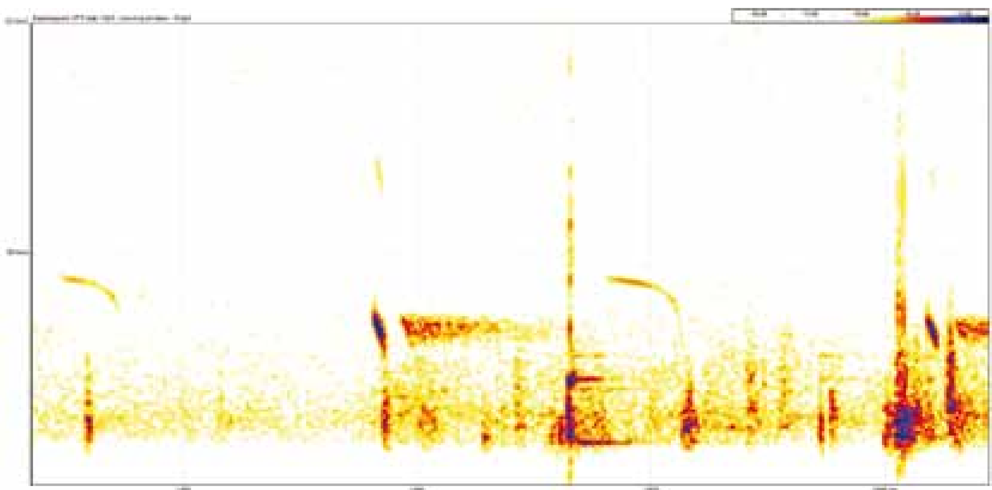


Fig. 195. Spectrogram of echolocation calls of *Barbastella darjelingensis* (Hodgson, 1855); an individual foraging in the valley near Arjank (Lorestan).

ECHOLOCATION. A single call sequence of *Barbastella darjelingensis* was documented from Iran, a call of a foraging individual was recorded in the valley near Arjank (Lorestan; Fig. 195). Due to a rather low quality of the recording, we measured only a limited number of echolocation characteristics (Table 3). The species identification of the call to *B. darjelingensis* was made on biogeographical grounds, with respect to the distributional pattern of the two *Barbastella* species in Iran (Fig. 191).

Similarly as other species of the genus, *B. darjelingensis* produces calls of two types (see under *B. barbastellus*), a short frequency-modulated call that is alternated with a long call with a convex frequency-time course (Fig. 195). The values of calls measured in *B. darjelingensis* are similar to those recorded from *B. leucomelas* in Jordan and Sinai (Benda et al. 2008, 2010), at least in the FMAX value. Some differences could be observed in the EF values, which are slightly lower in *B. leucomelas*.

B. leucomelas from the Holy Land and *B. beijingensis* Zhang, Han, Jones, Lin. Zhang, Zhu, Huang et Zhang, 2007 from China have similar designs of their echolocation calls as both Iranian *Barbastella* species, including the presence of the two signal types (Dietz 2005, Dietz et al. 2007, Zhang et al. 2007, Benda et al. 2008, 2010). *B. leucomelas* has the highest peak frequencies of both call types within the genus, which is correlated with body size – this species is the smallest representative of the genus (Benda et al. 2008, cf. Zhang et al. 2007).

FEEDING ECOLOGY. *Barbastella darjelingensis* is a medium-sized bat and its foraging ecology was studied in West Turkestan (Sierro & Arlettaz 1997); it was reported to feed predominantly on Lepidoptera (99.4% of volume) with a small proportion of Neuroptera (Hemerobiidae). *B. darjelingensis* seems to have a very narrow trophic niche. Its trophic ecology is very similar to other members of the genus *Barbastella*, which are generally characterised as moth-eating specialists (Benda et al. 2008, Andreas et al. 2012a). The diet of *B. darjelingensis* in Iran has not yet been studied.

Plecotus auritus (Linnaeus, 1758)

RECORDS. **Published data**: G i l â n: Assalem [1], edge of small clearing in forest, 1250 m, 22 July 1968: net. 1 fa (Steiner & Gaisler 1994).

DISTRIBUTION. *Plecotus auritus* is a very rare bat species in Iran, only one record is known from the north-western part of the country, from the Talysh Mts., the Gilani portion of the humid zone of the Hyrcanian mixed forests (Fig. 196). The only available Iranian specimen of this species was reported by Steiner & Gaisler (1994) and although its identification predates the recognition of *P. macrobullaris* as a species on its own (see below), according to the dimensions given by the latter authors (Table 35) the determination sounds correct (cf. Karami et al. 2008).

P. auritus is known to occur in the Caucasus region (Spitzenberger et al. 2006) and the southern extensions from this area represent the only occurrence spots of this species within the whole Middle East; besides the record in Assalem, Iran, two records were documented from the mountain forest zone of north-eastern Turkey (von Helversen 1989, Steiner & Gaisler 1994). The Iranian occurrence spot is the southernmost and easternmost within the Crimea-Caucasus island of *P. auritus* distribution.

FIELD NOTES. The record of the only specimen of *Plecotus auritus* currently known from Iran was described by Steiner & Gaisler (1994: 28) as follows: "Near Assalem a F[emale] was netted (14 net-nights) in a forest clearing, 1250 m [a. s. l.]." Concerning the site characterisation, these authors mentioned: "Forests on the luff side of the mountains (1150–1250 m above sea level.)

Fagus orientalis predominates. […] Assalem is in the Talysh Mountains, […]. The collecting site was at the edge of a small clearing." (Steiner & Gaisler 1994: 7). Along with one *P. auritus*, two *Eptesicus serotinus* were also netted at the site during two weeks of netting (Steiner & Gaisler 1994). The locality is reported to be situated in a 'wooded area' (Steiner & Gaisler 1994: 28), however, according to the altitude given, it does not seem to lie on the proper eastern slope of the Talysh Mts. covered by dense and humid beech forests, but rather on the drier plateau above this slope covered also by open habitats (fields and pastures). However, this habitat difference obvious at present time might have been less apparent at the time of the record, some 45 years ago, when the degree of deforestation was not so high.

Morphology and variation. External and cranial dimensions of the only known Iranian specimen of *Plecotus auritus* given by Steiner & Gaisler (1994) are shown in Table 35.

The *P. auritus* population occurring in the Talysh Mts. of Iran, of which only a single representative has been known, belongs to the Caucasian part of the species distribution range (see Distribution). Strelkov (1988) regarded this area to be occupied by the nominotypical form of the species and Steiner & Gaisler (1994) also tended to this opinion. However, based on a pro-

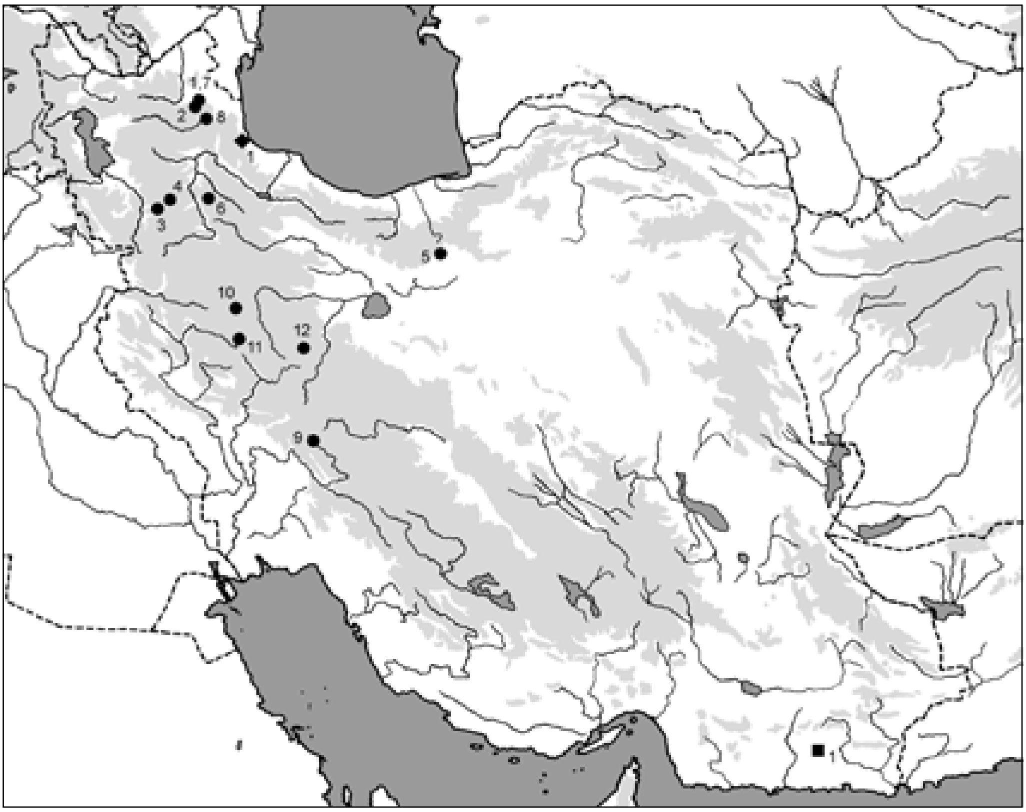


Fig. 196. Records of *Plecotus auritus* (Linnaeus, 1869) (diamond), *P. macrobullaris* Kuzâkin, 1965 (circles), and *P.* cf. *strelkovi* Spitzenberger, 2006 (square) in Iran.

found comparison of morphological and especially of genetic traits, Spitzenberger et al. (2006) demonstrated a separate position of the Caucasian populations within the *auritus* group of the genus *Plecotus*, perhaps deserving elevation to the subspecies level (the reported genetic divergence from the European samples of *P. auritus* s.str. in the control region of the mtDNA was rather deep, 7.3–7.5% of uncorrected *p* distances). Nevertheless, no name is available for this potential taxon.

Echolocation. *Plecotus auritus* produces very quiet frequency-modulated calls with two harmonics overlapping in their start and end values, 55–20 kHz and 80–40 kHz, respectively (Kolb 1965, Waters & Jones 1995, Dietz et al. 2007). Range of frequencies of maximum energy in Italian populations varied between 25–42 kHz (Russo & Jones 2002); however, no data on echolocation are available from the Asian part of the species range.

Feeding ecology. *Plecotus auritus* is a medium-sized bat applying the foliage gleaning foraging strategy with a frequent use of passive listening (Anderson & Racey 1991, Swift & Racey 2002). It was found to feed mostly on Lepidoptera (Beck 1995, Ashrafi et al. 2011, Razgour et al. 2011, Andreas et al. 2012b and many others), but Diptera sometimes also represent an important diet item (Swift & Racey 1983, Rydell 1989, Shiel et al. 1991). The majority of Lepidoptera in the diet of *P. auritus* was recorded also in Turkey (Whitaker & Karataş 2009). The diet of *P. auritus* in Iran has not yet been studied.

Plecotus macrobullaris Kuzâkin, 1965

Records. **Original data**: A r d a b i l: Dâshkasan [1], 17 km SE of Meshginshahr, Dâshkahul cave, 29 September 2011: net. 1 ma (NMP 94110; Fig. 197), det. & rec. calls of 1 foraging ind.; – Qutur Su [2], 17 km SE of Meshginshahr, sulphuric caves, 5 June 2006: remnants of 1 ind. found in the cave. – Â z a r b â i j a n - e G h a r b i: rock valley 7 km SE of Chuplu [3], 10 km NW of Takab, small cave, 2 October 1998: net. 2 ma, 5 fa (NMP 48123–48129; cf. Benda et al. 2004c, 2006, Juste et al. 2004); – Takht-e Soleyman [4], 22 km NNE of Takab, ruins, 3 October 1998: coll./net. 3 ma, 1 ms (NMP 48138–48141; cf. Benda et al. 2004c, 2006, Juste et al. 2004). – S e m n â n: Gandab [5], 11 km NW of Aftar, 31 km NW of Semnan, house ruins, 14 May 2006: obs. a dispersed colony, coll./net. 2 ma, 6 fG (NMP 90767–90774; Fig. 198; cf. Benda et al. 2006). – Z a n j â n: Golgik [6], 25 km W Zanjân, Golgik cave, 11 May 2009: coll. 1 ma (HMNH 2009.46.3.; don. F. Hemmati). – **Published data**: A r d a b i l: Banelar [7], 25 km NE Meshginshahr, Qaranuh Kahul cave, 10 December 2005: 1 m[a, HMNH] (Sheikh-Jabbâri 2008); – Guter-Su [= Qutur Su] [2], Sulphur Caves, north of Mt. Sabalan, 21 August 1961: 3 m, BMNH (Harrison 1963 [as *P. austriacus*], Spitzenberger et al. 2006); – Vind-e Kalkhorân [8], 10 km S Sare'ain, Âghâ Mohammad cave, 9 September 2006: 1 m hanged from the cave ceiling, 14 November 2006: 1 f (Sheikh-Jabbâri 2008). – C h a h â r M a h â l v a B a k h t i â r i: Shah Abbas Caves [9], near Kuh Rang, cave, 1965: 1 ms, 1 fa, 1 fs, BMNH (Lay 1967, DeBlase 1980 [as *P. austriacus*], Spitzenberger et al. 2006). – H a m a d â n: Hamadan [10], Tomb of Alivion [= Gonbad-e Alaviân], August 1965: obs. a colony, incl. 2 f (BMNH), 1 ind. (Etemad 1967, 1969, 1984, DeBlase 1980 [as *P. austriacus*], Spitzenberger et al. 2006); – Sultanabad area [11], near Malayer in the Zagros Mts., cave, 31 August 1973: 1 m, BMNH (DeBlase 1980 [as *P. austriacus*], Spitzenberger et al. 2006). – M a r k a z i: Enjedân [12], 37 km SE Arâk, Enjedân cave, 2 m (Etemad 1984 [as *P. austriacus*]), Endgan, Arak, 1975: 1 ind., BMNH (Spitzenberger et al. 2006). – Z a n j â n: Golgik [6], 25 km W Zanjân, Golgik cave, 7 December 2008: 1 m (Hemmati 2009).

Distribution. *Plecotus macrobullaris* ranks among rather uncommon bats in Iran, 12 record sites are known from the western part of the country (Fig. 196). Although DeBlase (1980) reported only four records to be assigned to *P. macrobullaris* from Iran (see Spitzenberger et al. 2006), these few findings geographically well delineated the currently known range in the country, represented by three times higher number of records. The localities are concentrated into a relatively narrow belt stretching from the Ardabil province to the central part of the Zagros Mts. The only exception is the recent evidence from the mountain steppe at Gandab, situated on the southern slope of the Alborz Mts. in the extreme west of the Semnan province. This new record also represents the easternmost occurrence spot within the whole distribution range of *P. macrobullaris* (cf. Spitzen-

Fig. 197. Portrait of *Plecotus macrobullaris* Kuzâkin, 1965 from the Dashkasan cave (Ardabil). Photo by A. Reiter.

berger et al. 2006). The record from the central Zagros Mts. in south-western Iran (Chahar Malal va Bakhtiari prov.) represents the southernmost verified record within the species range; another similarly southern extension of the species range lies in the Levant, where the revised records are available from the Syrian Anti-Lebanon Mts. (Benda et al. 2004c, 2006), some 150 km north of the latitude of the Zagrosian occurrence. The Iranian records come from mountain steppe plateaus above 1700 m a. s. l. (average altitude of the record locality is 2113 m), which conforms to the distribution pattern of *P. macrobullaris* in other parts of the Middle East (Benda et al. 2006).

P. macrobullaris has been defined as a separate species very recently (Spitzenberger et al. 2003, see below) and its distribution area is probably still insufficiently known. The revised records cover south-European and south-west-Asian mountain regions from the Pyrenees over the Alps and Dinaric mountains to Crete and Anatolia, Caucasus region and the Levant (Juste et al. 2004). Hence, the Iranian range represents extreme extension of the Caucasus-Anatolian part of the species distribution area in the south-eastern direction.

Field notes. *Plecotus macrobullaris* was recorded in Iran mostly in or at its roosts; foraging individuals were recorded only exceptionally. No remains were found in the bone material from owl pellets.

Two records could be considered as findings of colonies. Etemad (1967: 278) reported: “At August 1965 I found a colony of this bat [= *Plecotus austriacus* s.l.] in an old tomb in Hamadan.”

Later, this author (Etemad 1969, 1984) specified the record; according to the photograph published, the group of some 12–15 bats roosted in a brick-constructed ventilation shaft of the medieval mausoleum of Gonbad-e Alavian (Tomb of Alivion by DeBlase 1980) in the centre of Hamadan (Hamadan). Three bats were collected from the group; at least two were females (Etemad 1967, 1969). The aggregation of the bats at one place as well as the prevailing sex of the collected specimens suggest a record of a maternity colony (perhaps shortly before its disintegration, considering the late summer period of the record).

Another record of a colony was made at Gandab near Aftar (Semnan) on 14 May 2006. The colony most probably roosted in a hidden place in a group of abandoned houses (Fig. 199), a minor part of the houses (still with roofs) was perhaps temporarily used as a sheep shelter. The presence of the colony was discovered shortly after sunset, when the bats started to forage among as well as inside the buildings; eight bats were caught into hand-nets and also to mist-nets quickly installed inside some of the houses. The sex and physiological status of the collected specimens (six pregnant females besides two adult males) clearly indicate foraging of a maternity aggregation. Since there is no other roosting opportunity close to the respective group of houses, the roost of the colony should be present just there (although it was not exactly localised). This former settlement is situated in a broad valley with pastures in the mountain plateau in the south-eastern extension of the Alborz Mts. at the altitude of around 2100 m a. s. l. (Fig. 199).

Other records of *P. macrobullaris* from roosts are most probably related to solitary individuals. Three individuals were collected (perhaps roosting) in the Shah Abbas caves near Kuh Rang (Chahar Mahal va Bakhtiari) in 1965 (Lay 1967, DeBlase 1980, Spitzenberger et al. 2006). DeBlase (1980: 239) reported a BMNH specimen collected in the Sultanabad area near Malayer

Fig. 198. *Plecotus macrobullaris* Kuzâkin, 1965 from Gandab (Semnan). Photo by A. Reiter.

Fig. 199. Almost abandoned and ruined agricultural settlement at Gandab near Aftar (Semnan), a foraging habitat and most probably also a roosting place of *Plecotus macrobullaris* (see text). Photo by A. Reiter.

(Hamadan) in the Zagros Mts. and added: "The Sultanabad specimen is a male found "10 m. inside horizontal cave roosting singly on rock shelf" (specimen tag) by T. Booth on 31 August 1973." (the species identification was confirmed by Spitzenberger et al. 2006). Etemad (1984) collected two males of *P. macrobullaris* (cf. Spitzenberger et al. 2006) in the Enjedan cave near Arak (Markazi) in 1975. Sheikh-Jabbâri (2008) reported a male hanging from the cave ceiling of the Agha Mohammad cave at Vind-e Kalkhoran near Sare'ain (Ardabil) observed on 9 September 2006 and another individual, female, observed there on 14 November 2006; this author also collected an adult male in the Qaranuh Kahul cave at Banelar near Meshginshahr (Ardabil) on 10 December 2005. The latter finding most probably represents a hibernation record. From the hibernation period – 7 December 2008 – also the record of a male by Hemmati (2009) from the Golgik cave near Zanjan (Zanjan) is available; another male specimen (currently at HMNH) collected on 11 May 2009, also originates from this cave.

Altogether four individuals of *P. macrobullaris* were collected in the ruins of Takht-e Soleyman near Takab (Azarbaijan) on 3 October 1998 (Fig. 87); three of them were taken from fissures between stones or bricks in vaulted corridors leading from the walled area of the monument, one bat was caught into a net installed in such a corridor.

Two records of this species were made in the sulphuric caves at Qutur Su near Meshginshahr (Ardabil) in 1961 (Harrison 1963; under *P. austriacus* s.l.), three mummified individuals were found there along with 14 specimens of other five bat species (*Myotis blythii*, *M. schaubi*, *M. mystacinus*, *Eptesicus serotinus*, and *E. bobrinskoi*; see Table 24); one more dead individual was found in these caves in 2006, along with three *E. bobrinskoi* (see Benda & Reiter 2006). This site represents an unusually positioned and acting trap for animal life in the Sabalan mountains – the bats and other animals which visit the cave are "overcome by the sulphur fumes in the cave" (Harrison 1963: 301); see under *E. bobrinskoi* for more details. However, the caves are visited by bats most probably as a potential roost.

P. macrobullaris was found to share some of its roosts with other bat species. During two visits of the Golgik cave (see above) two other bat species were recorded, viz. *Rhinolophus blasii* and *Myotis blythii*, Hemmati (2009) mentioned additionally *Miniopterus pallidus*. *Myotis blythii* and *M. schaubi* were collected along with *P. macrobullaris* in Takht-e Soleyman. Sheikh-Jabbâri (2008) found also *Myotis schaubi* in the Qaranuh Kahul cave, however, during a different visit.

Individuals of *P. macrobullaris* were netted at three sites. One of them was the ruin of Takht-e Soleyman, see above, where also roosting bats were found; at two other sites the bats were netted close to cave entrances, hence, swarming behaviour or approaching the roost is also possible along with the foraging activity. Seven individuals were netted near the entrance to a small cave in the valley of a river near Chuplu (Azarbaijan) on 2 October 1998 (along with one *Myotis schaubi*, while solitary individuals of *Rhinolophus ferrumequinum* and *R. hipposideros* were recorded inside the cave). An adult male of *P. macrobullaris* was caught into a net installed at the entrance of the Dashkahul caves at Dashkasan near Meshginshahr on the northern slope of the Sabalan Mts. (Ardabil) on 29 September 2011 (Fig. 200). *Eptesicus serotinus* and *Miniopterus pallidus* were also recorded during this netting session.

Evidence of reproduction of *P. macrobullaris* is available from one site in Iran. Six pregnant females were collected at Gandab near Aftar on 14 May; five of these females contained one foetus each, their crown-rump lengths were in the range 7.0–12.4 mm (mean 9.7 mm). The remaining female had a slightly enlarged uterus, indicating an initial stage of pregnancy. This record suggests occurrence of births in northern Iran from the second half of May till the first half of June.

Material examined. 2 ♂♂, 5 ♀♀ (NMP 48123–48129 [S+A]), Chuplu (Azarbaijan-e Gharbi Prov.), 2 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 94110 [S+A]), Dashkahul cave (Ardabil Prov.), 29 September 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂, 6 ♀♀ (NMP 90768–90774 [S+A], NMP 90767 [A]), Gandab, Aftar (Semnan Prov.), 14 May 2006, leg. P. Benda & A. Reiter; – 1 ♂ (HMNH 2009.46.3. [S+A]), Golgik cave [Zanjan Prov.], 11 May 2009, collector unlisted, don. F. Hemmati; – 1 ♂ (HMNH 2007.52.1. [S]), Qaranuh Kahul cave

Fig. 200. Dashkasan near Meshginshahr (Ardabil); foraging area of *Rhinolophus ferrumequinum*, *Myotis blythii*, *Eptesicus serotinus*, *Plecotus macrobullaris*, *Miniopterus pallidus*, and *Tadarida teniotis*. Photo by A. Reiter.

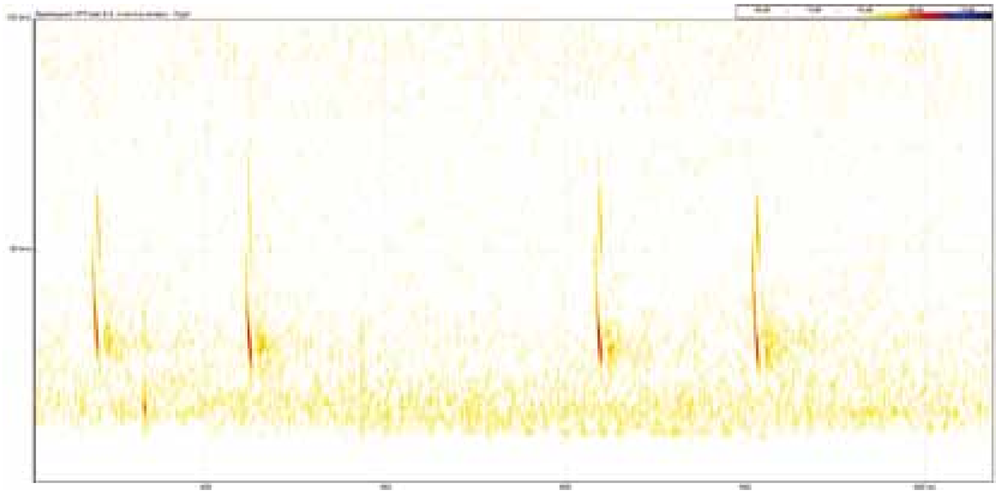


Fig. 201. Spectrogram of echolocation calls of *Plecotus macrobullaris* Kuzâkin, 1965; an individual foraging at the Dashkasan cave (Ardabil).

[Ardabil Prov.], 10 December 2005, collector unlisted; – 4 ♂♂ (NMP 48138–48141 [S+A]), Takht-e Soleyman (Azarbaijan-e Gharbi Prov.), 3 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Plecotus macrobullaris* are shown in Table 35. For the material examined see above.

Originally (Harrison 1963, Etemad 1967, 1969, 1984, Lay 1967, DeBlase 1980), the Iranian populations of *P. macrobullaris* were assigned to *P. austriacus* (Fischer, 1829), a species formerly regarded to be distributed in the broad belt of the southern part of the Palaearctic from the Canary islands to China (Hanák 1966, Corbet 1978, Koopman 1994). DeBlase (1980) avoided assigning the Iranian samples of this species to any then recognised subspecies, with a reference to complexity of the intrageneric taxonomy of *Plecotus* and a lack of a profound revision.

The recent analyses by Spitzenberger et al. (2003) and Juste et al. (2004) have shown the *Plecotus* populations of the Middle East, formerly regarded to be a part of *P. austriacus* s.l. (Harrison 1963, 1964, Hanák 1966, Etemad 1967, 1969, 1984, Lay 1967, DeBlase 1980, Harrison & Bates 1991), to pertain to a newly defined species, *P. macrobullaris*, described originally as a subspecies of *P. auritus* from the northern Caucasus (type locality: Ordžonikidze, Severo-Osetinskaâ ASSR, Kavkaz [= Vladikavkaz, North Ossetia, Russia]; Kuzâkin 1965: 99). *P. austriacus* is currently considered to be confined to the southern part of the European continent, with the easternmost extensions of its range known from Turkish Thrace and Crimea (Spitzenberger et al. 2006).

Spitzenberger et al. (2003, 2006), Juste et al. (2004) and Benda et al. (2004c, 2006, 2009b) recognised two subspecies of *P. macrobullaris* within its distribution range; a smaller *P. m. alpinus* Kiefer et Veith, 2002 in Europe and a larger *P. m. macrobullaris* Kuzâkin, 1965 in Crete, Caucasus and the Middle East, including Iran. No further remarkable metric variation was found in samples from the Middle East and Caucasus (see Benda et al. 2004c, 2006).

Echolocation. Like other species of the genus, *Plecotus macrobullaris* emits downward frequency-modulated signals with two dominant harmonics. In the European populations, the first harmonic begins at about 46 kHz and ends around 23 kHz (Dietrich et al. 2006). We recorded echolocation calls of *P. macrobullaris* only at a single site in Iran, inside the Dashkahul cave (Fig. 201). Despite a rather low quality of the recording (Fig. 201), we were able to measure all basic echolocation parameters that are given in Table 3. The calls show the pattern typical for the genus *Plecotus*, the range of frequency of maximum energy of the first harmonic was between ca. 30–34 kHz. No other data on echolocation of *P. macrobullaris* are available from the Asian part of the species range.

Feeding ecology. *Plecotus macrobullaris* is a small- to medium-sized bat; in Europe, it was found to feed predominantly on Lepidoptera (Ashrafi et al. 2011, Alberdi et al. 2012). The other taxa recorded in its diet (mostly in quite minute proportions) were Diptera, Coleoptera, Hymenoptera, Araneae, and Chilopoda. The analyses of the diet of *P. macrobullaris* from the Middle East also showed an overwhelming majority of moths with some small proportions of Hemiptera, Orthoptera, Diptera, Coleoptera, and Neuroptera (Benda et al. 2006, Whitaker & Karataş 2009).

Little is known about foraging ecology and strategies of *P. macrobullaris*. Echolocation calls are more similar to the signals of *Plecotus austriacus* (Fischer, 1829), which is expected to hunt more aerially than the predominantly gleaning *P. auritus* (Anderson & Racey 1991, Dietrich et al. 2006, Ashrafi et al. 2011). Moreover, the presence of flightless or diurnal taxa in its diet is quite negligible, especially when compared to *P. auritus* (Ashrafi et al. 2011, Alberdi et al. 2012); therefore, aerial hawking is supposed to be the main foraging strategy in *P. macrobullaris*.

From Iran, the diet composition of *P. macrobullaris* was analysed from four sites. The contents of eight digestive tracts and eight faecal pellets from Chuplu (Azarbaijan), four digestive tracts from Takht-e Soleyman (Azarbaijan) and two faecal pellets from one bat collected at the Dashkahul caves (Ardabil) contained solely Lepidoptera. Only in the material of 17 faecal pellets from eight bats collected at Gandab (Semnan) there were mainly Lepidoptera (97.9% of volume) with additional small proportions of brachyceran Diptera (1.8%) and Neuroptera (0.3%).

This diet composition confirms *P. macrobullaris* as a moth feeding specialist and our results correspond well with previous studies. The finding of a very small proportion of brachyceran Diptera, a mostly diurnal group, cannot be regarded as an evidence of some more extensive use of foliage gleaning in the studied animals (the flies were perhaps caught during foraging in the abandoned cowshed [see Field notes], where their presence is well presumable).

Records of ectoparasites. **Original data**: I s c h n o p s y l l i d a e: *Ischnopsyllus petropolitanus*: 6 ma, 2 fa (CMŠ [P]) from 2 ma, 6 fa (NMP 90767–90774), Gandab, Aftar (Semnan Prov.), 14 May 2006.

Comments on ectoparasites. Only one ectoparasite species of *Plecotus macrobullaris* has been documented from Iran, the bat flea *Ischnopsyllus petropolitanus* (Wagner, 1898). This is the first record of this parasite species from Iran, it is distributed mainly in West Turkestan, where *Plecotus austriacus* s.l. (= mostly *P. strelkovi*) is reported to be its principal bat host (Medvedev et al. 1984).

Plecotus strelkovi Spitzenberger, 2006

Records. **Published data**: Iran (undef.): Persien, 2 inds., ZMB (Peters 1867 [as *P. auritus*]), Perse (Trouessart 1879 [as *P. auritus*]), Iran, 2 inds., ZMB, 1 ind., NMW (Spitzenberger et al. 2006). – S i s t â n v a B a l u c h e s t â n: Nikshahr, 1 ind., IPHR (DeBlase 1980 [as *P. austriacus*]).

Distribution. *Plecotus strelkovi* is a very rare bat species in Iran, only three specimens are available from unspecified locality/localities in the country (Spitzenberger et al. 2006). The known records of this recently described species covers mainly the mountains of the eastern parts of West

Turkestan (namely the high massifs in Kirghizstan and Tajikistan) and this range extends in the north to eastern Kazakhstan, in the east to East Turkestan of China, in the south to Afghanistan, and in the west to Iran (Spitzenberger et al. 2006). However, although the Iranian localities are not specified, they could be expected in the regions lying in a prolongation from the distribution area in the Pamir massif, along the Hindu Kush range of Afghanistan, i.e. somewhere in the eastern and/or south-eastern Iran, most probably in the provinces of Khorasan-e Janubi and Sistan va Baluchestan. Anyway, Spitzenberger et al. (2006: 209) noted: "Three specimens of *P. strelkovi* in the Berlin [= ZMB] and Vienna [= NMW] museums from 'Iran' […] indicate a south-western extension of the species' range. As the north Iranian mountain chains are connected through the Hindu Kush with the Pamir massif, it is also possible that *P. strelkovi* is continuously distributed from Iran to eastern Tienshan in China."

From the province of Sistan va Baluchestan another record of *Plecotus* originates, that published by DeBlase (1980) under *P. austriacus* (see above) from Nikshahr (Fig. 196). Here, we very tentatively assign this record to *P. strelkovi*, the only species of the genus may occur in the area. Unfortunately, DeBlase (1980) did not present any morphological data concerning this record, so we assign the record here solely on the biogeographical grounds. On the other hand, since DeBlase (1980) reported the finding as being told him by another author, without examination of any specimen, there still is possibility that such a record in the respective region could represent a bat of the genus *Otonycteris* rather than of *Plecotus* (see Fig. 181). The similarity between bats of these genera could cause the confusion quite easily, namely in the cases of findings of dead and mummified bats or observed individuals without any proper examination.

Field notes. No ecological and/or biological data are available on the only reliable specimens of *P. strelkovi* (NMW 29871, ZMB 3089, 3089A) originating from Iran (see also Peters 1867*, Spitzenberger et al. 2006). Concerning the general ecological characterisation of this bat, Spitzenberger et al. (2006: 209) mentioned: "The Pamir and Tienshan mountain ranges are generally characterized by an extreme continental climate that resembles that of the adjacent deserts. Some localities, however, are characterized by a semi-arid or even temperate climate."

As we stressed above, DeBlase (1980: 238) had no available data on the specimen collected at Nikshahr (Baluchestan), the collection of the bat was reported to him by another person without any additional details (incl. sex, age, date of collection, etc.).

Miniopterus pallidus Thomas, 1907

Records. **Original data**: A r d a b i l: Dâshkasan [1], 17 km SE of Meshginshahr, Dâshkahul cave, 29 September 2011: net. 1 ma (NMP 93860; Fig. 203), det. & rec. calls of 1 ind. – Â z a r b â i j a n - e G h a r b i: SZ Iran, uŝ. Kotur-Čaâ, bl. gor. Hoâ [= north-western Iran, Qotur Chay canyon, near the town of Khoy] [2], 29 August 1914: 1 m, 8 f (ZIN 58545–58554; leg. P. V. Nesterov). – Â z a r b â i j a n - e S h a r q i: Vâyqân [3], 25 km W of Kalibar, Vâyqân cave, 23 October 2009: obs. a colony of ca. 150 inds. – C h a h â r M a h â l v a B a k h t i â r i: Darre Duâli cave [4], 15 km SE of Shahr-e Kord, Summer 2001: net. 20 m, 19 f (cf. Ashrafi 2001 [as *M. schreibersii*]), 7 May 2010: net. 4 m (cf. Faizolahi et al. 2011 [as *M. schreibersii*]); – Omid Âbâd [5], 42 km W of Shahr-e Kord, Sarâb cave, Summer 2001: net. 17 m, 1 f (cf. Ashrafi 2001 [as *M. schreibersii*]), 13 August 2010: obs. 5–7 active inds. (cf. Faizolâhi et al. 2011 [as *M. schreibersii*]). – F â r s: 5 km E of Sivand [6], 64 km NE of Shiraz, 30 April 1996: remnants of 2 inds. (2 right and 2 left mandibles) found in the *Bubo bubo* pellets; – 10 km NW of Hesar [7], 66 km NW of Marv Dasht, above a stream, 5 October 2011: net. 3 ma, coll. 1 m (NMP 93869); – Bishapur [8], 20 km NW of Kâzerun, Shahpur cave, 3 May 1996: remnants of 1 ind. (pair of mandibles, skull fragments) found in the *Bubo bubo* pellets; – Bishapur [9], 19 km NW of Kâzerun, large cave above the Sâsân spring, 21 April 2000: remnants of 1 ind. (pair of mandibles) found in *Strix aluco* pellets (cf. Obuch 2011 [as *M. schreibersii*]) and remnants of 3 inds. (3 right and 3 left mandibles, 4 skull fragments) found in *Bubo bubo* pellets, 6 October 2011: obs. a colony of ca. 50 inds., net. 6 ma, 1 fa, 3 fs in the cave, coll. 1 ma (NMP 93874); – Dashtak [10],

*Peters (1867: 18): "Unsere Sammlung besitzt von derselben Art [= *Plecotus* sp.] zwei Exemplare, welche der verstorbene Preußische Gesandte Hr. von Minutoli in Persien gesammelt hatte."

32 km SSW of Yasuj, 3 May 1996: net. 1 ind. (JOC unnumbered); – Tâdovân [11], 44 km NW of Jahrom, Tâdovân cave, 21 November 2009: obs. 1 ind. in torpor, 7 October 2011: obs. a colony of ca. 1000 inds., net. 70 ma, 12 ms, 32 fa, 4 fs (coll. 1 ma; NMP 93882; Fig. 204), det. & rec. several calls of foraging inds. – G o l e s t a n: Khanbebin [12], Shirabad cave, October 1997: coll. 1 fa (HNMH 2007.3.15.; leg. S. Ashrafi, M. Peymani & H. Zohoori). – H a m a d â n: Gonbad [13], 25 km SE of Hamadân, 8 May 1996: remnants of 1 ind. found in the *Bubo bubo* pellets. – I l â m: Abdanan river 15 km SW of Mormori [14], 25 km E of Dehlorân, above the river, 16 October 2011: net. 1 fa (NMP 93902), det. & rec. calls of several foraging inds. – K e r m â n s h a h: Bisotun [15], 28 km E of Kermanshah, small cave, 8 October 1998: net. 1 ma, 1 ms, 1 fs (NMP 48149–48151; cf. Benda et al. 2006 [as *M. schreibersii*], Šrámek et al. in press). – K h o r a s â n - e R a z a w i: 5 km S of Mina [16], 20 km SW of Dargaz, above a pool, 22 May 2006: net. 7 ma (NMP 90825–90831; cf. Benda et al. 2006 [as *M. schreibersii*], Šrámek et al. in press); – Bazangân [17], 75 km SW of Sarakhs, Bazangân cave, August 1999: net. 3 m, 3 f (cf. Faizolahi 1999 [as *M. schreibersii*]), September 2009: obs. a colony of ca. 1500 inds., net. 1 ind.; – Mozdurân [18], 2 km N of Mazdâvand, Mozdurân cave, September 2009: obs. ca. 20 inds., net. 1 ind. – K o h g i l u y e v a B o y e r A h m a d: valley 3 km N of Meymand [19], 24 km N of Pataveh, above a river, 4 October 2011: net. 1 fs (NMP 93865). – K o r d e s t â n: Karaftu cave [20], 22 km WSW of Takab, 18 October 2011: obs. a colony of ca. 100 inds., coll. 2 ma (NMP 93912, 93913); – Sanandaj [21], 11 September 1998: coll. 1 fa (HMNH 2000.63.7.; leg. M. Szatyor). – L o r e s t a n: Lenje Abad [22], 6 km SW of Dorud, above a river, 8 October 1998: net. 1 ma (NMP 48154; cf. Benda et al. 2006 [as *M. schreibersii*], Šrámek et al. in press); – 3 km S of Lenje Abad [23], 9 km SW of Dorud, 1 October 2011: det. & rec. calls of several foraging inds. – Z a n j â n: Golgik [24], 25 km E of Zanjân, Golgik cave, 28 September 2009: obs. a colony of more than 500 inds., net. 2 inds.; – Shâhneshin [25], 10 km SE of Âbbar,

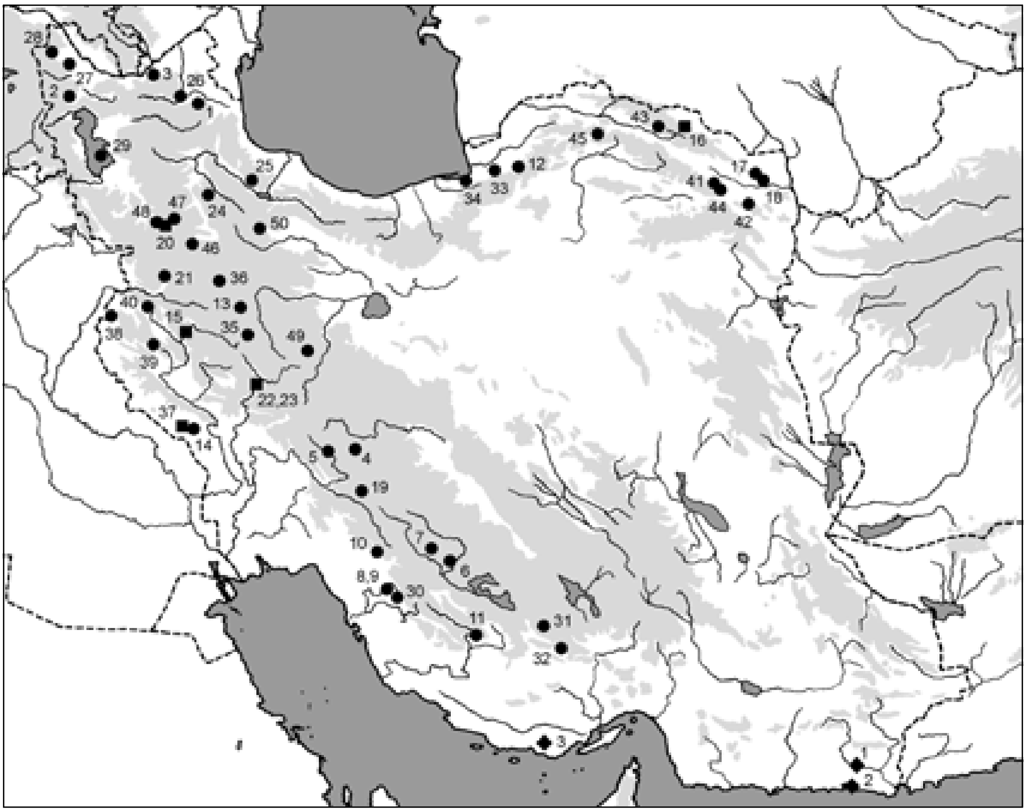


Fig. 202. Records of *Miniopterus pallidus* Thomas, 1907 (circles and squares) and *Nyctinomus aegyptiacus* Geoffroy, 1818 (diamonds) in Iran. Squares denote localities of origin of the genetically identified specimens of *M. pallidus*.

Kharmanesar cave, 27 September 2009: 1 ind. – Iran (undef.): Vostočn. Iran [= eastern Iran], 1898 [= between 14 (= 26 NS) March and 15 (= 27 NS) November 1898, see Zarudnyj (1898)]: 1 m (ZIN 9438; leg. N. A. Zarudnyj; according to Zarudnyj [1898], the specimen should originate from the teritorry of north-eastern, eastern or south-eastern Khorasân [Khorasân-e Razawi and Khorasân-e Janubi provinces] or the Sistân va Baluchestân province). – Iran (undef.): Persiâ [= Iran], 1899 [? 1898]: 2 m (ZIN 6019, 6020; leg. N. A. Zarudnyj). – **Published data** [all under *M. schreibersii*]: A r d a b i l: Kojanagh [26], 20 km NW Meshginshahr, Kojanagh cave, 31 May 2007: 2 m, 2 f [coll. 1 ma, HMNH] (Sheikh-Jabbâri 2008). – Â z a r b â i j a n - e G h a r b i: 44 km. southeast of Maku [27], cave, 31 September – 1 October 1962: obs. a colony of several hundreds, coll. 18 m, 13 f, FMNH (Lay 1967, DeBlase 1980); – Zangamar River Cave near Maku [28], 27 September 1962: coll. 1 f, 1 ind., FMNH (Lay 1967, DeBlase 1980). – Â z a r b â i j a n - e S h a r q i: Quyn Daghi [= Kabudan] Island [29], Lake Rezaiyeh [= Oromiyeh], near spring above lodge, 6 November 1969: shot 1 m, MMTT (DeBlase 1980). – F â r s: 5 km. SE Pol-i-Abgineh [30], vertical well shaft, 28 December 1962: 2 m, 4 f, FMNH (DeBlase 1980, cf. Lay 1967); – 11 km. NW Darab [31], 11 July 1965: 1 m, USNM (DeBlase 1980); – Rostâgh [32], Sahlak, 65 km SE Dârâb, Mozaffar cave (Akmali et al. 2011a); – Shahpur Cave [8], 29 December 1962: 8 inds., resp. 1 m, 5 f, FMNH (Lay 1967, DeBlase 1980), 9 October 1968: obs. ca. 145 inds., coll. 13 m, 20 f, 1 ind., FMNH (DeBlase 1980); – Tâdovân [11], 50 km NW Jahrom, Tâdovân cave (Akmali et al. 2011a). – G o l e s t a n: 8 km. north of Gorgan [33], over a lagoon, 31 October 1962: shot 1 m, FMNH (Lay 1967, DeBlase 1980); – Shirabad Cave (5 km SE of Shirabad, 60 km east of Gorgan, 310 m) [12], June 1999 (Morshed & Patton 2002); – South coast of Caspian [= vicinity of Bandar-e Gaz] [34], –25 m, 25 March 1907: 1 f, BMNH (Thomas 1907, Lay 1967, Gaisler 1970, cf. Uchikawa 1985). – H a m a d â n: Arac Langri [35], Malayer area, cave, 25 August 1973: 9 m, 4 f, BMNH (DeBlase 1980); – Alisard [= Ali Sadr] cave [36], Kabutar-Ahand near Hamedan, August 1965: 1 f (Etemad 1967, 1984, DeBlase 1980), Alisard [= Ali Sadr] Cave, near Gol Tappen, 2 September 1973: 3 m, 6 f, BMNH (DeBlase 1980). – I l â m: Sarin Ab-Garma Cave [37], Dehloran, 5 September 1968: 6 m, 7 f, 1 ind., FMNH (DeBlase 1980), Dehloran, Khofash cave, large aggregation (Sharifi et al. 2002), Sarin Ab-Garma Cave, Dehloran, 25 July 2006: net. 1 f, ZDNU (Karataş et al. 2008), Sarin Ab-Garma, 1 ind. (Furman et al. 2009, 2010a), Khoffâsh cave, N Dehlorân (Akmali et al. 2011a). – K e r m â n s h a h: Kilasefid [38], 30 km NE Qasr-e Shirin, Kilasefid cave, 1 September 1999: coll. 3 m, 1 f, 19 October 1999: coll. 13 m, 6 f, 9 July 2000: coll. 6 f, RUBC (Hemmati 2001); – Mahidasht cave [39], 20 October 2000: 1 m, 2 f, RUBC (Sharifi et al. 2002), Mâhidasht Cave, 30 km SW Kermânshâh, 18 October 2002: obs. a large colony, net. several inds. (Akmali 2004), Mahidasht Cave, August 2001: colony of 140 inds. (Sharifi 2004a), Mahidash Cave, colony (Sharifi 2004b), Mâhidasht Cave, 18 October 2000, 27 March 2001, 26 April 2001, 2 May 2001, 26 June 2001, 10 October 2001: coll. 7 m, 8 f, RUBC (Rahimi et al. 2007), Mahidasht cave (Sharifi & Hemmati 2004); – River Cave (= Korie Cowat) [40], Ravansar, 23 August 1968: obs. ca. 1000 inds., coll. 8 m, 9 f, FMNH (DeBlase 1980). – K h o r a s â n - e R a z a w i: 20 km. W Meshad [41], 23 July 1969: 14 m, 9 f, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – 71 km. SE Meshad [42], 29 July 1969: 2 m, 5 f, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – Chelmir [43], 28 July 1968: 3 m, IPHR (DeBlase 1980), 16 July 1969: 1 ma, IPHR (Farhang-Azad 1970a ex DeBlase 1980); – Moghan cave 30 kms. north [= south; see Etemad (1969)] of Meshhad [44], September 1963: 1 f, 51 inds., resp. 2 f, 1ind. (Etemad 1967, 1984, DeBlase 1980), Mashad (Moghan cave), July 1968: 21 m, 25 f (Farhang-Azad 1969); – Mozduran cave 110 kms. east of Meshhad [19], September 1963: 1 m (Etemad 1967, 1984), Mozduran, 4 October 1974: 8 m, 7 f, SMF (DeBlase 1980, Kock 1983), Mozdooran, cave, 17 August 1968: 1 mummy (Steiner & Gaisler 1994). – K h o r a s â n - e S h o m â l i: Ganjah Kuh Cave [45], 3 km. north of Jochdi, 12 November 1962: 9 inds., resp. ca. 45 inds. in a colony, 7 m, FMNH (Lay 1967, DeBlase 1980). – K o r d e s t â n: Âftâbi cave [46], 24 July 2000: coll. 1 f, RUBC (Hemmati 2001); – Gara Tarik (Cave) [47], 4 km. N Qareh, 13 and 14 August 1968: obs. a colony of ca. 5500 inds., coll. 11 m, 15 f, FMNH (DeBlase 1980); – Karaftu (Cave) near Dashbologh village [20], about 51.5 km. N Divandarreh, 16 August 1968: obs. ca. 25 inds., coll. 2 m, 6 f, FMNH (DeBlase 1980), Karaftu, 45 km NW Divândarreh, Karaftu cave, 19 February 1998: obs. 12 m, 24 July 2000: coll. 2 m, 5 f, RUBC (Hemmati 2001), Karaftu Cave, 25 km to Tikab, 9 June 2006: net. 2 f, ZDNU (Karataş et al. 2008), Karafto, 2 inds. (Furman et al. 2009, 2010a); – Zivieh [48], 40 km E Saqqez, Zivieh cave (Akmali et al. 2011a). – M a r k a z i: Âzâd-Khân cave in Mahalat [= Senje Bâshi, 12 km W Mahallât] [49], March 1965: 1 f (Etemad 1967, DeBlase 1980). – Z a n j â n: 4 km. W Abhar [50], 12 and 13 August 1970: 11 m, 11 f, IPHR (Farhang-Azad 1971 ex DeBlase 1980); – Golgik [24], 25 km E Zanjân, Golgik cave, 7 December 2008: 1 m (Hemmati 2009), Golgik cave (Akmali et al. 2011a). – Iran (undef.): Iran, 16 inds., BMNH (Uchikawa 1985).

Distribution. *Miniopterus pallidus* is a common bat species in Iran, at least 50 record sites are known throughout the country (Fig. 202). The localities are concentrated mainly in the mountain ranges of northern, western and south-western regions of Iran with rather mild climatic conditions. However, some records are available also from rather arid slopes of the Zagros Mts. in the Ilam and Fars provinces. On the other hand, there is no evidence of distribution of *M. pallidus* in most of the Hyrcanian zone of humid forests of the Gilan and Mazandaran provinces (Fig. 202). Although DeBlase (1980) summarised less than a half of the number of currently known records

(Table 1), his picture of distribution of *M. pallidus* in Iran was almost identical with that presented here. The newly gathered records only make the known occurrence area more precise, namely in the north-western part of the country.

In several sites in Iran, the presence of *M. pallidus* was confirmed more times and suggested continual occurrence over long periods, e.g. in the Karaftu caves near Takab (1968, 1998, 2000, 2006, 2011), in the caves of the Bishapur area near Kazerun (1962, 1968, 2000, 2011), or in the Dehloran cave near Dehloran (1968, before 2002, 2006). However, in the latter site the species occurrence was not confirmed during our visit in October 2011.

A separate species position of *M. pallidus* has been suggested very recently (see Benda et al. 2010, Furman et al. 2010b, Bilgin et al. 2012, Šrámek et al. in press) and its whole distribution range is defined only approximately. However, it seems clear that this bat is an endemic of the Middle East, with only a minute reach to south-eastern Transcaucasia (mountain regions of southern Armenia and Azerbaijan) and south-western Turkmenistan (see also Benda et al. 2011c). While in the western part of the Middle East (Anatolia, Levant) it occurs in parapatry or even sympatry with its congener *M. schreibersii* (Kuhl, 1817), in Iran and Turkmenistan only *M. pallidus* seem to occur (Benda et al. 2011c, Šrámek et al. in press, cf. Strelkov et al. 1978), see also below. According to the current knowledge, the Iranian range of *M. pallidus* represents a major part of the species occurrence area and its southernmost (Fars) and easternmost (Khorasan) extensions.

Fig. 203. *Miniopterus pallidus* Thomas, 1907 from the Dashkasan cave (Ardabil). Photo by A. Reiter.

FIELD NOTES. *Miniopterus pallidus* was recorded in Iran mostly in or at its roosts, only few findings were made in its foraging habitats. Its bone remains were found in owl pellets collected at three sites.

Most probably, findings of nursery colonies are not available from Iran, since all records of large aggregations were documented from late summer or autumn. However, some of these aggregations could represent colonies remaining from the nursing period. The first such record was reported by Lay (1967: 148) from the Azarbaijan province: "Several hundred [*Miniopterus*] inhabited the cave 44 km. southeast of Maku. Here many hung in clusters from the ceiling, while several groups took refuge in small cavities in the ceiling […]. Although exceedingly fat, these bats remained active on September 31." The roost was described by Lay (1967: 90) as follows: "Forty-three kilometers southeast of Maku a cave near top of a large limestone dome, between two mountain ridges, […]. The entrance led immediately into a large, high-ceilinged circular room (ca. 60×60 m.). A passage at the back of this chamber led down into a series of tunnels about 30 m. in length. Large cavities existed below these upper tunnels but the small cracks connecting the two would not allow my passage. Water dripped through the rear tunnels creating a cool, moist situation throughout the cavern." Concerning the sex ratio of the collected samples (18 males : 13 females, no juveniles noted; DeBlase 1980), the type of the colony is not clear (regular aggregation of roosting bats vs. aggregation remaining from a nursery colony). A similar ratio, 8 males : 9 females, without juveniles, was collected from a colony of some 1000 *M. pallidus* observed by DeBlase (1980) in the River Cave or Korie Cowat (Kermanshah), respectively, on 23 August 1968; the bats were found in torpor, hanging singly or in pairs. DeBlase (1980: 316–317) described the cave and the observation inside as follows: "From a very large semi-circular opening […] the cave floor sloped very steeply downward to a tunnel containing a stream. The stream was flowing toward the tunnel entrance at the bottom of the slope and disappeared through an opening that was under the slope and was completely concealed beneath the water. The twilight zone ended at about the point where we reached the water. We waded upstream and observed numerous *Myotis blythi* and *Miniopterus schreibersi* [= *M. pallidus*] hanging from the ceiling of the cave. Several meters back from the tunnel entrance the cave bent to the right at a sharp angle, but at this point the stream depth was above our waists and we did not continue further. A very large cluster of *M. blythi* carpeted the ceiling above the deep water at the bend. I estimated the numbers we had observed as 7,000 *M. blythi* and 1,000 *M. schreibersi* [= *M. pallidus*]." A large colony of some 5500 bats, mixed of *M. pallidus*, *Myotis blythii* and *Rhinolophus mehelyi* in the ratio of ca. 2 : 8 : 1, thus, containing about 1000 individuals of *Miniopterus*, was observed by DeBlase (1980) in the Gara Tarik cave at Qareh (Kordestan) on 14 August 1968 (for description of the cave see under *R. mehelyi*). DeBlase (1980: 325) added: "The *M. schreibersi* [= *M. pallidus*] were […] rather active but less quick to fly." Eleven males and fifteen females were collected from this colony, no juvenile or subadult specimens were noted by DeBlase (1980).

Several records of *Miniopterus* aggregations are available from the Mahidasht cave (Kermanshah); Sharifi (2004a) observed a colony of 140 bats there in August 2001, Akmali (2004) "a large colony" on 18 October 2002. Records of *M. pallidus* from this cave were reported also from other visits, however, it is not clear whether a colony of this bat was present; Sharifi et al. (2002) collected three specimens there on 20 October 2000 and Rahimi et al. (2007) altogether fifteen bats on 18 October 2000, 27 March 2001, 26 April 2001, 2 May 2001, 26 June 2001, and 10 October 2001. These data suggest a permanent presence of at least several individuals of this bat in the Mahidasht cave throughout the year, including the period of existence of nursery colonies (presumably May–July), but with the exception of the hibernation period (or no data are available from that period, respectively). This large cave served as a roost of five bat species (see below) with an estimated total population of about 3000 bats; however, it was destroyed due to mining activities (Akmali et al. 2011a). A large colony of some 1500 individuals of *M. pallidus* was observed in the Bazangan cave near Sarakhs (Khorasan) in September 2009 and a colony of more than 500 bats in the Golgik cave near Zanjan (Zanjan) on 28 September 2009 (the species was mentioned from the latter cave without details already by Akmali et al. 2011a). Another large colony of some 1000 *Miniopterus* was observed in the Tadovan cave near Jahrom (Fars; Figs. 43, 44; see under *Rhinopoma microphyllum* for description of the cave by DeBlase 1980) on 7 October 2011; this bat was documented in this cave also on 21 November 2009 (most probably a hibernating individual found in torpor), and also by Akmali et al. (2011a), who, however, did not give any details concerning the date or the number of bats. A smaller colony of some 50 *Miniopterus* bats was observed in the large cave above the Sasan spring at Bishapur near Kazerun (Fars) on 6 October 2011; the bats were hidden in a corridor leading from the main dome of the cave where also colonies of *Rousettus* and *Rhinopoma* were present (see details under *Rousettus aegyptiacus*). The *Miniopterus* aggregations of various size were observed several times in the Karaftu cave near Takab (Kordestan) in different seasons, including winter; for the description of

Fig. 204. *Miniopterus pallidus* Thomas, 1907 roosting in the Tadovan cave (Fars). Photo by A. Reiter.

this combination of natural and artificial caves see under *Myotis blythii* (see Figs. 31–33). DeBlase (1980) visited the cave on 16 August 1968 and found 50–60 scattered bats in torpor there from which a minority, ca. 25 individuals, were *Miniopterus* (the sex ratio of the collected specimens was one male to three females). Hemmati (2001) and Karataş et al. (2008) observed and/or collected *M. pallidus* in the Karaftu cave also on 19 February 1998, 24 July 2000 and 9 June 2006, however, they gave no closer data on the records; the former observation from February most probably represents a hibernation record. During the last visit in the cave on 18 October 2011, an aggregation of about one hundred bats in torpor was observed. These data suggest the whole-year use of the Karaftu cave as a roost by *M. pallidus*.

Hibernation records of *M. pallidus* are available also from other roosts, mostly natural caves. Lay (1967) found several hibernating individuals of *Miniopterus* in the Shahpur cave at Bishapur (Fars; for details on the cave see under *Rhinolophus ferrumequinum*) on 29 December 1962 and about 145 *Miniopterus* individuals hanging singly or in pairs in torpor were observed in this cave on 9 October 1968 by DeBlase (1980). Lay (1967: 148), describing a hibernation record of *Miniopterus* made in winter 1962, noted as follows: "Bats of this species had entered hibernation when we examined Ganjah Kuh cave [at Jochdi, Khorasan], November 12. It should be noted, however, that this latter locality lies 1220 m. higher than the Turkmen Plains. Because of the difference in ambient temperatures of these two places [i.e. Ganjah Kuh and Gorgan] one might expect that the *M. schreibersi* [= *M. pallidus*] inhabiting the higher, colder locality enter hibernation earlier. At Ganjah Kuh cave *M. schreibersi* [= *M. pallidus*] were present in the ratio of about one-to-ten *Rhinolophus blasii* in a compact, unsegregated colony that numbered in excess of 500 bats." (For description of the cave by DeBlase 1980 see under *Rhinolophus ferrumequinum*.) A colony of some 150 individuals of *M. pallidus* in torpor, most probably also representing a hibernation aggregation, was observed in the Vayqan cave at Kalibar (Azarbaijan) on 23 October 2009. The only artificial hibernaculum of *M. pallidus* known from Iran was described by Lay (1967), who found a mixed colony of *Miniopterus* and *Myotis capaccinii* "in vertical well shaft" at Pol-i-Abgineh (Fars) on 28 December 1962; since Lay (1980) misidentified all the bats from the colony as *M. capaccinii*, there is no information on the size of the part of the colony composed of *Miniopterus* (see other details under *M. capaccinii*).

At numerous sites, smaller groups or solitary individuals of *M. pallidus* were found to roost. Lay (1967) collected two individuals from the Zangamar river cave near Maku (Azarbaijan) on 27 September 1962; he noted on the record (p. 148): "A few *M. schreibersi* [= *M. pallidus*] roosted among many *Rhinolophus euryale* [= *R. euryale* and *R. mehelyi*; see DeBlase 1980] in the large, wet cave near Maku." For the description of the cave see under *R. euryale*. Several specimens of *M. pallidus* were collected from the spacious Ali Sadr cave near Gol Tappeh (Hamadan) on two occasions; Etemad (1967) reported one female found in the cave in August 1965 and DeBlase (1980: 244) mentioned nine BMNH specimens collected "150 m. inside wet and muddy cave" on 2 September 1973. Several times, *M. pallidus* was documented from the Mozduran cave at Mazdavand (Khorasan); Etemad (1967) collected one male there in September 1963, Steiner (in Steiner & Gaisler 1994) one mummified specimen on 17 August 1968, Felten (in DeBlase 1980 and Kock 1983) fifteen individuals on 4 October 1974, and last time, a group of some 20 bats was observed there in September 2009. In the nearby situated Moghan cave, south-west of Mash'had (Khorasan), several or several tens of individuals of *M. pallidus* were collected by Etemad (1967) in September 1963 and a similar number by Farhang-Azad (1969) in July 1968; concerning the latter record, Farhang-Azad (1969: 732) noted: "These specimens were mating at the time collected." Etemad (1967) found one female in the Senje Bashi cave near Mahallat (Markazi) in March 1965. Collection of thirteen BMNH individuals of *M. pallidus* "20 m. inside [the] cave" of Arac Langri in the Malayer area (Hamadan) on 25 August 1973 was reported by DeBlase (1980: 244).

Different numbers of *M. pallidus* were recorded in the Dehloran cave at Dehloran (Ilam; Fig. 206); for description of this cave, called also Sarin Ab-Garma Cave or Khofash cave, see under *Rhinopoma microphyllum*. DeBlase (1980: 244) collected 14 individuals there on 5 September 1968, adding: "Collected with handnet while flying in cave at dusk. Only seen among 5,000 *A. tridens* and *R. microphyllum* roosting." Sharifi et al. (2002) observed a large aggregation there and Furman et al. (2009) collected one individual there; also Akmali et al. (2011a) reported *M. pallidus* from this cave, however, they did not give any details concerning the date or the number of bats. Hemmati (2001) collected altogether 29 specimens from the Kilasefid cave near Qasr-e Shirin (Kermanshah) during three visits in 1999–2000; the same author found one female in the Aftabi cave (Kordestan) on 24 July 2000. Sheikh-Jabbâri (2008) found four *M. pallidus* in the Kojanagh cave near Meshginshahr (Ardabil) on 31 May 2007 and Hemmati (2009) reported one male, most probably a hibernating individual, from the Golgik cave near Zanjan (Zanjan) on 7 December 2008. One female specimen discovered in HNMH was collected in the Shirabad cave at Khanbebin (Golestan) in October 1997. One *M. pallidus* was found in torpor in the Kharmanesar cave at Shahneshin near Abbar (Zanjan) on 27 September 2009, and 5–7 active individuals were observed in the Sarab cave at Omid Abad (Chahar Mahal va Bakhtiari) on 13 August 2010.

As mentioned above, Akmali et al. (2011a) reported findings of *M. pallidus* from several caves (Dehloran cave, Golgik cave, Mozaffar cave, Tadovan cave, Zivieh cave), however, without specification of observation details.

At a majority of these sites, *M. pallidus* was recorded to share its roost with other bat species. Lay (1967) reported four bat species found together in the Shahpur cave during the visit in December 1962 (besides *M. pallidus* also *Rhinolophus mehelyi*, *Myotis capaccinii* and *Pipistrellus kuhlii*) and DeBlase (1980) found five bat species there during the visit in October 1968 (*M. pallidus* plus *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis capaccinii*, and *Pipistrellus pipistrellus*). Five bat species were collected also from the Mozduran cave in October 1974 (Felten

Fig. 205. Abdanan river valley near Mormori (Ilam), a foraging habitat of *Pipistrellus kuhlii* and *Miniopterus pallidus*. Photo by A. Reiter.

et al. 1977, Kock 1983); in addition to *M. pallidus* also *Rhinolophus ferrumequinum*, *R. euryale*, *R. blasii*, and *Myotis blythii*, however, this species number was not confirmed during other visits of the cave, Etemad (1967) reported additionally only *R. ferrumequinum* from September 1963 and only *R. blasii* was found in the cave along with *M. pallidus* in October 2009. Five bat species roosting together were also documented in the Tadovan cave in November 2009, when *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus ferrumequinum*, and *R. euryale* were observed along with *M. pallidus*, and even seven species in October 2011, when also *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus ferrumequinum*, *R. blasii*, *Myotis blythii*, and *M. capaccinii* were found. Five bat species were reported by Etemad (1967, 1984) from the Azad-Khan cave, however, it is not clear whether all of them were present in the cave during the same visit; viz. *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis blythii*, *M. emarginatus*, and *M. pallidus*. A community of three species was documented in the Karaftu cave, where *R. ferrumequinum* and *Myotis blythii* were found along with *M. pallidus* in October 2011, while Hemmati (2001) reported a triad composed of *Rhinolophus mehelyi*, *M. blythii*, and *M. pallidus* from this cave; in August 1968, DeBlase (1980) documented only two species from this cave, *M. pallidus* and *M. blythii*. DeBlase (1980) reported findings of three species including *M. pallidus* in the Gara Tarik cave (plus *R. mehelyi* and *M. blythii*), and in the Zangamar river cave at Maku (plus *Rhinolophus euryale* and *R. mehelyi*). In September 1968, DeBlase (1980) observed *M. pallidus* along with colonies of *Rhinopoma microphyllum* and *Asellia tridens* in the Dehloran cave. From the Golgik cave near Zajan, Hemmati (2009) reported roosting of four species, *M. pallidus*, *Rhinolophus blasii*, *Myotis blythii* and *Plecotus macrobullaris* (Akmali et al. 2011a found only *M. pallidus* and *Rhinolophus hipposideros* there, moreover, it is not clear if these species were present in the cave simultaneously). Various authors reported observations of *Rhinolophus mehelyi*, *Myotis blythii*, *Pipistrelus kuhlii* and *M. pallidus* during different visits of the Kilasefid cave near Qasr-e Shirin and simultaneous occurrence of these species cannot be excluded there. A similar situation is in the Mahidasht cave near Kermanshah, where various authors reported presence of *Rhinolophus mehelyi*, *Myotis blythii*, *M. capaccinii*, *Pipistrellus pipistrellus*, and *M. pallidus*. *M. pallidus* was found along with *Rhinolophus hipposideros* and *Myotis blythii* in the Moghan cave. In the large cave above the Sasan spring at Bishapur, colonies of four species were documented, besides *M. pallidus* also *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, and *R. muscatellum*.

In several sites, *M. pallidus* shared its roost with one additional bat species. Lay (1967) reported also *Rhinolophus ferrumequinum* from the Ganjah Kuh cave and this species was found with *M. pallidus* also in the Vâyqân cave. Sheikh-Jabbâri (2008) found *R. ferrumequinum* in the Kojanagh cave in November 2005, while in May 2007, he found *M. pallidus* there; simultaneous occurrence of these species is thus very probable in this cave. In the Kharmanesar cave, *M. pallidus* was found along with *Myotis blythii*, in the Aftabi cave along with *Rhinolophus mehelyi*, and in the Bazangan cave along with a medium-sized horseshoe bat (i.e. *Rhinolophus euryale* or *R. blasii*). The only artificial roost of *M. pallidus* known in Iran, the well shaft at Pol-i-Abgineh, was shared by this species with *Myotis capaccinii* (DeBlase 1980).

In summary, *M. pallidus* was found to share its roosts with the very high number of fifteen bat species. Roost sharings at three sites or more was found for ten species, viz. (ordered by frequency) *Myotis blythii* (12 sites), *Rhinolophus ferrumequinum* (9), *R. mehelyi* (7), *Myotis capaccinii* (5), *Rhinopoma microphyllum* (4), *R. hipposideros* (4), *R. blasii* (4), *Rhinopoma muscatellum* (3), *Rhinolophus euryale* (3), and *Pipistrellus kuhlii* (3). Other five bat species (*Rousettus aegyptiacus*, *Asellia tridens*, *Myotis emarginatus*, *Pipistrellus pipistrellus*, *Plecotus macrobullaris*) were found to share the *M. pallidus* roosts only once.

Several times, *M. pallidus* was netted at the entrances to caves. Karataş et al. (2008) netted one female at the Dehloran cave (Ilam). At the Darre Duali cave near Shahr-e Kord (Chahar Mahal va Bakhtiari), 39 individuals of *M. pallidus* were netted in the summer 2001 and other four individuals in May 2010 (along with seven *Myotis blythii*). Eighteen *M. pallidus* were netted at the Sarab cave at Omid Abad (Chahar Mahal va Bakhtiari) in the summer 2001 (along with *Rhinolophus ferrumequinum* and *Myotis blythii*). At a small cave in the rocky massif above the Bisotun village (Kermanshah), in the rock wall where also the ancient monument of Bisotun is present, three individuals of *M. pallidus* were netted on 8 October 1998. During this netting session, also *Rhinolophus ferrumequinum*, *Myotis capaccinii*, and *Eptesicus anatolicus* were netted, and calls of *Tadarida teniotis* recorded. One adult male was caught into a net installed at the entrance of the Dashkahul cave at Dashkasan near Meshginshahr (Ardabil) on 29 September 2011 (along with *Eptesicus serotinus* and *Plecotus macrobullaris*); this small cave is situated on the northern slope of Mount Sabalan at 1920 m a. s. l. (Fig. 200), surrounded by extensively used farmland. Altogether 118 *M. pallidus* of both sexes were caught into a net exposed at the entrance to the Tadovan cave near Jahrom (Fars) on 7 October 2011, when entering or leaving of the cave; a large colony of about one thousand bats of this species was found to roost inside the cave, along with smaller colonies of other bats, see above. *Rhinopoma microphyllum*, *R. muscatellum*, *Myotis blythii*, and *M. capaccinii* were also netted during this netting session.

At several sites, individuals of *M. pallidus* were recorded in their foraging habitats. Lay (1967: 76) reported: "We shot several *Pipistrellus pipistrellus* and single examples of *Miniopterus schreibersi* [= *pallidus*] and *M.* [cf.] *mystacinus* as they flew over a pool in the Qareh Su drainage on the plains 9 km. north of Gorgan [Golestan]." and at another site Lay (1967: 48) mentioned: "Eight kilometers north of Gorgan, about 9:00 P.M., October 31 [1962], we shot one [male] as it flew about catching insects over a lagoon." Farhang-Azad (1969a) reported on netting over a small stream at Chelmir (Khorasan) within the main range of the Kopetdagh Mts. in July 1968; during the netting session covering probably more evenings, an extremely rich community of bats was recorded, composed of nine species: along with three males of *M. pallidus*, also *Rhinolophus ferrumequinum*, *Myotis blythii*, *M. emarginatus*, *Eptesicus serotinus*, *E. ognevi*, *Hypsugo savii*, *Otonycteris*

Fig. 206. Dehloran cave in the arid landscape north of Dehloran (Ilam), a roost of large colonies of *Rhinopoma microphyllum*, *R. muscatellum*, *Asellia tridens*, and *Miniopterus pallidus*. Photo by A. Reiter.

leucophaea, and *Tadarida teniotis* were caught. Next year, at the same site Farhang-Azad (1970a) netted one male of *M. pallidus* along with *Rhinolophus blasii*, *Myotis blythii*, *Eptesicus serotinus*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Nyctalus leisleri*, *Otonycteris leucophaea*, and *Tadarida teniotis*. DeBlase (1980: 244) reported on an individual "shot near spring above lodge, much subcutaneous fat," on the Kabudan island, Oromiyeh lake, on 6 November 1969 (Azarbaijan). One individual of *M. pallidus* (plus one *Rhinolophus blasii*) was netted at Dashtak near Yasuj (Fars) on 3 May 1996. *M. pallidus* was registered twice at Lenje Abad near Dorud (Lorestan); on 8 October 1998, an adult male was netted, and on 1 October 2011, echolocation calls of a foraging individual were recorded in the floodplain vegetation in the broad valley of the Dez river south of Dorud (Fig. 40). During the former evening, also *Vespertilio murinus* and *Pipistrellus pipistrellus* were netted, during the latter evening, one individual of *P. pipistrellus* was netted and calls of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Asellia tridens*, *Pipistrellus kuhlii*, and *Tadarida teniotis* were detected and recorded. Seven adult males of *M. pallidus* were netted above a pool at a thermal spring situated in a small valley south of Mina on the northern slope of the Kopetdagh Mts. near Dargaz (Khorasan) on 22 May 2006; the site was ringed by several trees and a small area of riparian vegetation, while the surrounding landscape by dry steppes and pastures. At this site also *Myotis blythii* and *Hypsugo savii* were netted. One subadult female of *M. pallidus* was netted into a net exposed above a river in the valley near Meymand (Kohgiluye va Boyer Ahmad) on 4 October (Fig. 48); at this site *Pipistrellus pipistrellus* and *P. kuhlii* were also netted and their calls detected. Three adult males of *M. pallidus* were caught into a net installed above a small stream in a pasture valley near Hesar (Fars) on 5 October 2011 (Fig. 143); *Myotis blythii*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *P. kuhlii*, and *Tadarida teniotis* were netted along with *M. pallidus* at Hesar. An adult female was netted and calls of several foraging individuals were detected above the Abdanan river at Mormori near Dehloran (Ilam) on 16 October 2011; the river runs there through a very arid rocky landscape with few traces of vegetation (Fig. 205). The bat perhaps originated from the colony roosting in the Dehloran cave, some 25 km west of the site in aerial distance; however, during the visit made on the same day, the colony was not documented in the cave, but it was found there previously by other authors (see above). Calls of *Pipistrellus kuhlii* were also detected at the latter netting site.

Sharifi et al. (2002) and Rahimi et al. (2007) observed some characteristics of the reproduction cycle of *M. pallidus* in western Iran (however, the latter paper is largely a translation of the former to Farsi). Sharifi et al. (2002: 62) described the microscopic observation of the female genitalia from two bats dissected in late October as follows: "The presence of corpus luteum […] indicates that the bat has released an ovocyte. Moreover, an active endoderm of the ovary […] indicates that this bat is prepared to engulf a fertilized egg if copulation occurs successfully. The size of growing follicles […] demonstrates that the female reproductive tract is in oestrous state." These data give the only information on reproduction of *M. pallidus* from Iran. Although Sharifi et al. (2002: 63) estimated "the total gestation period for western Iran […] to be 7.5 to 8 months", they did not give any data supporting this estimation.

From the Lesser Caucasus (SW Azerbaijan), Rahmatulina (2005) reported the following data on the reproduction of *Miniopterus* (presumably *M. pallidus*, see Furman et al. 2009, 2010a, Benda et al. 2011c): the development of embrya started at the end of the hibernation period, in early April; small embrya were observed in mid-April; juveniles were observed in the second half of June and in July; the term of parturitions was spread over 30 days; the weight of juveniles was on average some 86% of the weight of adults at the end of August; the lactation period finished in the second half of July. Similarly, Aşan Baydemir & Albayrak (2006) reported for Anatolian populations (i.e. observations mixed of the data from *M. pallidus* and *M. schreibersii*) findings of pregnant females in April, May, and June and of lactating females in June and July. Most pro-

Table 36. Basic biometric data on the examined Iranian samples of *Miniopterus pallidus* Thomas, 1907, *Tadarida teniotis* (Rafinesque, 1814), and *Nyctinomus aegyptiacus* (Geoffroy, 1818). For abbreviations see p. 171

	Miniopterus pallidus					*Tadarida teniotis*					*Nyctinomus aegyptiacus*				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LC	19	**60.1**	56	65	2.747	12	**91.3**	87	95	2.563	3	**79.0**	78	81	1.732
LCd	19	**61.6**	58	66	2.241	12	**54.8**	49	61	3.810	3	**54.7**	53	56	1.528
LAt	32	**46.18**	43.4	48.0	0.965	13	**61.07**	57.8	63.1	1.784	3	**53.83**	52.7	55.1	1.206
LA	19	**13.48**	11.7	14.9	0.852	12	**32.38**	29.0	36.1	1.904	3	**25.70**	24.3	27.2	1.453
LT	19	**5.68**	4.9	6.3	0.369	12	**7.34**	6.2	8.8	0.869	3	**6.50**	6.1	6.8	0.361
LCr	20	**15.34**	14.93	15.83	0.261	12	**24.03**	23.56	24.56	0.283	3	**20.59**	20.12	21.22	0.569
LCb	20	**14.91**	14.56	15.32	0.245	11	**23.42**	23.02	24.02	0.309	3	**20.30**	19.82	20.92	0.562
LaZ	20	**8.76**	8.44	9.19	0.189	12	**14.19**	13.87	14.47	0.247	3	**12.73**	12.49	13.09	0.316
LaI	21	**3.53**	3.24	3.79	0.109	12	**4.63**	4.39	4.77	0.124	3	**4.23**	4.10	4.32	0.117
LaInf	20	**4.05**	3.81	4.21	0.104	12	**4.95**	4.62	5.38	0.189	3	**5.00**	4.83	5.23	0.208
LaN	20	**8.05**	7.64	8.41	0.183	12	**11.88**	11.39	12.26	0.245	3	**9.77**	9.67	9.90	0.117
LaM	20	**8.83**	8.43	9.21	0.220	12	**12.92**	12.42	13.17	0.212	3	**11.67**	11.59	11.79	0.106
ANc	20	**6.49**	6.06	8.19	0.427	11	**7.26**	6.93	7.57	0.223	3	**6.60**	6.42	6.81	0.197
LBT	19	**3.01**	2.82	3.17	0.107	12	**5.46**	5.21	5.68	0.152	3	**4.54**	4.44	4.67	0.117
CC	20	**4.63**	4.33	4.87	0.136	12	**5.70**	5.49	5.93	0.163	3	**5.56**	5.28	6.10	0.465
M^3M^3	20	**6.46**	6.26	6.64	0.126	12	**9.50**	9.23	9.75	0.174	3	**8.93**	8.62	9.32	0.358
CM^3	20	**5.98**	5.83	6.21	0.118	12	**9.07**	8.81	9.61	0.224	3	**8.06**	7.88	8.29	0.208
LMd	26	**10.85**	10.23	11.34	0.234	12	**16.96**	16.42	17.44	0.306	5	**14.61**	14.13	15.05	0.334
ACo	26	**2.55**	2.39	2.71	0.079	12	**4.04**	3.81	4.23	0.147	5	**4.21**	4.02	4.37	0.139
CM_3	20	**6.39**	6.21	6.65	0.120	12	**9.76**	9.50	10.41	0.247	3	**8.63**	8.42	8.87	0.226

bably, similar timing of reproduction as in the *Miniopterus* bats in Azerbaijan and Turkey can be expected also in the Iranian populations of *M. pallidus*.

Osteological remains of *M. pallidus* were recorded in pellets of two owl species coming from four sites of Iran (Table 40). At all sites this species was found in pellets of *Bubo bubo*, at one of them also in pellets of *Strix aluco*. Remains of a skull were documented from the eagle owl pellets collected at Gonbad (Hamadan) and two pairs of mandibles from pellets collected at Sivand (Fars). Owl pellets were collected twice near Bishapur (Fars), in the large cave above the Sasan spring and in Shapur cave, and in both caves remains of *M. pallidus* were found in this material; fragments of a skull and a pair of mandibles (i.e. bones from one individual) in Shahpur cave in 1996 and three mandible pairs with some skull fragments (i.e. from three individuals) in the large cave at Bishapur 2000. These *M. pallidus* remains made up 1.0–6.7% (mean 3.22%) of all prey items (and 1.7–16.7% [mean 6.22%] of mammal items) in the respective samples and 0.09% of all prey items (0.12% of mammal items) in the whole analysed eagle owl diet from Iran (Table 40). Two mandibles from one individual of *M. pallidus* were recorded from pellets of *Strix aluco* also collected in the large cave above the Sasan spring at Bishapur (Obuch 2011). This finding represented 0.50% of all prey items (and 4.17% of mammal items) in the respective sample and 0.15% of all prey items (0.37% of mammal items) in the whole analysed tawny owl diet from Iran (Table 40). Although in the Middle East remains of *Miniopterus* bats were obtained from owl pellets in various countries (see the review by Benda et al. 2006), no published records of *M. pallidus* seem to be available outside Iran.

Material examined. 1 ♂ (NMP 93874 [S+A]), Bishapur (Fars Prov.), 6 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin; – 4 inds. (JOC unnumbered [Sf]), Bishapur (Fars Prov.), 21 April 2000, leg. J. Obuch; – 2 ♂♂, 1 ♀ (NMP 48149–48151 [S+A]), Bisotun (Kermanshah Prov.), 8 October 1998, leg. M. Andreas,

P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93860 [S+A]), Dashkahul cave, Dashkasan (Ardabil Prov.), 29 September 2011, leg. leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93869 [S+A]), Hesar (Fars Prov.), 5 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂ (NMP 93912, 93913 [S+A]), Karaftu cave (Kordestan Prov.), 18 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (HMNH 2007.30.8. [S]), Kojanagh cave [Ardabil Prov.], 31 May 2007, leg. E. Sheikh-Jabbari & H. Sheikh-Jabbari; – 1 ♂ (NMP 48154 [S+A]), Lenje Abad (Lorestan Prov.), 8 October 1998, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 93865 [S+A]), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 7 ♂♂ (NMP 90825–90830 [S+A], NMP 90831 [A]), Mina (Khorasan-e Razawi Prov.), 22 May 2006, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 93902 [S+A]), Mormori (Ilam Prov.), 16 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (HMNH 2000.63.7. [A]), Sanandaj [Kordestan Prov.], 11 September 1998, leg. M. Szatyor; – 1 ♀ (HNMH 2007.3.15. [S]), Shirabad cave [Golestan Prov.], October 1997, leg. S. Ashrafi, M. Peymani & H. Zohoori; – 2 inds. (JOC unnumbered [S]), Sivand (Fars Prov.), 20 April 1996, leg. J. Obuch; – 1 ♂ (NMP 93882 [S+A]), Tadovan cave (Fars Prov.), 7 October 2011, leg. M. Andreas, S. Ashrafi, P. Benda, K. Faizolahi, A. Reiter & M. Uhrin.

MORPHOLOGY AND VARIATION. External and cranial dimensions of the Iranian specimens of *Miniopterus pallidus* are shown in Table 36. For the material examined see above.

The *Miniopterus* populations from the northern part of the Middle East including Iran were traditionally assigned to *M. schreibersii pallidus* Thomas, 1907 (type locality: vicinity of Bandar-i-Gaz on the southeast coast of the Caspian Sea [Golestan, Iran]; Lay 1967: 148) (Ellerman & Morrison-Scott 1951, Aellen 1959a, Harrison 1964, Kuzâkin 1965, Gaisler 1970, Corbet 1978, Strelkov et al. 1978, DeBlase 1980, Strelkov 1981a, Nader & Kock 1987, Harrison & Bates 1991, Koopman 1994, Horáček et al. 2000, Rahmatulina 2005, Simmons 2005). Thomas (1907) described the subspecies *M. s. pallidus* on the basis of a different pelage colouration, being paler on the dorsal side and more brownish on the belly than the European *M. s. schreibersii* (Kuhl, 1817). Harrison (1956a) described another form from the Middle East, *M. s. pulcher* Harrison, 1956 (type locality: Ser'Amadia, Kurdistan, Northern Iraq; Harrison 1956: 261), differing from *M. s. schreibersii* and *M. s. pallidus* by paler and greyish dorsal pelage colouration. However, the subspecies *M. s. pulcher* was almost immediately rejected (Aellen 1959a) and the name was considered a junior synonym of *M. s. pallidus*. Later on, Lay (1967: 150), based on examination of the Iranian samples of the *Miniopterus* bats argued to refuse both names from the Middle East as follows: "The evidence of molt presented by our Iranian series of *M. schreibersi* […] strongly suggests that pelage color changes greatly in the period between molts. Unless fading can be eliminated as possible cause of seemingly geographic differences, pelage color is evidently therefore of no taxonomic value for defining subspecies of this bat in Europe and the Middle East. *M. s. pallidus* Thomas and *M. s. pulcher* Harrison represent different stages in the annual pelage color change of *M. s. schreibersi* Kuhl, and should be regarded as synonyms of it." However, this opinion was almost completely refused by subsequent authors and the name *pallidus* continued to be used for assignation of the north-Middle Eastern populations, although no other character than colouration have been suggested to distinguish them from the European *Miniopterus* bats (for other details see the review by Benda et al. 2006).

However, in the last few years a series of papers have appeared (Bilgin et al. 2006, 2008a, 2012, Furman et al. 2009, 2010a, b, Šrámek et al. in press), which subsequently gathered arguments to recognise the *Miniopterus* populations from the eastern part of the Middle East as a separate species. Based on the results of molecular genetic analyses, Bilgin et al. (2006) and Furman et al. (2009) suggested two forms of *M. schreibersii* to occur in a clear parapatry in the Middle East, *M. s. schreibersii* in coastal areas of the eastern Mediterranean and *M. s. pallidus* in continental areas of Anatolia and in Iran. Furman et al. (2010b) and Bilgin et al. (2012) further suggested that these two forms represent separate species, based on genetic and also biogeographical characters – evidence of roosts shared by bats belonging to both genetic lineages as well as presence of a very low hybridization rate. Furman et al. (2009) and Šrámek et al. (in press) analysed genetic material of the genus *Miniopterus* from a higher number of Iranian localities including eastern regions of the country (Ilam, Kermanshah, Khorasan, Kordestan, Lorestan; see Fig. 202) and found solely members of the *pallidus* lineage there. Since the type locality of *M. pallidus* (see above) lies between the sites of origin of the analysed samples, we regard this name appropriate for designation of the populations inhabiting the territory of Iran and the species represented by the respective genetic lineage as well. According to the available data (see also Šrámek et al. in press), no geographical variation has been found in *M. pallidus*.

Karataş et al. (2008) described karyotype of the species using specimens originating from in western Iran (Ilam, Kordestan): the diploid number of chromosomes 2n=46, the fundamental number of arms NF=54, the number of autosomal arms NFa=50, X chromosome metacentric, Y chromosome acrocentric.

ECHOLOCATION. No published data on echolocation characteristics of *Miniopterus pallidus* are available. We recorded calls of this species at a single site in Iran, produced by flying bats inside the Tadovan cave (Fars; Fig. 207). Basic values of measured echolocation characteristics are given in Table 3, we observed the frequency of maximum energy at ca. 56 kHz. The pattern of echolocation calls is similar to that described in the close relative of *M. pallidus*, the European *M. schreibersii*, with an exception of the peak frequency, which is lower by ca. 2 kHz in the European species (Russo & Jones 2002, Obrist et al. 2004, Papadatou et al. 2008).

FEEDING ECOLOGY. Bats of the *Miniopterus schreibersii* complex are aerial hawkers hunting mostly in open spaces, however, manoeuvrable flights around street lamps, below the forest canopy or close to vegetation were also observed (Lugon & Roue 1999, Presetnik 2002, Dietz et al. 2007). The diet composition of *M. schreibersii* s.str. is most frequently dominated by Lepidoptera (Lugon & Roue 1999, Benda et al. 2006). Whitaker & Karataş (2009) studied the diet of *M. schreibersii* s.l. from Turkey (presumably including the diets of both *M. pallidus* and *M. schreibersii* s.str.) and

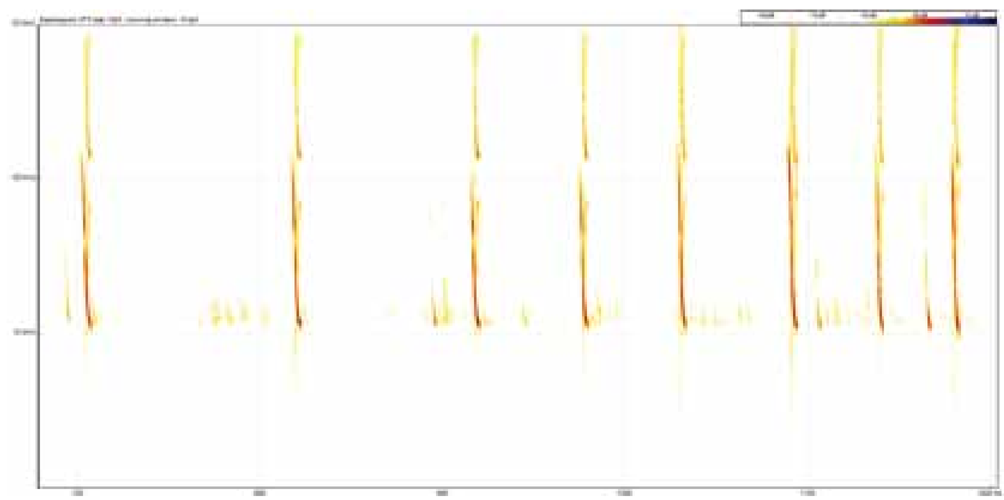


Fig. 207. Spectrogram of echolocation calls of *Miniopterus pallidus* Thomas, 1907; an individual flying inside the Tadovan cave (Fars).

recorded important proportions of Coleoptera (30% of volume), Orthoptera (25%), Lepidoptera (24.5%), and Hemiptera (20%). The diet composition of *M. pallidus* was previously studied only in Jordan and solely remnants of Lepidoptera were documented (Benda et al. 2010).

From Iran, the diet of *M. pallidus* was analysed from six sites throughout the country. We found 100% volume of Lepidoptera in the following sample sets: three digestive tracts from Bisotun (Kermanshah), 25 faecal pellets from two bats netted at Hesar (Fars), 15 pellets from one bat collected at the Tadovan cave (Fars). The diet of *M. pallidus* at other sites was also dominated by Lepidoptera, but some small proportions of other taxa were recorded; viz. Culicidae (0.7% of volume) and neuropteran Hemerobiidae and Chrysopidae (0.7%) in 14 faecal pellets from one bat collected at Meymand (Kohgiluye va Boyer Ahmad), Odonata (5%) in six pellets from one bat collected at Mormori (Ilam), and Neuroptera (2.2%) in 18 pellets from seven bats collected at Mina (Khorasan).

Our results of diet analyses from Iran suggest *M. pallidus* to represent a moth-eating specialist. However, the high proportions of Coleoptera and Orthoptera in the samples from Turkey (Whitaker & Karataş 2009) or Coleoptera in the samples from Syria (Benda et al. 2006) indicate that other prey than moths can be also effectively hunted by bats of this species complex. This view is also supported by the results of diet analyses of *M. natalensis* (Smith, 1834) – another species also belonging to the *M. schreibersii* complex from southern Africa, showing predominance of Diptera and Coleoptera in the diet (Fenton et al. 1977, Fenton & Thomas 1980).

RECORDS OF ECTOPARASITES. **Original data**: N y c t e r i b i i d a e: *Nycteribia schmidlii*: 1 fa (CMŠ [A]) from 1 fs (NMP 93865), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011; – 3 ma, 1 fa (CMŠ [A]) from 1 fa (NMP 93869), Hesar (Fars prov.), 5 October 2011; – 3 fa (CMŠ [A]) from 1 ma, 1 fs, Bishapur, cave at the Sasan spring (Fars Prov.), 6 October 2011; – 1 ma (CMŠ [A]) from 1 ma (NMP 93882), Tadovan, Tadovan cave (Fars Prov.), 7 October 2011; – 1 ma (CMŠ [A]) from 1 fa (NMP 93902), Mormori (Ilam Prov.), 16 October 2011. – *Penicillidia conspicua*: 1 ma (CMŠ [A]) from 1 ma (NMP 93860), Dashkasan, Dashkahul cave (Ardabil Prov.), 29 September 2011; – 1 ma (CMŠ [A]) from 1 fs (NMP 93865), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011; – 1 ma, 1 fa (CMŠ [A]) from 2 ma, Bishapur, cave at the Sasan spring (Fars Prov.), 6 October 2011; – 2 ma, 1 fa (CMŠ [A]) from 1 ma (NMP 93882), Tadovan, Tadovan Cave (Fars Prov.), 7 October 2011. – A r g a s i d a e: *Argas vespertilionis*: 1 nymph (CMŠ [P]) from 1 ma (NMP 93860), Dashkasan, Dashkahul cave (Ardabil Prov.), 29 September 2011. – S p i n t u r n i c i d a e: *Spinturnix psi*: 2 ma, 1 fa, 1 nymphal stage specimen (CMŠ [P]) from 5 ma (NMP 90825–90829), Mina (Khorasan-e Razawi Prov.), 22 May 2006; – 1 ma, 2 fa (CMŠ [P]) from 1 ma (NMP 93860), Dashkasan, Dashkahul cave (Ardabil Prov.), 29 September 2011; – 1 ma, 3 fa, 4 nymphal stages specimens (CMŠ [P]) from 1 fs (NMP 93865), Meymand (Kohgiluye va Boyer Ahmad Prov.), 4 October 2011; – 1 fa (CMŠ [P]) from 1 fa (NMP 93869), 1 fa (CMŠ [P]) from 1 fa, Hesar (Fars Prov.), 5 October 2011; – 3 ma, 5 fa (CMŠ [P]) from 4 ma, 1 fs, Bishapur, cave at the Sasan spring (Fars Prov.), 6 October 2011; – 1 ma (CMŠ [P]) from fa (NMP 93902), Mormori (Ilam Prov.), 16 October 2011. – **Published data**: N y c t e r i b i i d a e: *Nycteribia schmidlii*: 3 ma, 3 fa from 4 inds., Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.], 4 October 1974 (Kock 1983). – *Penicilidia conspicua*: 1 ma from 1 ind., Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.], 4 October 1974 (Kock 1983). – M y o b i i d a e: *Calcaromyobia dusbabeki*: 2 ma, 14 fa, 37 nymphal stage specimens from 17 inds., Iran (undef.) (Uchikawa 1985).

COMMENTS ON ECTOPARASITES. Two species of bat flies parasitic on *Miniopterus pallidus* were collected in Iran, *Nycteribia schmidlii* Schiner, 1853 and *Penicillidia conspicua* Speiser, 1901 (Fig. 208); they are primary parasites of bats of the *M. schreibersii* complex (incl. *M. pallidus*) and belong to the typical cave fauna of flies. Their occurrence spots in Iran represent the eastern extents of distribution ranges of these species; both reach their eastern limits at the margin of *M. pallidus* range – in Turkmenistan and Afghanistan (Aellen 1959b, Hůrka 1969).

The soft tick *Argas vespertilionis* (Latreille, 1796) was collected from *M. pallidus* in north-western Iran. This tick parasitises principally bats of the genus *Pipistrellus* (Beaucournu 1966, Dusbábek 1972). From Iran, it was previously collected only from *Pipistrellus pipistrellus* (Filippova et al. 1976), however, it has been recently recorded also in *Rhinolophus ferrumequinum* and *Pipistrellus pygmaeus* (see under these species)

Fig. 208. Dorsal view of a female *Penicillidia conspicua* Speiser, 1901 collected from *Miniopterus pallidus* Thomas, 1905 from the cave above the Sasan spring at Bishapur (Fars). Photo by O. Balvín.

The mite *Spinturnix psi* (Kolenati, 1856) is a permanent parasite of bats of the genus *Miniopterus* (Uchikawa et al. 1994). *S. psi* is here reported from Iran for the first time (see also under *Myotis capaccinii*). *Calcarmyobia dusbabeki* Uchikawa, 1985 is a mite parasitic on bats of the *Miniopterus schreibersii* group and it probably is a specific parasite of this species complex. Its records are available from eastern Europe, North Africa and the Middle East (Uchikawa 1985, Dubinina et al. 1995).

From neighbouring Afghanistan, mites of the families Macronyssidae and Trombiculidae were additionally collected from the *M. schreibersii* complex (Dusbábek 1970), viz. *Macronyssus leucipe* (Domrow, 1959 and *Audytrombicula taumasia* Vercammen-Grandjean, 1963. However, the suggested primary host of the latter species is *Rhinopoma hardwickii*.

Tadarida teniotis (Rafinesque, 1814)

Records. **Original data**: A r d a b i l: Dâshkasan [1], 17 km SE of Meshginshahr, at cliffs, 29 September 2011: obs., det. & rec. 1 foraging ind. – B u s h e h r: river valley at Darvishi [2], 55 km SE of Khormuj, 13 October 2011: det. & rec. calls of several foraging inds. – F â r s: small cave 3 km SW of Serizjan [3], 10 km N of Firuz Abad, 21 April 2000: net. 1 ma (NMP 48458; cf. Benda et al. 2006, 2008), det. calls of ca. 5 inds.; – valley 10 km NW of Hesar [4], 66 km NW of Marv Dasht, above a stream, 5 October 2011: net. 1 ma (NMP 93870; Figs. 211, 212), det. & rec. calls of several foraging inds.; – Tâdovân [5], 44 km NW of Jahrom, Tâdovân cave, above a wadi below the cave, 7 October 2011: det. calls of 1 foraging ind. – G o l e s t a n: oak forest 5 km E of Tunel-e Golestan [6], 44 km E of Kalaleh, 26 May 2006: det. calls of several inds. – H o r m o z g â n: valley 7 km SE of Gishan [7], 50 km N of Bandar Abbâs, above a river, 19 April 2000: net. 3 ma, 3 fG (NMP 48449–48454; cf. Benda et al. 2006, 2008); – river valley 12 km NNE of Chah Mosallam [8], 42 km NE of Bandar Lengeh, 12 October 2011: det. & rec. calls of several foraging inds. – K e r m â n s h a h: Bisotun [9], 28 km E of Kermanshah, 8 October 1998: det. calls of ca. 5 inds. – K h o r a s â n - e R a z a w i: valley 2 km S of Dorbadam [10], 16 km S of Bajgiran, 23 May 2006: net. 1 ma (NMP 90833; cf. Benda et al. 2006, 2008), det. calls of 2+ inds.; – valley 4 km SE of Emamqoli [11], 30 km N of Quchan, 11 May 1997: det. calls of 1 ind.; – valley 3 km SW of Tahir Abad [12], 45 km NE of Mashhad, above a creek, 21 May 2006: net. 1 fG (NMP 90811; cf. Benda et al. 2006, 2008), det. calls of 1+ ind.; – Shurlaq [13], 53 km WSW of Sarakhs, above a stream, 18 May 2006: net. 2 fa (NMP 90797, 90798; Fig. 210; cf. Benda et al. 2006, 2008). – K h o r a s â n - e S h o m â l i: valley 7 km W of Kalatah Chenar [14], 27 km N of Ashkaneh, 25 May 2006: det. calls of 1+ ind. – K h u z e s t â n: valley 2 km S of Sarkan [15], 9 km SW of Izeh, at a small cave, 12 October 1998: obs. 1 foraging ind.; – valley at Valiabad [16], 15 km SE of Behbahan, at a stream, 14 October 2011: det. & rec. calls of 1 ind. – L o r e s t a n: 3 km S of Lenje Abad [17], 9 km SW of Dorud, 1 October 2011: det. calls of 1+ ind. – M â z a n d a r a n: rocky valley 3 km NW of Nach [18], 18 km E of Baladeh, 30 May 2006: obs. & det. calls of 1+ ind.; – alpine meadow 3 km E of Ilka [19], 34 km W of Baladeh, at a small lake, 31 May 2006: det. calls of 3+ inds. – Q a z v i n: Emamzadeh Mousa [20], 3 km E of Razmiyan, 12 May 2006: det. calls of 2+ inds. – **Published data**: B u s h e h r: Bushire, Persia [= Bushehr] [21], 1 ind., BMNH (Lewis & Harrison 1962), Bushire [= Bushehr], Summer 1968: 1 ms, IPHR (DeBlase 1980). – G o l e s t a n: Foot of the Elburz Mts. S. E. of Caspian [= vicinity of Bandar-e Gaz] [22], 1 ind., BMNH (Lewis & Harrison 1962). – H o r m o z g â n: Minab [23], over the Dozan River, 29 November 1968: shot 1 m, FMNH (DeBlase 1971a). – K h o r a s â n - e R a z a w i: Chelmir [24], above a stream, 14 July 1968: net. 2 fa, 16 July 1969: net. 2 fa, IPHR (Farhang-Azad 1970a ex DeBlase 1980). – S i s t â n v a B a l u c h e s t â n: Kusheh [25],

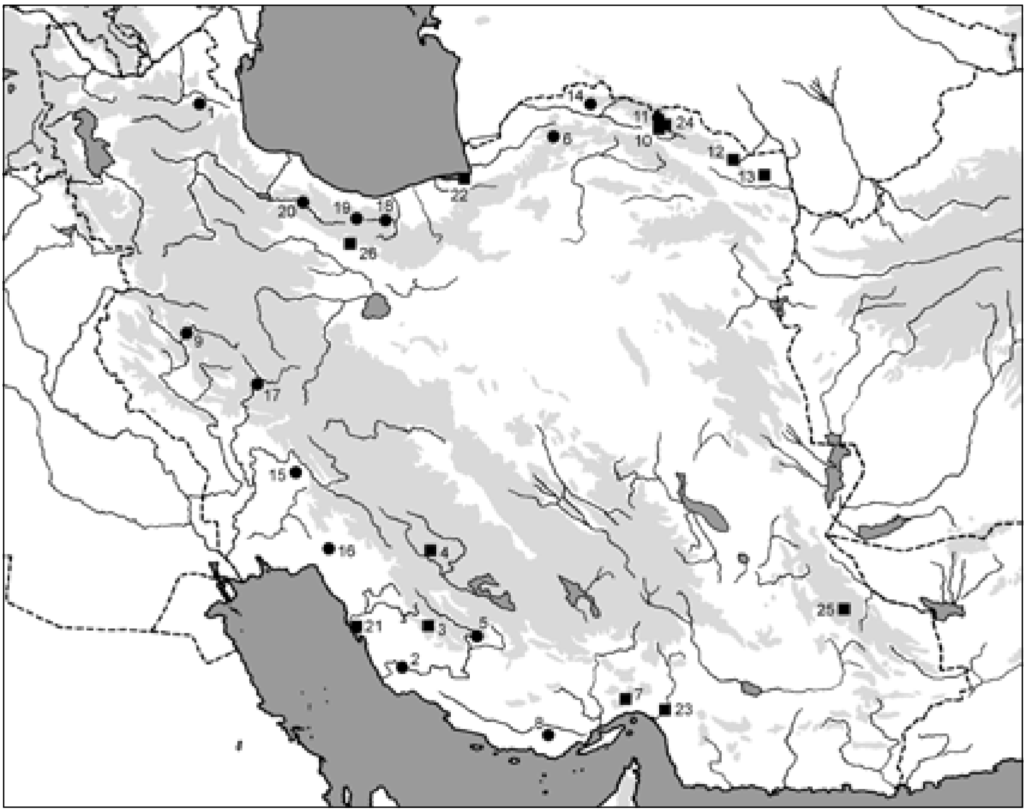


Fig. 209. Records of *Tadarida teniotis* (Rafinesque, 1814) in Iran. Squares denote localities of origin of the examined individuals (see text), circles all other records.

western slope of the Kuh-e Taftan Mt., 2250–2600 m, 14 June 1975: 1 ma, MHNG (de Roguin 1988). – T e h r â n: NW Tehrân [26], 1 m (Etemâd 1984). – Iran (undef.): Persia (de Winton 1901, Trouessart 1904).

Distribution. Although *Tadarida teniotis* is not a quite common bat species in Iran, it is one of the most widespread species – 26 record sites are known throughout the country (Fig. 209). DeBlase (1980) reported only four records of this species from Iran coming from two widely separated areas, northernmost Iran (Golestan and Khorasan) and southernmost Iran (Bushehr and Hormozgan). The sites reviewed here also lie in two regions, although separated less widely. The northern group of localities lies in a narrow belt that stretches over the northern mountain ranges from the Ardabil province via the Alborz Mts. to the Kopetdagh Mts. of Khorasan. The southern group of localities creates a wider belt stretching over rather arid areas along the southern slopes of south-Iranian mountains from the Kermanshah province via the areas adjacent to the Zagros range (Lorestan, Khuzestan, Fars, Hormozgan) to Baluchestan. While the north-Iranian range of *T. teniotis* connects its occurrence in southern Transcaucasia and north-eastern Turkey with the distribution in the southern regions of West Turkestan (Strelkov et al. 1978, Benda & Horáček 1998, Rahmatulina 2005, etc.), the south-Iranian range continues from the Mesopotamian lowlands (Harrison & Bates 1991, Benda et al. 2006). However, since *T. teniotis* is a bat well able to fly in considerable heights over long distances, it is well possible that the two documented areas of distribution in Iran are not isolated from each other, as indicated by the distribution of localities, and that the mountain plateaus of the north-western part of the country are inhabited by this species similarly as in north-eastern Iran.

Fig. 210. Portrait of *Tadarida teniotis* (Rafinesque, 1814) from Shurlaq (Khorasan). Photo by A. Reiter.


Figs. 211, 212. *Tadarida teniotis* (Rafinesque, 1814) from Hesar (Fars). Photo by A. Reiter.

Anyway, despite the conspicuous echolocation calls of this bat, which are easily audible also to the naked ear, *T. teniotis* has been recorded rather scarcely in Iran; the number of sites where individuals were examined (12) is very similar to the number of sites where only calls were detected (14) (Fig. 209). Such a ratio is in variance with the evidence from some other parts of the species distribution range. In the Mediterranean areas of Europe (perhaps those with sufficient distribution of available habitats useful for roosting), this bat was found very frequently and documented mainly by its call registrations, while only exceptionally also by examinations of individuals (Hanák et al. 2001, Benda et al. 2009b). Similarly, in eremic areas of the southern parts of the Middle East where an appropriate investigation was done, e.g. in the southern parts of the Holy Land (Mendelssohn & Yom-Tov 1999, Benda et al. 2008, 2010), *T. teniotis* also ranks among the most common bats. For example, the ratio between evidences of echolocation calls and individual bat examinations was 88:5 in the Mediterranean Crete and 11:5 in arid Jordan, and in both countries *T. teniotis* was the most frequently documented bat species (Benda et al. 2009b, 2010). These values of the ratio indirectly show that the species was more abundant than was the capacity for its catching – unlike the situation documented in Iran.

On the other hand, in the countries situated in the northern parts of the Middle East (Turkey, Azerbaijan, Cyprus, Syria, Lebanon), where climatic/vegetation zones represent a mixture of the Mediterranean arboreal habitats and (continental) semi-arid steppes, *T. teniotis* has not been found to be a quite common, but rather an accesoric member of the fauna (Benda & Horáček 1998, Rahmatulina 2005, Benda et al. 2006, 2007, Horáček et al. 2008). Thus, the pattern of *T. teniotis* distribution in Iran well corresponds with the patterns documented in the latter group of neighbouring territories situated on the transition between the European Mediterranean arboreal and Middle Eastern eremic regions. This geographically broad highland area of transition perhaps possesses such a combination of environmental characteristics, which gives only limited conditions for *T. teniotis* occurrence, unlike both bordering environments.

FIELD NOTES. *Tadarida teniotis* was recorded in Iran solely at its foraging grounds. No data on this species from roosts nor from osteological findings are available. However, some records were not specified, concerning the way of collection (cf. de Winton 1901, Trouessart 1904, Lewis & Harrison 1962, Etemâd 1984).

At least at nine sites, *T. teniotis* was collected during its foraging activity, and at fourteen other sites, the typical echolocation calls of this bat were detected. Farhang-Azad (1970a) reported on four *T. teniotis* netted above a stream at Chelmir in the Kopetdagh Mts. (Khorasan); two females were caught in July 1968 and other two in July 1969. DeBlase (1971a) shot one male as it flew over the Dozan river at Minab in the arid coastal plain of the Strait of Hormuz (Hormozgan) on 29 November 1968. De Roguin (1988) reported an adult male *T. teniotis* (most probably) netted at Kusheh on the western slope of the Kuh-e Taftan Mt. (Baluchestan) on 13 June 1975, at the altitude between 2250–2600 m a. s. l. (see under *Rhinolophus blasii* for a brief description of this site). Three males and three females of *T. teniotis* were netted above a pool of remaining water in an almost dried valley at Gishan (Hormozgan), in the arid rocky landscape (Fig. 92). An adult male was caught into a net stretched across a large rocky overhang / small cave in the wall of the canyon of a large river at Serizjan, north of Firuz Abad (Fars) on 21 April 2000; this record perhaps also indicates a roost – calls of a larger number of *T. teniotis*, flying along the wall with a lot of fissures, crevices and other possible shelters, were detected. Two adult females were caught into a net installed above a stream at Shurlaq near Sarakhs (Khorasan) on 18 May 2006. This site lies at the northern foothill of the Kopetdagh Mts. and on the southern border of the Karakum desert, it is a very arid place covered by dry steppe (Fig. 189). An adult female of *T. teniotis* was netted above a creek in a small village lying in a shallow valley covered by agricultural landscape at Tahir Abad near Mashhad (Khorasan) on 21 May 2006 (Fig. 132) and calls of other individuals

Fig. 213. River valley near Chah Mosallam (Hormozgan), a foraging habitat of *Asellia tridens*, *Otonycteris hemprichii* and *Tadarida teniotis*. Photo by A. Reiter.

of this bat were detected around. An adult male was captured into a net over a small stream and calls of several other individuals of *T. teniotis* were detected in a broad valley at Dorbadam near Bajgiran on the southern slope of the Kopetdagh Mts. (Khorasan) on 23 May 2006 (Fig. 214). Another adult male was netted above a small stream in the pasture valley near Hesar (Fars; Fig. 143) on 5 October 2011 (calls of a larger number of foraging indviduals were also detected).

Echolocation calls of *T. teniotis* were detected in a valley at Emamqoli near Quchan in the Kopetdagh Mts. (Khorasan) on 11 May 1997, in a rocky terrain at Bisotun near Kermanshah in the western Zagros Mts. (Kermanshah) on 8 October 1998, at a small cave in the valley at Sarkan near Izeh in the south-western Zagros Mts. (Khuzestan) on 12 October 1998, at the small village of Emamzadeh Mousa near Razmiyan in the western Alborz Mts. (Qazvin) on 12 May 2006 (Fig. 91), in the valley at Kalatah Chenar near Ashkaneh in the westernmost Kopetdagh Mts. (Khorasan) on 25 May 2006, in the forested valley at Tunel-e Golestan near Kalaleh (Golestan) on 26 May 2006, in the rocky valley at Nach near Baladeh in the central Alborz Mts. (Mazandaran) on 30 May 2006, at a small lake on the alpine meadow at Ilka near Baladeh in the central Alborz Mts. (Mazandaran) on 31 May 2006 (Fig. 122), at rocky cliffs at Dashkasan near Meshginshahr on the northern slope of Mount Sabalan (Ardabil) on 29 September 2011 (Fig. 200), in the broad valley at Lenje Abad near Dorud in the western Zagros Mts. (Lorestan) on 1 October 2011 (Fig. 40), above a wadi below the Tadovan cave near Jahrom in the south-eastern Zagros Mts. (Fars) on 7 October 2011 (Figs. 43, 44), in the river valley north of Chah Mosallam near Bandar Lengeh (Hormozgan) on 12 October 2011 (Fig. 213), in the river valley at Darvishi near Khormuj (Bushehr) on 13 October 2011, and at a stream in the valley at Valiabad near Behbahan (Khuzestan) on 14 October 2011.

In most of these sites, *T. teniotis* was documented to forage along with other bat species. During two resaearch seasons at Chelmir, Fahrang-Azad (1970a) netted *T. teniotis* together with *Rhinolophus ferrumequinum*, *R. blasii*, *Myotis blythii*, *M. emarginatus*, *Eptesicus serotinus*, *E. ognevi*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Nyctalus leisleri*, *Otonycteris leucophaea*, and *Miniopterus pallidus*. DeBlase (1980) shot at Minab also *Taphozous perforatus* and *Rhyneptesicus nasutus*. De Roguin (1988) reported from Kusheh additionally also *Rhinolophus blasii*, *Eptesicus bottae*, and *Hypsugo savii*. *Myotis emarginatus* was also netted at Gishan and *Myotis blythii* at Serizjan. Above the stream at Shurlaq, *Eptesicus ognevi*, *Pipistrellus pipistrellus*, *P. kuhlii*, and *Otonycteris leucophaea* were also collected. *Myotis blythii*, *Eptesicus serotinus*, *E. ognevi*, and *Pipistrellus pipistrellus* were also recorded at Tahir Abad. At Dorbadam, *Myotis blythii* and *Pipistrellus pipistrellus* were also netted. *Myotis blythii*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *P. kuhlii*, and *Miniopterus pallidus* were netted along with *T. teniotis* at Hesar. At Bisotun, where the calls of *T. teniotis* were detected, *Rhinolophus ferrumequinum*, *Myotis capaccinii*, *Eptesicus anatolicus*, and *Miniopterus pallidus* were netted. At Sarkan near Izeh, where the calls of *T. teniotis* were detected, also the colonies of *Rhinopoma muscatellum* and *R. hardwickii* were found. One *Myotis emarginatus* was netted at Emamzadeh Mousa, where the calls of *T. teniotis* were detected. Together with these calls also the calls of *Hypsugo savii* and *Pipistrellus pipstrellus* were detected at Kalatah Chenar. In the forest at Tunel-e Golestan, *Myotis bechsteinii*, *Pipistrellus pipistrellus*, and *Barbastella barbastellus* were netted and the calls of *Nyctalus leisleri* detected along with the calls of *T. teniotis*. Calls of *Hypsugo savii* were also detected at Nach and those of *Eptesicus* cf. *nilssonii* at Ilka, in the central Alborz Mts. At the village of Dashkasan, *Rhinolophus ferrumequinum*, *Myotis blythii*, *Eptesicus serotinus*, *Plecotus macrobullaris*, and *Miniopterus pallidus* were also recorded. *Rhinolophus ferrumequinum*, *R. hipposideros*, *Asellia tridens*, *Pipistrellus pipistrellus*, *P. kuhlii*, and *Miniopterus pallidus* were recorded at Lenje Abad along with *T. teniotis*. In the river valey at the Tadovan cave, besides the rich community inhabiting the cave (composed of *Rhinopoma microphyllum*, *R. muscatellum*, *Rhinolophus ferrumequinum*, *R. hipposideros*, *R.*

euryale, *R. mehelyi*, *R. blasii*, *Myotis blythii*, *M. capaccinii* and *Miniopterus pallidus*), also *Eptesicus anatolicus* was recorded together with *T. teniotis*. Calls of *Asellia tridens* and *Otonycteris hemprichii* were detected along with the calls of *T. teniotis* at Chah Mosallam, while those of *Pipistrellus kuhlii* at Valiabad. Hence, in Iran *T. teniotis* was documented to occur syntopically with a high number of 29 bat species (i.e. three fifths of the whole number of species in the fauna), most frequently it was found together with *Pipistrellus pipistrellus*, and very frequently also with *Myotis blythii* and *Miniopterus pallidus*.

From two sites of Iran, evidence of reproduction of *T. teniotis* is available. Three pregnant females were collected at Gishan (Hormozgan) on 19 April, each contained one foetus of the crown-rump length 9.9–12.4 mm (mean 11.2 mm). One pregnant female was netted at Tahir Abad (Khorasan) on 21 May, it contained one medium-sized foetus of the crown-rump length 16.5 mm. These records suggest different timing of births in southern and northern Iran; while in southern Iran they seem to occur in the second half of April, in northern Iran approximately one month later. On the other hand, in several regions of the Mediterranean (Iberia, Maghreb, Levant), females of *T. teniotis* were observed to be pregnant and/or to breastfeed their young in the course of long periods from April to August even within the same colony (see the review by Ibáñez & Pérez-Jordá 2004). Thus, the diverse records from Iran may also reflect only individual differences, rather than geographical differences in the timing of reproduction.

Material examined. 1 ♂ (NMP 90833 [S+A]), Dorbadam (Khorasan-e Razawi Prov.), 23 May 2006, leg. P. Benda & A. Reiter; – 3 ♂♂, 3 ♀♀ (NMP 48449–48454 [S+A]), Gishan (Hormozgan Prov.), 19 April 2000, leg. P. Benda & A. Reiter; – 1 ♂ (NMP 93870 [S+A]), Hesar (Fars Prov.), 5 October 2011, leg. M. Andreas, P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 48458 [S+A]), Serizjan (Fars Prov.), 21 April 2000, leg. P. Benda & A. Reiter; – 2 ♀♀ (NMP 90797, 90798 [S+A]), Shurlaq (Khorasan-e Razawi Prov.), 18 May 2006, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 90811 [S+A]), Tahir Abad

Fig. 214. Valley at Dorbadam in the southern part of the Kopetdagh Mts. (Khorasan), a foraging site of *Myotis blythii*, *Pipistrellus pipistrellus*, and *Tadarida teniotis*. Photo by A. Reiter.

(Khorasan-e Razawi Prov.), 21 May 2006, leg. P. Benda & A. Reiter; – 1 ♂ (MHNG 1704.1 [A]), Varaj [= Kusheh], Kuh-e Taftan Mt. [Sistan va Baluchestan Prov.], 14 June 1975, leg. M. Desfayes & J.-C. Praz.

Morphology and variation. External and cranial dimensions of the Iranian specimens of *Tadarida teniotis* are shown in Table 36. For the material examined see above.

Most authors recognise two subspecies of *T. teniotis* (Ellerman & Morrison-Scott 1951, Lewis & Harrison 1962, Harrison 1964, Kock 1969, DeBlase 1980, Kock & Nader 1984, Harrison & Bates 1991, Simmons 2005, etc.); viz. *T. t. teniotis* (Rafinesque, 1814) in Europe and the Maghreb (type locality: Sicile [Sicily, Italy]; Rafinesque-Schmaltz 1814: 12) and *T. t. rueppellii* (Temminck, 1826) in north-eastern Africa and south-western Asia (type locality: Cairo [Egypt]; Qumsiyeh 1985: 71). However, *T. teniotis* is considered a monotypic species by several other authors (Aellen 1966, Corbet 1978, Koopman 1994, Benda et al. 2008).

The differences between the two subspecies were restricted to colouration characters only – the pelage in *T. t. rueppellii* is referred to be paler and greyer than in the darker and more brownish nominotypical form (Lewis & Harrison 1962, Harrison 1964, Aellen 1966, von Lehmann 1966, Kock & Nader 1984, Qumsiyeh 1985, Harrison & Bates 1991, Ibáñez & Pérez-Jordá 2004, Benda et al. 2006, etc.). However, in all parts of the species distribution range the pelage colouration is highly variable; both colour morphs as well as intermediate stages between them were reported from southern Europe as well as from some parts of the Middle East and North Africa (Lewis & Harrison 1962, von Lehmann 1966, DeBlase 1980, Arlettaz 1990, Ibáñez & Pérez-Jordá 2004, Benda et al. 2008).

Considering solely the pelage colouration, the Iranian populations belong to the nominotypical form, since the dark brown morphs prevail among the samples from the country. Although DeBlase (1980: 249) concluded that: "it seems logical at least tentatively to assign the two southern Iranian specimens [= from Busheh and Minab] to *T. teniotis rueppelli*. The Elburz Mountains specimen, coming from a considerably moister environment, may well prove to be the nominate form, *T. t. teniotis*", we found dark and brown individuals both in the north-Iranian sites (Kopetdagh Mts., see Fig. 210) and in the south-Iranian localities (Zagros Mts., Mt. Taftan). The individual from Hesar (Fars) was intermediate in tinge, showing a medium-dark greyish brown colouration (Figs. 211, 212). A similar tinge was also found in some bats from the Gishan (Hormozgan) series. De Roguin (1988) considered his single individual from Kusheh (Baluchestan) as an example of *T. t. rueppellii*.

However, based on the examination of specimens of *T. teniotis* from Sinai, where both very dark brown and very pale grey morphs were present at the same site, Benda et al. (2008) considered the differences in pelage colouration to represent marginal stages of a cline shift throughout the Mediterranean rather than a step distinction between two population groups. Therefore, these authors suggested the name *Dysopes rupelii* Temminck, 1826 (= *T. t. rueppellii*) to be a junior synonym of the name *Cephalotes teniotis* Rafinesque, 1814 and thus, to regard the whole species *T. teniotis* as monotypic.

Most of the reviewing authors agreed on low metric variation in *T. teniotis* throughout its range (Lewis & Harrison 1962, Aellen 1966, Kock & Nader 1984, Ibáñez & Pérez-Jordá 2004, Benda et al. 2006). However, a comparison of more representative sample sets from all main parts of the species range, covering more than 150 museum specimens, revealed certain differences in body size among them (Table 37). Although not extensive, the differences between the mean and range values indicated groups of slightly larger bats from the Maghreb, Iran and West Turkestan and of slightly smaller bats from Europe and Cyrenaica, while the samples from the Levant and Egypt were rather medium-sized in this comparison. This geographically discontinual plasticity in metric traits suggests a morphological response to climatic conditions in the particular range

Table 37. Comparison of biometric data on six sample sets of *Tadarida teniotis* (Rafinesque, 1814). For abbreviations see p. 171

	Europe					Maghreb					Levant				
	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
LAt	23	**60.27**	55.8	63.1	1.530	8	**61.86**	60.0	63.7	1.323	29	**60.78**	58.0	64.0	1.585
LCr	23	**23.81**	22.75	24.48	0.470	10	**24.15**	23.74	25.07	0.384	29	**23.92**	23.11	24.62	0.388
LCb	23	**23.25**	22.12	24.43	0.492	10	**23.50**	23.13	24.35	0.352	28	**23.27**	22.18	23.93	0.420
LaZ	25	**13.86**	13.14	14.44	0.330	11	**14.31**	13.45	15.22	0.434	28	**14.02**	13.24	14.65	0.303
LaI	27	**4.58**	4.32	4.95	0.158	11	**4.58**	4.43	4.74	0.099	30	**4.67**	4.43	5.12	0.148
LaInf	27	**4.92**	4.68	5.23	0.185	12	**5.13**	4.88	5.49	0.202	23	**4.89**	4.59	5.21	0.134
LaN	27	**11.62**	11.22	12.13	0.247	11	**11.72**	11.42	12.39	0.248	28	**11.64**	11.17	12.37	0.324
LaM	27	**12.77**	12.25	13.31	0.240	11	**12.94**	12.63	13.48	0.249	23	**12.72**	12.34	13.30	0.262
ANc	25	**7.28**	6.88	7.65	0.172	10	**7.33**	6.87	7.63	0.221	27	**7.37**	7.13	7.74	0.125
LBT	22	**5.23**	4.92	5.49	0.151	10	**5.39**	5.15	5.68	0.164	24	**5.34**	5.11	5.65	0.148
CC	27	**5.58**	5.28	6.08	0.178	12	**5.85**	5.48	6.37	0.227	29	**5.65**	5.36	5.93	0.164
M^3M^3	27	**9.20**	8.71	9.83	0.265	12	**9.60**	9.14	10.12	0.239	29	**9.40**	8.86	9.68	0.197
CM^3	27	**8.89**	8.54	9.32	0.193	13	**9.11**	8.75	9.46	0.215	32	**8.95**	8.48	9.35	0.191
LMd	25	**16.87**	16.24	17.43	0.310	13	**17.10**	16.71	17.77	0.334	31	**16.83**	15.94	17.52	0.334
ACo	25	**4.11**	3.28	4.41	0.223	13	**4.25**	3.94	4.58	0.186	32	**4.04**	3.68	4.43	0.150
CM_3	25	**9.59**	9.13	10.05	0.204	13	**9.74**	9.37	10.09	0.225	30	**9.55**	9.12	10.01	0.228
	Cyrenaica					Egypt					West Turkestan				
LAt	19	**59.99**	56.9	63.1	1.672	16	**60.68**	58.0	64.3	1.750	12	**62.53**	60.3	65.5	1.575
LCr	19	**23.58**	22.63	24.25	0.404	15	**23.98**	22.97	24.43	0.436	16	**24.26**	23.23	25.28	0.470
LCb	19	**22.99**	21.92	23.73	0.485	16	**23.18**	22.13	23.92	0.512	16	**23.50**	22.18	24.57	0.523
LaZ	19	**14.10**	13.63	14.44	0.207	16	**14.13**	13.33	15.06	0.444	16	**14.12**	13.18	14.76	0.465
LaI	19	**4.58**	4.33	4.83	0.131	18	**4.67**	4.31	4.88	0.160	16	**4.65**	4.43	4.96	0.139
LaInf	19	**4.86**	4.69	5.11	0.109	18	**5.03**	4.72	5.59	0.205	16	**5.06**	4.71	5.33	0.158
LaN	19	**11.59**	11.27	12.07	0.238	16	**11.73**	11.22	12.16	0.259	16	**11.79**	11.39	12.19	0.211
LaM	19	**12.77**	12.41	13.31	0.226	17	**12.88**	12.38	13.43	0.268	16	**12.92**	12.43	13.48	0.262
ANc	19	**7.29**	7.11	7.56	0.121	16	**7.38**	7.11	7.74	0.174	16	**7.37**	6.84	7.73	0.200
LBT	16	**5.21**	4.93	5.52	0.162	14	**5.32**	5.00	5.64	0.186	16	**5.44**	5.31	5.58	0.081
CC	19	**5.61**	5.12	5.95	0.197	16	**5.76**	5.27	7.89	0.611	16	**5.59**	5.30	5.82	0.151
M^3M^3	19	**9.39**	9.08	9.93	0.206	18	**9.37**	9.14	10.01	0.223	15	**9.45**	8.71	10.04	0.338
CM^3	19	**8.80**	8.34	9.11	0.228	17	**9.00**	8.75	9.26	0.128	16	**9.18**	8.84	9.48	0.165
LMd	19	**16.67**	16.01	17.19	0.305	18	**16.85**	15.96	17.56	0.349	16	**17.17**	16.62	17.86	0.319
ACo	19	**4.15**	3.71	4.43	0.174	18	**4.03**	3.43	4.29	0.224	16	**4.14**	3.91	4.43	0.137
CM_3	19	**9.28**	6.67	9.84	0.687	18	**9.63**	9.29	9.91	0.151	16	**9.84**	9.64	10.04	0.130

parts; larger bats seem to occur in higher mountains or continental steppes (Atlas Mts., Iranian plateau, Tien-Shan Mts.), while smaller bats in coastal areas of the Mediterranean basin.

As already Benda et al. (2008) concluded, it cannot be excluded that the Asian and/or African populations of *T. teniotis* differ from the European ones and represent separate phylogenetic units within the species rank, however, such difference should be proved on other grounds than on differences in the pelage colouration; here we can add that also on other than metric differences. Perhaps only a molecular genetic analysis can prove a value of geographic variation in this species.

Echolocation. *Tadarida teniotis* produces almost constant-frequency calls with a very long duration (up to 27 ms) and with very long, but variable inter-pulse intervals (ca. 160–1160 ms). Bats from the European populations produce calls with frequency of maximum energy in the range of

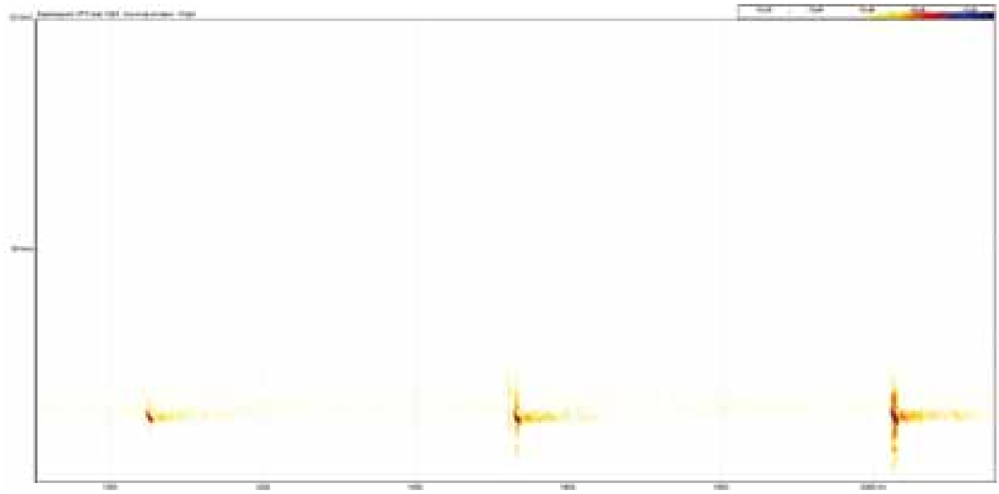


Fig. 215. Spectrogram of echolocation calls of *Tadarida teniotis* (Rafinesque, 1814); an individual foraging in the river valley near Chah Mosallam (Hormozgan).

10–15 kHz (Zbinden & Zingg 1986, Russo & Jones 2002, Ibáñez & Pérez-Jordá 2004, Obrist et al. 2004, Ciechanowski et al. 2005, Papadatou et al. 2008). Two types of calls of *T. teniotis* were reported from Crimea, Ukraine (Uhrin et al. 2009). An acoustic analysis revealed significant individual differences in call characters including year-to-year and site-to-site differences in some call features. When *T. teniotis* is flying in the presence of conspecifics, it changes its echolocation calls (Ulanovsky et al. 2004, Bayefsky-Anand et al. 2008).

We made an acoustic analysis of search calls of *T. teniotis* from four sites in Iran (see Figs. 173, 215). Basic parameters of echolocation signals are given in Table 3, an example of spectrogram of an echolocation call from Hormozgan is given in Fig. 215. Most of the echolocation parameters measured in the Iranian populations of *T. teniotis* fall to the ranges described by previous authors for the European populations and also for populations from the Middle East (Shalmon et al. 1993, Mendelssohn & Yom-Tov 1999, Benda et al. 2006, 2008, 2010).

Feeding ecology. *Tadarida teniotis* is a large aerial hawker hunting in direct flight in open spaces (Norberg & Rayner 1987, Feldman et al. 2000). Diet composition of this species was studied in Europe (France), in the Middle East (Turkey, Syria, Israel, Jordan, Sinai) and West Turkestan (Kirghizstan) (Rydell & Arlettaz 1994, Whitaker et al. 1994, Benda et al. 2006, 2008, 2010, Whitaker & Karataş 2009). All these studies pointed out the dominance of Lepidoptera as the most important food item in the diet of *T. teniotis* with exception of the Turkish samples, where Orthoptera prevailed over moths (Whitaker & Karataş 2009). Orthoptera were found to contribute to the diet considerably also in the samples from Jordan (40% of volume; Benda et al. 2010). The proportion of other taxa (Neuroptera, Hemiptera, Coleoptera, Trichoptera, Blattodea, and Diptera) in the diet of *T. teniotis* is much smaller and frequently only marginal. One exceptional sample set (20 faecal pellets analysed from three bats) was collected from Rhodes, Greece, where a significant majority of Coleoptera (especially Curculionidae) was found (94% of volume); other taxa recorded in these faeces were Hymenoptera, Lepidoptera and Neuroptera (own unpubl. data).

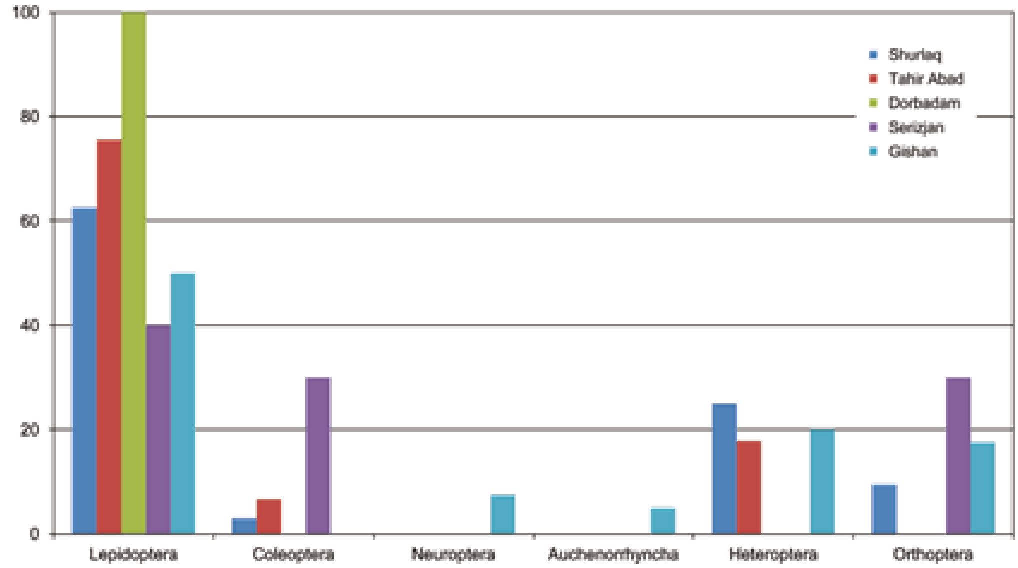


Fig. 216. Percentage volume of particular food items in the diet of *Tadarida teniotis* (Rafinesque, 1814) in Iran. Material analysed: Shurlaq (20 faecal pellets / from one bat), Tahir Abad (9 / 1), Dorbadam (6 / 1), Serizjan (one digestive tract), Gishan (six digestive tracts).

From Iran, diet composition of *T. teniotis* was analysed from five sites (Fig. 216). In all these sample sets, Lepidoptera were the most important diet item and Coleoptera, Orthoptera (Ensifera) and Heteroptera also contributed to the diet significantly. The proportions of Neuroptera (Chrysopidae) and Auchenorrhyncha were nearly negligible. The results of the diet analysis of *T. teniotis* from Iran do not differ significantly from the previously published studies (see above).

Nyctinomus aegyptiacus Geoffroy, 1818

Records. **Original data**: S i s t â n v a B a l u c h e s t â n: Pir Sohrab [1], 54 km NE of Chabahar, above a pool, 12 April 2000: net. 1 ma, 2 fa (NMP 48400–48402); – cliff 1 km N of Tis [2], 8 km N of Chabahar, rocky crevice, 13 April 2000: remnants of 1 ind. (pair of mandibles, 2 fragments of a skull) found in *Athene brama* pellets. – **Published data**: H o r m o z g â n: Chah Moslem [3], about 57 km. N of Bandar-e-Lengeh, 22 November 1968: shot 2 ma, FMNH (DeBlase 1971a, 1980).

Distribution. *Nyctinomus aegyptiacus* is a rare bat species in Iran, only three sites of records are available from the south-eastern part of the country (Fig. 202). The records are confined to the most arid areas of Iran, situated to desert lowlands (at altitudes in the range 0–60 m a. s. l.) along the coast of the Gulf of Oman and the mouth of the Persian Gulf, respectively. DeBlase (1971a, 1980) reported on a record from the coastal lowland in the west of the Hormozgan province, until now representing the only evidence of this bat from the country. Two other findings were made in southern Baluchestan, three bats were netted and remains of one individual found in owl pellets.

N. aegyptiacus has a rather unusual type of distribution range showing very broad occurrence area, it comprises a large part of sub-Saharan (mainly southern and eastern) Africa, almost complete North Africa, southern Arabia and a large part of the Indian Subcontinent up to Bengal and Ceylon (Bates & Harrison 1997, Horáček et al. 2000, Simmons 2005). Its limited Iranian range interconnects the west-Indian occurrence in the Indus valley of Pakistan (six localities in the provinces of Punjab and Sind; Roberts 1977) and over the Strait of Hormuz the range in southern Arabia, i.e. the localities in Oman, southern Saudi Arabia and Yemen (Harrison & Bates 1991, Benda et al. 2011b, own unpubl. data). Concerning its common occurrence in north-eastern Oman (about 15 localities are known from a recent survey; own unpubl. data), *N. aegyptiacus* could be expected to inhabit more abundantly also the neighbouring areas of south-eastern Iran.

Field notes. Individuals of *Nyctinomus aegyptiacus* were recorded in Iran twice at their foraging grounds and its bone remains were found in owl pellets at one site.

DeBlase (1971a: 12) reported the first record of *N. aegyptiacus* from Iran: "The 1968 Street Expedition collected two male [*N. aegyptiacus*] at the village of Chah Moslem [Hormozgan], about 57 km. N of Bandar-e-Lengeh […]. Both were shot as they flew high and straight over our camp on November 22." DeBlase (1980: 335) added: "[…] the 1968 Street Expedition camped […] on the narrow coastal strip just north of Bandar-e Lengeh. Numerous bats could be seen and heard flying over the barren fields around camp each evening. Shooting yielded one *Taphozous perforatus*, seven *Pipistrellus kuhli* and two *Tadarida* [= *Nyctinomus*] *aegyptiaca*."

One male and two female *N. aegyptiacus* were netted above a pool of remaining water in the dried valley of the Kaju river at Pir Sohrab near Chabahar (Baluchestan) on 12 April 2000 (Figs. 148, 217), in a dry steppe landscape (see under *Hypsugo arabicus* for closer description of the site). *Rhinopoma muscatellum*, *Rhyneptesicus nasutus*, *Hypsugo arabicus*, *Pipistrellus kuhlii*, and *Otonycteris hemprichii* were also recorded at the site.

No data on reproduction of *N. aegyptiacus* are available from Iran.

Remains of *N. aegyptiacus* were recorded from pellets of *Athene brama* collected at Tis near Chabahar (Baluchestan; Table 40). Bone fragments from one bat were found there, representing

Fig. 217. *Nyctinomus aegyptiacus* Geoffroy, 1818 from Pir Sohrab (Baluchestan). Photo by A. Reiter.

0.51% of all prey items (and 1.85% of mammal items) in the respective sample and 0.07% of all prey items (0.82% of mammal items) in the whole analysed spotted owlet diet available from Iran (Table 40).

MATERIAL EXAMINED. 1 ♂, 2 ♀♀ (NMP 48400–48402 [S+A]), Pir Sohrab (Sistan va Baluchestan Prov.), 12 April 2000, leg. P. Benda & A. Reiter; – 1 ind. (JOC unnumbered [Sf]), Tis (Sistan va Baluchestan Prov.), 13 April 2000, leg. J. Obuch.

MORPHOLOGY AND VARIATION. External and cranial dimensions of the Iranian specimens of *Nyctinomus aegyptiacus* are shown in Table 36. For the material examined see above.

N. aegyptiacus is traditionally considered a polytypic species, in total five subspecies were recognised by the last compendia (Koopman 1994, Horáček et al. 2000, Simmons 2005); Koopman (1994) enumerated these forms as follows (under the traditional genus name *Tadarida*): *T. a. aegyptiaca* Geoffroy, 1818 in Arabia and most of the African range of the species, and *T. a. bocagei* (de Seabra, 1900) in the south-western part of Africa from western Zambia to Angola and Namibia, *T. a. tragata* (Dobson, 1874) in north-eastern India (Bengal), *T. a. sindica* Wroughton, 1919 in southern Pakistan and Iran, *T. a. thomasi* Wroughton, 1919 in the western part of India and in Ceylon. Thus, while only two forms of *N. aegyptiacus* are recognised in the whole African range, four subspecies are considered to occur in south-western Asia (from Arabia to India).

This taxonomic arrangement of the Asian populations of *N. aegyptiacus* was introduced by Wroughton (1919), who described three separate species of *Tadarida* from the west of the Indian continent (*sindica*, *thomasi*, *gossei*), differing in size and colouration, and accepted the species status of *Nyctinomus tragatus* Dobson, 1874 (type locality: Calcutta [= Kolkata, India]; Dobson 1876: 203). Ellerman & Morrison-Scott (1951) regarded the Wroughton's forms to be three subspecies of *N. aegyptiacus*, while they kept Dobson's *tragatus* as a separate species; this

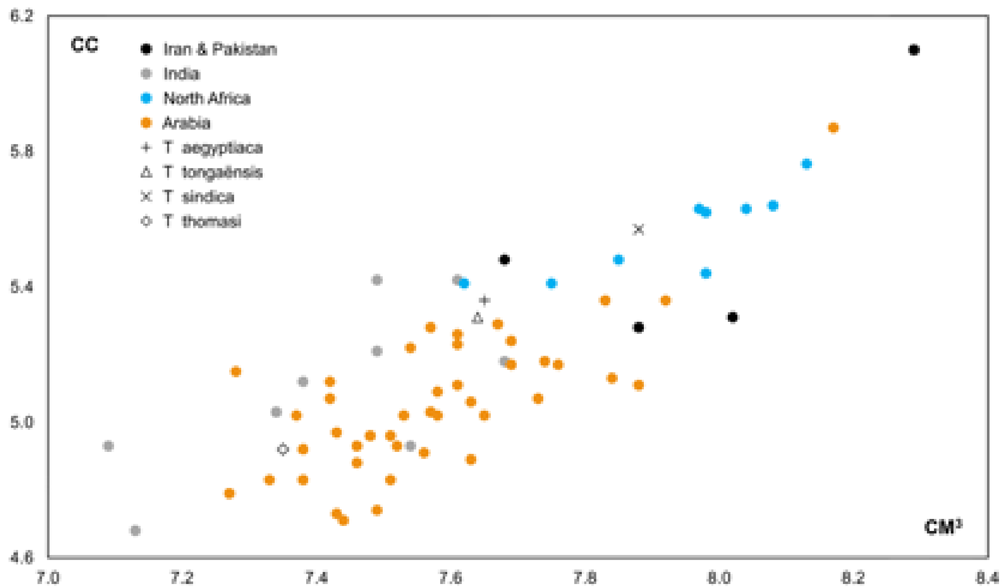


Fig. 218. Bivariate plot of the examined Iranian and comparative samples of *Nyctinomus aegyptiacus* Geoffroy, 1818 s.l.: length of upper tooth-row (CM^3) against the rostral width between canines (CC). T = type specimen.

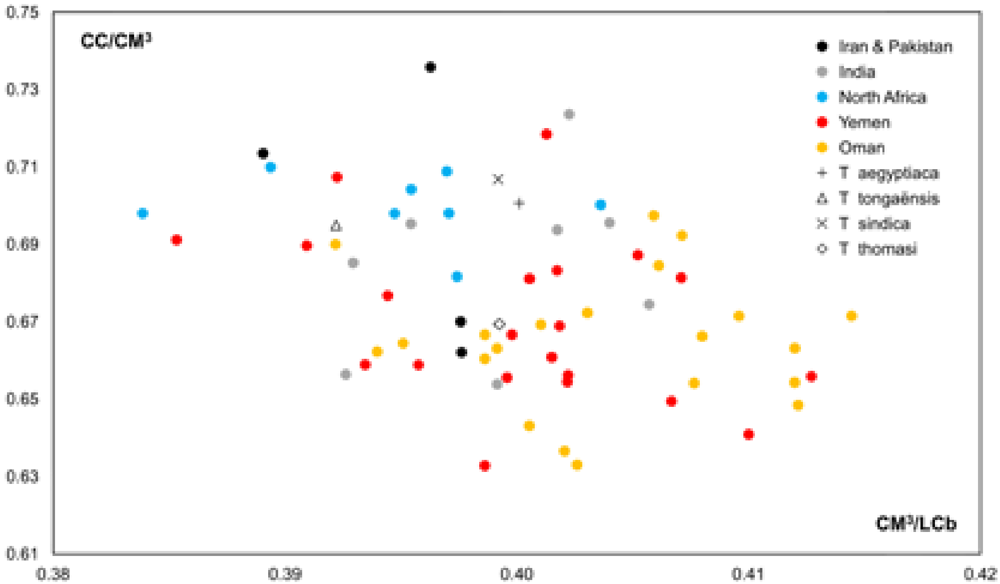


Fig. 219. Bivariate plot of the examined Iranian and comparative samples of *Nyctinomus aegyptiacus* Geoffroy, 1818 s.l.: relative length of rostrum (CM^3/LCb) against the relative width of rostrum (CC/CM^3). T = type specimen.

arrangement was completely accepted by Hill (1961). Brosset (1962) avoided to identify any subspecies of *N. aegyptiacus* from India due to extreme variation in size and colouration of the respective samples, and suggested the Indian populations to belong to the only local form [i.e., to *N. a. thomasi*]; Sinha (1970) agreed with this opinion and regarded the name *gossei* a junior synonym of *thomasi*. However, Chaturvedi (1964) examined the type specimen of *N. tragatus*, revised its separate species position, and finally introduced this name into synonymy of *N. aegyptiacus*. Therefore, Corbet (1978) considered the name *tragatus* to be the prior synonym for the Indian populations of the species.

On the other hand, Harrison (1964) and Harrison & Bates (1991) reported all Arabian populations, including the Omani ones, under the nominotypical subspecies, *N. a. aegyptiacus*. This form is described from north-eastern Africa (type locality: Giza, Egypt; Koopman 1975: 422) and is reported to occur in the whole northern and eastern parts of the African continent, with the names *Dysopes talpinus* von Heuglin, 1877 (type locality: Gebiet der Kidj-Neger am westlichen Ufer des Kir oder Baher el Djebel [= Unity State, South Sudan; cf. von Heuglin 1869]; von Heuglin 1877: 28) and *Nyctinomus tongaënsis* von Wettstein, 1916 (type locality: Tonga am Oberen Weißen Nil [Upper Nile State, South Sudan]; von Wettstein 1916: 192) as synonyms (see Koopman 1966, 1975, 1994, Kock 1969, Simmons 2005).

Consequently, several names and taxonomic conceptions are available for assignation of the Iranian populations of *N. aegyptiacus*. DeBlase (1980) failed to identify the two specimens available to him to subspecies; considering their size, he suggested them to belong either to *aegyptiacus* or *sindicus*. Roberts (1997) referred the Pakistani populations to *T. a. sindica*, and Koopman (1994) assigned also the populations of southern Iran to this form.

Table 38. Comparison of biometric data on six sample sets of *Nyctinomus aegyptiacus* Geoffroy, 1818 s.l. For abbreviations see p. 171. Yemeni specimens were sorted to two groups (Yemen I, II) according to the respective skull and body size

	n	M	min	max	SD	n	M	min	max	SD	n	M	min	max	SD
		Iran & Pakistan					North Africa						India		
LAt	5	**53.12**	51.6	55.1	1.335	13	**52.35**	50.7	55.1	1.228	9	**47.91**	46.6	48.6	0.672
LCr	5	**20.45**	20.12	21.22	0.443	10	**20.41**	19.55	20.74	0.387	9	**19.20**	18.72	19.82	0.358
LCb	5	**20.08**	19.74	20.92	0.503	10	**19.93**	19.12	20.48	0.442	8	**18.49**	17.93	18.93	0.345
LaZ	5	**12.88**	12.49	13.26	0.322	10	**12.66**	11.88	13.14	0.386	9	**11.80**	11.26	12.35	0.320
LaI	5	**4.34**	4.10	4.54	0.172	10	**4.40**	3.68	4.62	0.287	9	**4.47**	4.27	4.68	0.118
LaInf	5	**5.17**	4.81	5.56	0.337	11	**5.29**	5.02	5.56	0.166	9	**4.88**	4.37	5.43	0.289
LaN	5	**10.06**	9.67	10.58	0.410	10	**10.63**	10.27	11.08	0.299	9	**9.57**	8.82	10.02	0.351
LaM	5	**11.75**	11.61	11.93	0.134	9	**11.77**	11.29	12.32	0.339	9	**11.05**	10.71	11.47	0.268
AN	5	**6.66**	6.42	7.02	0.250	10	**6.48**	6.03	6.69	0.193	8	**6.25**	6.04	6.51	0.139
ACr	4	**8.08**	7.94	8.17	0.106	8	**7.77**	7.42	8.22	0.257	5	**7.42**	7.35	7.61	0.108
LBT	4	**4.45**	4.17	4.72	0.225	8	**4.49**	4.27	4.83	0.213	7	**4.24**	4.11	4.29	0.060
CC	5	**5.55**	5.28	6.10	0.331	11	**5.52**	5.31	5.76	0.145	9	**5.05**	4.68	5.42	0.214
M^3M^3	5	**8.88**	8.62	9.32	0.264	10	**8.75**	8.49	9.14	0.182	9	**8.26**	7.87	8.67	0.227
IM^3	5	**9.27**	9.04	9.57	0.207	12	**9.23**	8.98	9.47	0.149	9	**8.60**	8.28	8.88	0.222
CM^3	5	**7.95**	7.68	8.29	0.225	12	**7.89**	7.62	8.13	0.181	9	**7.40**	7.09	7.68	0.202
M^1M^3	5	**4.79**	4.58	5.04	0.174	12	**4.79**	4.66	4.91	0.087	9	**4.50**	4.43	4.63	0.062
CP^4	5	**3.65**	3.53	3.76	0.082	12	**3.68**	3.36	4.04	0.216	9	**3.40**	3.11	3.74	0.186
LMd	5	**14.44**	14.13	15.05	0.369	12	**14.39**	13.83	14.74	0.318	9	**13.53**	12.93	14.01	0.308
ACo	5	**4.18**	4.02	4.37	0.128	12	**4.01**	3.65	4.29	0.184	9	**3.84**	3.51	4.03	0.161
IM_3	4	**9.20**	8.88	9.58	0.288	12	**9.09**	8.82	9.31	0.170	9	**8.53**	8.28	8.82	0.190
CM_3	5	**8.56**	8.28	8.87	0.223	12	**8.56**	8.31	8.73	0.144	9	**7.99**	7.69	8.28	0.205
M_1M_3	5	**5.58**	5.18	5.75	0.228	12	**5.48**	5.33	5.61	0.094	8	**5.07**	4.83	5.27	0.141
CP_4	5	**3.21**	3.04	3.43	0.142	12	**3.28**	2.76	3.75	0.278	9	**3.03**	2.80	3.21	0.133
LCb/M^3M^3	5	**2.261**	2.223	2.299	0.030	9	**2.281**	2.216	2.370	0.062	8	**2.254**	2.179	2.324	0.055
CC/CM^3	5	**0.698**	0.662	0.736	0.031	11	**0.700**	0.682	0.710	0.008	9	**0.682**	0.654	0.712	0.020
ACo/LMd	5	**0.289**	0.285	0.296	0.005	12	**0.278**	0.263	0.291	0.009	9	**0.283**	0.271	0.295	0.007
LaM/LCr	5	**0.575**	0.553	0.589	0.014	9	**0.574**	0.553	0.596	0.015	9	**0.575**	0.561	0.588	0.008
LaZ/LCr	5	**0.630**	0.617	0.654	0.017	10	**0.620**	0.605	0.635	0.012	9	**0.614**	0.601	0.623	0.007
AN/LaM	5	**0.567**	0.543	0.593	0.020	9	**0.555**	0.540	0.571	0.009	8	**0.565**	0.548	0.575	0.010
CM^3/LCb	5	**0.396**	0.389	0.399	0.004	10	**0.395**	0.384	0.404	0.006	8	**0.399**	0.393	0.406	0.005
CC/LCb	5	**0.276**	0.263	0.292	0.012	10	**0.276**	0.268	0.283	0.005	8	**0.270**	0.258	0.281	0.008

Morphometric comparison of some 80 samples of *N. aegyptiacus* from the northern part of its distribution range (North Africa, Middle East, Pakistan, western India) including three bats from Iran and most of the available type material from the respective area (Tables 38, 39), separated the specimens into two groups; larger bats from Iran, Pakistan, North Africa and also several from Arabia, and smaller bats from India and most from Arabia. Although these two groups slightly overlap in their value ranges, they clearly differ in mean values (Table 38); the sets of larger bats show mean forearm lengths (LAt) above 52.5 mm (range 50.9–54.1 mm) and the greatest lengths of skull (LCr) above 20.4 mm (19.55–21.22 mm), while the sets of smaller bats have mean LAt<48.0 mm (46.6–52.5 mm) and LCr<19.4 mm (18.72–19.92 mm). These groups also differ in the shape of the skull, the larger bats have relatively short and broad rostra (CM^3/LCb 0.384–0.404, CC/CM^3 0.662–0.736), while the smaller bats show relatively long and narrow rostra (CM^3/LCb 0.392–0.414, CC/CM^3 0.633–0.698), see Table 38 and Figs. 218, 219. Separation of these two size groups or skull morphotypes, respectively, in *N. aegyptiacus* is also well supported by the results of a principal component analysis (Fig. 220) conducted from all cranial dimensions and their

Table 38. (continued)

	n	**M**	min	max	SD	n	**M**	min	max	SD	n	**M**	min	max	SD
	Yemen I					Yemen II					Oman				
LAt	19	**48.91**	46.7	50.7	1.265	4	**53.50**	53.0	54.1	0.535	29	**50.43**	47.50	52.50	1.146
LCr	17	**19.21**	18.88	19.65	0.202	4	**20.46**	20.07	20.75	0.305	21	**19.49**	18.88	19.92	0.272
LCb	17	**18.62**	18.35	19.02	0.193	4	**19.95**	19.62	20.36	0.334	21	**18.82**	18.29	19.30	0.320
LaZ	17	**11.60**	11.22	11.87	0.185	4	**12.53**	12.39	12.74	0.165	21	**11.77**	11.33	12.23	0.261
LaI	17	**4.34**	4.16	4.54	0.105	4	**4.43**	4.29	4.53	0.104	21	**4.40**	4.25	4.65	0.120
LaInf	16	**4.63**	4.23	5.04	0.219	4	**5.15**	4.86	5.38	0.214	21	**4.82**	4.52	5.21	0.209
LaN	17	**9.52**	9.21	9.78	0.164	4	**10.33**	10.17	10.48	0.127	21	**9.58**	9.06	9.81	0.196
LaM	17	**10.95**	10.67	11.29	0.164	4	**11.61**	11.48	11.68	0.091	21	**11.02**	10.47	11.39	0.214
AN	16	**6.20**	5.97	6.39	0.117	4	**6.54**	6.29	6.78	0.225	19	**6.18**	5.93	6.41	0.124
ACr	17	**7.60**	7.41	7.89	0.146	3	**7.71**	7.58	7.89	0.163	21	**7.64**	7.19	7.92	0.186
LBT	17	**4.23**	3.82	4.39	0.149	3	**4.54**	4.09	4.97	0.441	21	**4.26**	4.02	4.53	0.139
CC	17	**4.97**	4.74	5.24	0.145	4	**5.45**	5.26	5.87	0.286	21	**5.05**	4.71	5.36	0.167
M^3M^3	17	**8.22**	7.92	8.73	0.197	4	**8.61**	8.46	8.74	0.130	21	**8.30**	7.92	8.76	0.219
IM^3	17	**8.58**	8.33	8.89	0.162	4	**9.16**	8.92	9.53	0.280	21	**8.78**	8.58	9.08	0.124
CM^3	17	**7.48**	7.27	7.73	0.143	4	**7.84**	7.61	8.17	0.256	21	**7.60**	7.42	7.88	0.140
M^1M^3	17	**4.58**	4.38	4.75	0.116	4	**4.69**	4.62	4.75	0.070	21	**4.64**	4.43	4.87	0.127
CP^4	17	**3.48**	3.23	3.79	0.165	4	**3.68**	3.42	3.96	0.221	21	**3.40**	3.17	3.67	0.145
LMd	17	**13.41**	13.17	13.74	0.188	4	**14.26**	14.03	14.68	0.305	21	**13.64**	13.22	13.98	0.228
ACo	17	**3.81**	3.58	4.02	0.130	4	**3.91**	3.75	4.03	0.123	21	**3.83**	3.58	4.08	0.147
IM_3	15	**8.50**	8.24	8.92	0.176	4	**8.93**	8.69	9.35	0.298	20	**8.60**	8.29	9.06	0.199
CM_3	17	**7.98**	7.71	8.35	0.192	4	**8.43**	8.08	8.86	0.337	21	**8.10**	7.88	8.56	0.179
M_1M_3	17	**5.19**	4.97	5.38	0.122	4	**5.45**	5.35	5.61	0.113	21	**5.26**	4.97	5.57	0.149
CP_4	17	**3.02**	2.84	3.31	0.142	4	**3.52**	3.08	4.37	0.603	21	**2.99**	2.74	3.26	0.125
LCb/M^3M^3	17	**2.265**	2.151	2.343	0.046	4	**2.318**	2.245	2.374	0.055	21	**2.267**	2.149	2.356	0.056
CC/CM^3	17	**0.665**	0.633	0.707	0.019	4	**0.694**	0.677	0.718	0.018	21	**0.665**	0.633	0.698	0.017
ACo/LMd	17	**0.284**	0.268	0.304	0.009	4	**0.274**	0.262	0.283	0.008	21	**0.281**	0.265	0.298	0.009
LaM/LCr	17	**0.570**	0.552	0.591	0.011	4	**0.568**	0.556	0.582	0.011	21	**0.566**	0.550	0.582	0.008
LaZ/LCr	17	**0.604**	0.584	0.620	0.010	4	**0.613**	0.601	0.635	0.015	21	**0.604**	0.588	0.622	0.011
AN/LaM	16	**0.567**	0.543	0.588	0.015	4	**0.563**	0.541	0.591	0.022	19	**0.560**	0.543	0.584	0.013
CM^3/LCb	17	**0.402**	0.392	0.413	0.005	4	**0.393**	0.385	0.401	0.007	21	**0.404**	0.392	0.414	0.006
CC/LCb	17	**0.267**	0.252	0.278	0.007	4	**0.273**	0.266	0.288	0.010	21	**0.269**	0.255	0.283	0.008

indices (see Table 38). The groups of specimens were divided solely according to PC1 (54.03% of variance), which suggests body size to be the main grouping factor, while PC2 (8.97%) did not contribute to the separation; PC1< –0.5 grouped the large-sized samples from Iran, Pakistan, North Africa and Yemen, including type specimens of *aegyptiacus* Geoffroy, 1818, *tongaënsis* von Wettstein, 1916 and *sindica* Wroughton, 1919, and PC2> –0.25 grouped the small-sized samples from India, Oman and Yemen, including the type specimen of *thomasi* Wroughton, 1919 and the type series of *gossei* Wroughton, 1919.

The pelage colouration in the Iranian specimens of *N. aegyptiacus* is pale brownish grey (DeBlase 1980; see Fig. 217). However, the colouration, considered taxonomically important in *N. aegyptiacus* by some authors (Wroughton 1919, Hill 1961), was reported to be extremely variable, even within populations of the species (similarly as in *Tadarida teniotis*, see above) by most of other authors, who do not consider this character valuable for evaluation of geographical variation in *N. aegyptiacus* (Brosset 1962, Sinha 1970, Harrison & Bates 1991, Koopman 1994, Bates & Harrison 1997).

Based on the above metric comparison, it seems to be clear that the separated groups of specimens represent two distinct morphotypes, distinct in body and skull size and skull shape (Fig. 221), which thus represent two separate taxa. Moreover, since in south-western Arabia (western and eastern Yemen) these morphotypes were found to occur in sympatry, they certainly should represent two separate species. The examined sets of comparative specimens contained also the majority of the available type specimens, which fall into one or the other sample groups; types of *aegyptiacus*, *tongaënsis* and *sindica* fit in the group of larger bats, while types of *thomasi* and *gossei* in the group of smaller bats. Two other names were created on the basis of material from the respective area, *tragatus* Dobson, 1874 and *talpinus* von Heuglin, 1877; both can be assigned to the group of larger bats according to their published dimensions (Chaturvedi 1964, Kock 1969). While the name *aegyptiacus* is undoubtedly the prior name of the group of larger bats (with *geoffroyi*, *tragatus*, *talpinus*, *tongaënsis*, and *sindica* as synonyms), the name *thomasi* represents the prior available name for the species represented by the smaller bats (with *gossei* as a synonym), i.e. as *Nyctinomus thomasi* (Wroughton, 1919).

The distribution range of *N. aegyptiacus* s.str. remains almost unchanged in the respective area, covering North Africa, south-western and eastern parts of the Middle East (Yemen, Iran) and southern Pakistan. According to the data given by Brosset (1962), the two size morphotypes (here suggested to represent two species) seem to occur also in western India, the large one being rare and known only from Gujarat. However, since the range is more or less continuous from North Africa to western India, it is formally not necessary to divide these populations into more taxa.

On the other hand, the known range of *N. thomasi* (type locality: Bhuj, Cutch [= Kutch, Gujarat, India]; Wroughton 1919: 733) is composed of two areas, southern Arabia (Yemen, Oman) and

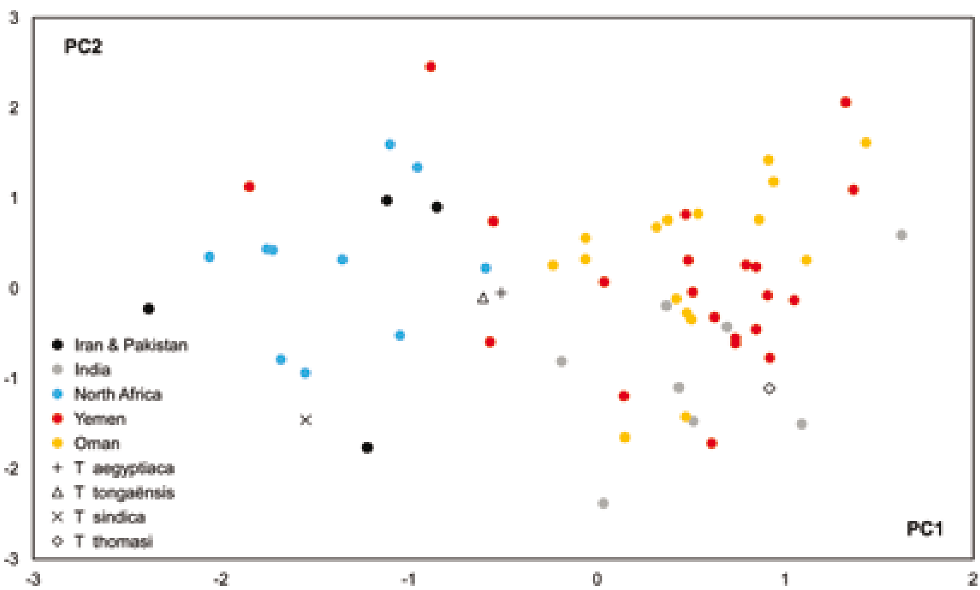


Fig. 220. Bivariate plot of the examined Iranian and comparative samples of *Nyctinomus aegyptiacus* Geoffroy, 1818 s.l.: results of the principal component analysis. T = type specimen.

Table 39. Basic biometric data on the examined type specimens of the traditional species rank of *Nyctinomus aegyptiacus* Geoffroy, 1818 (for detials see text). For abbreviations see p. 171

	aegyptiacus MNHN 1986-1084	*tongaënsis* NMW 8407	*sindica* BMNH 15.11.1.51.	*thomasi* BMNH 12.10.4.32
LAt	50.9	52.3	52.5	48.6
LCr	19.55	20.12	20.23	18.98
LCb	19.12	19.48	19.74	18.41
LaZ	11.88	12.37	12.96	11.72
LaI	4.53	3.68	4.47	4.38
LaInf	5.11	5.18	5.43	4.79
LaN	10.55	10.27	10.58	9.39
LaM	11.77	11.63	11.84	10.81
AN	6.03	6.47	7.02	6.17
ACr	7.65	7.98	8.08	7.42
LBT	4.49	4.41	4.45	4.25
CC	5.36	5.31	5.57	4.92
M^3M^3	8.58	8.79	8.88	8.31
IM^3	9.03	8.98	9.17	8.44
CM^3	7.65	7.64	7.88	7.35
M^1M^3	4.82	4.68	4.75	4.49
CP^4	3.55	3.74	3.53	3.45
LMd	13.88	13.83	14.27	13.34
ACo	3.65	3.87	4.14	3.88
IM_3	8.82	8.83	9.18	8.38
CM_3	8.43	8.31	8.61	7.82
M_1M_3	5.54	5.41	5.65	5.02
CP_4	3.20	2.83	3.21	2.92

western India (Gujarat, Karnataka, Madhya Pradesh, Maharashtra; Wroughton 1919, Hill 1961, Brosset 1962), including Ceylon (Hill 1961). The ranges of both species still to be need elucidated by revision of the available museum material.

However, another subspecies from the south-western part of sub-Saharan Africa is recognised within the species rank of *N. aegyptiacus* s.l., *N. a. bocagei* (incl. two synonyms; see de Winton 1901, Koopman 1966, 1994, Horáček et al. 2000, Simmons 2005) and its relation to the two newly defined taxa remains unclear. Thus, the group of populations currently regarded as *N. aegyptiacus* s.l. (cf. Simmons 2005) should be thoroughly revised using both morphological and molecular genetic approaches to resolve phylogenetic and taxonomic relations within the whole complex. Anyway, the status of the here splitted species *N. thomasi* seems to be well-founded.

The above comparison of metric traits clearly showed the agreement of morphotypes represented by type specimens of the names *aegyptiacus* and *sindica* as well as their respective populations, which thus do not belong to different taxa. Hence, the Iranian populations pertain to the nominotypical form, *N. a. aegyptiacus*, when it is recognised as a subspecies (i.e., when another subspecies from the African range is considered within *N. aegyptiacus* s.str.).

ECHOLOCATION. Echolocation calls of *Nyctinomus aegyptiacus* have not been described in detail so far. The species produces quasi-constant-frequency calls with values of the frequency of maximum energy at 18 kHz, additional harmonics could be sometimes present in the sequence of searching calls (Fenton & Jones 1981, Neuweiler et al. 1984). Echolocation characteristics of

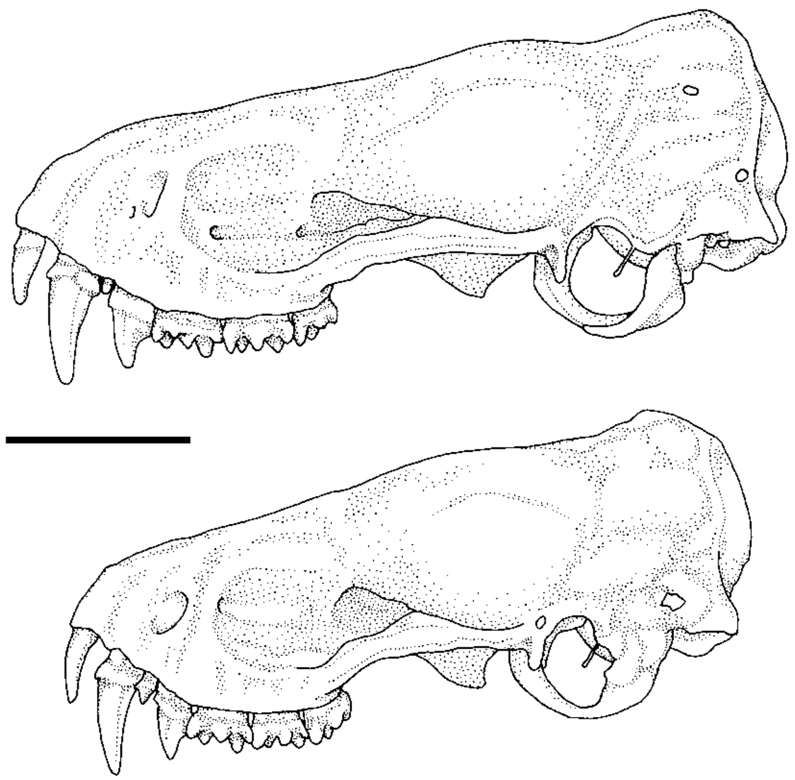


Fig. 221. Skulls of *Nyctinomus aegyptiacus* Geoffroy, 1818 and *N. thomasi* (Wroughton, 1919); top – *N. aegyptiacus*, NMP 48400, Pir Sohrab (Baluchestan); bottom – *N. thomasi*, NMP pb2983, Hauf (Al Mahrah), Yemen. Scale bar – 5 mm.

N. aegyptiacus have not yet been studied in Iran; the peak frequencies in the Omani populations were between 18–21 kHz (own unpubl. data).

FEEDING ECOLOGY. *Nyctinomus aegyptiacus* is a medium-sized bat hunting in open space (Neuweiler 1984). The diet analysis from southern Africa showed Coleoptera and Lepidoptera to be consumed (in the ratio 11 : 14; Fenton & Thomas 1980). Nine diet sample sets from *N. aegyptiacus* s.l. collected in southern Arabia showed a wide variety of prey taxa – three of them were dominated by Lepidoptera, in two sets Coleoptera and Hymenoptera were the most important items, while Heteroptera with Brachycera prevailed in another set; other taxa recorded in these samples were Neuroptera, Auchenorrhyncha, Nematocera, and Odonata (own unpubl. data).

From Iran, we analysed three digestive tracts of *N. aegyptiacus* collected at Pir Sohrab (Baluchestan). One tract was empty, one contained Lepidoptera (30% of volume), Coleoptera (Scarabaeidae) (30%), Neuroptera (Myrmeleontidae) (10%), and Orthoptera (Ensifera) (30%), and the third tract contained Coleoptera (Elateridae, Carabidae) (60%) and Orthoptera (Ensifera) (40%).

These results conform to the studies from southern Africa and Arabia and show the dominance of Coleoptera and Lepidoptera in the diet of *N. aegyptiacus*. However, the diet composition recorded from Iran was rather diverse and contained also other prey taxa as compared to the data by Fenton & Thomas (1980). On the other hand, the higher diversity is in good accordance with the results from southern Arabia (see above).

DISCUSSION AND CONCLUSIONS

Fauna

The present review summarises 902 records of 50 bat species from the territory of Iran (Table 1). Such species number is almost twice higher than are the numbers in faunas of the countries in the western part of the Middle East (Harrison & Bates 1991, Benda & Horáček 1998, Mendelssohn & Yom-Tov 1999, Benda et al. 2006, 2010), but comparable with the fauna of Pakistan (Mahmood-Ul-Hassan et al. 2009). Concerning the bat species number, the faunal list of Iran is the richest of all countries of the Middle East. The comprehensive review of the Iranian bat fauna by DeBlase (1980) brought 375 records of 38 species (Table 1). In comparison with this report, the number of records summarised here has increased more than twice (240%) and the number of species has increased by thirteen species newly reported from Iran, while one species has been deleted from the list (increase by 31.6%).

The increase in the number of fauna members has been caused by two main ways; (1) by findings of new species for the fauna of Iran (*Hipposideros fulvus*, *Myotis nattereri*, *Eptesicus bottae* s.str., *Hypsugo arabicus*, *Barbastella barbastellus*, *Plecotus auritus*), and (2) by taxonomical splitting (*Myotis davidii*, *Eptesicus anatolicus*, *Otonycteris leucophaea*, *Plecotus strelkovi*); also by a combination of both these ways (*M. hyrcanicus* sp. n., *Eptesicus pachyomus*, *Pipistrellus pygmaeus*). Taxonomical revisions also brought new naming of some Iranian bat populations that were assigned to different species by the previous authors (*Myotis schaubi*, *Eptesicus ognevi*, *Barbastella darjelingensis*, *Miniopterus pallidus*); however, these changes did not affect the number of bat species in the Iranian fauna. One bat species (*Rhinolophus bocharicus*) was deleted from the faunal list by DeBlase (1980). Two bat species (*Hipposideros fulvus*, *Myotis nattereri*) are here listed from Iran for the first time.

Although the number of bat records has increased significantly (Table 1), only in a minor part of the species (ca. one third) their Iranian distribution range has been significantly modified in comparison with that summarised by DeBlase (1980), viz. *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. hardwickii*, *Rhinolophus hipposideros*, *Taphozous perforatus*, *T. nudiventris*, *Myotis blythii*, *M. bechsteinii*, *M. capaccinii*, *Eptesicus anatolicus*, *Rhyneptesicus nasutus*, *Nyctalus noctula*, *Otonycteris hemprichii*, *Barbastella darjelingensis*, *Plecotus macrobullaris*, *Tadarida teniotis*, and *Nyctinomus aegyptiacus* (see under Distribution of these species). In ca. a half of the species number, their new records rather conform to the ranges delineated already by DeBlase (1980). On the other hand, the distribution ranges have been dramatically shifted towards the Iranian territory in the ten species recorded from Iran for the first time; their Iranian occurrence continues from different geographical directions, viz. from the north-west (*Myotis nattereri*, *Pipistrellus pygmaeus*, *Barbastella barbastellus*, *Plecotus auritus*), from the east (*Hipposideros fulvus*, *Eptesicus pachyomus*, *Plecotus strelkovi*) and from the south (*Eptesicus bottae*, *Hypsugo arabicus*).

Only two bat species can be considered as very abundant (*Myotis blythii*, *Pipistrellus kuhlii*), they are known from around one hundred records from Iran (Table 1). On the other hand, only ten other bat species are known from more than 25 records and at least six bat species are still known only from a single record from Iran (*Hipposideros fulvus*, *Myotis hyrcanicus* sp. n., *Eptesicus bobrinskoi*, *Hypsugo arabicus*, *Nyctalus lasiopterus*, *Plecotus auritus*, *P. strelkovi*). Only one species can be considered an endemic of the Iranian territory (*Myotis hyrcanicus* sp. n.).

DeBlase (1980) suggested possible occurrence in Iran of five bat species that are known to occur in the surrounding countries close to the Iranian border. Two of these species, *Hipposideros fulvus* and *Barbastella barbastellus* have been indeed found in Iran in the last years (moreover, one misidentified record of *B. barbastellus* was already mentioned by DeBlase 1980, see above). However, DeBlase (1980) suggested also the occurrence of *Rhinolophus lepidus* Blyth, 1844, *Pipistrellus nathusii* (Keyserling et Blasius, 1839), and *Pipistrellus rueppellii* (Fischer, 1829). None of these bats has been found in Iran, although the records of the latter two species are known from sites situated very close to the borders of Iran. *P. nathusii* is an Eurasian forest bat species, relatively abundantly occurring in Transcaucasia; it is one of the rather commonly recorded bats in Azerbaijan, numerous records are available from the forested areas of the Lənkəran area just on the Iranian-Azerbaijani border at the Caspian shore (Rahmatulina 2005). With a certain netting effort, *P. nathusii* should be recorded in the adjacent Iranian areas of the Gilan province, namely in the transient periods of the year when this bat migrates and its mobility is relatively high (Strelkov 1997). *P. rueppellii* is an African savannah- and desert-dwelling bat species that reaches the eastern margins of its distribution range in Arabia; it is known from five records in Iraqi Mesopotamia (Harrison & Bates 1991) and its occurrence is very probable in the Iranian provinces of Ilam and Khuzestan, in the desert areas of the Mesopotamian lowlands. *R. lepidus* is a horseshoe bat that occurs in a large part of the Oriental region (Bates & Harrison 1997) and the westernmost margins of its distribution range lie in elevated areas of northern Afghanistan and eastern West Turkestan (Uzbekistan, Kirghizstan) (Benda et al. 2011c). Theoretically, this bat could be recorded also in Iran, perhaps in mountainous regions of the eastern part of the country, adjacent to the westernmost fringes of the Hindu Kush range in eastern Khorasan; however, its closest records in Afghanistan are localised more than 300 km from the eastern border of Iran (Felten et al. 1977).

Karami et al. (2008) suggested possible occurrence of three other bat species in Iran, *Myotis myotis* (Borkhausen, 1797), *Eptesicus gobiensis* Bobrinskoj, 1926, and *Plecotus turkmenicus* Strelkov, 1988. From this trinity, the latter species is the hottest candidate to enrich the bat fauna of Iran. *P. turkmenicus* lives in the Karakum desert of north-western Turkmenistan and western Kazakhstan (Spitzenberger et al. 2006); it may be present in the Turkestan plain of the northern Golestan province of Iran. *M. myotis* is a European species occurring also in western and central Turkey and the Levant, the easternmost records from Anatolia lie ca. 250 km westwards from the western border of Iran (Aşan et al. 2010); however, this bat does not occur in the Caucasus region and its occurrence in Iran is less probable (see also under *Myotis blythii*). *E. gobiensis* is distributed in the mountains of Central Asia (Strelkov 1986), the closest record to the Iranian territory is known from western Tajikistan, some 650 km to the east; theoretically, it could be found in the mountains of eastern parts of Iran (for more details see under *Eptesicus nilssonii*).

DeBlase (1980) and Karami et al. (2008) reported an occurrence of *Rhinolophus bocharicus* in Iran; however, the respective record was convincingly doubted (see Strelkov et al. 1978 and above). Nevertheless, this species remains among the potential members of the Iranian fauna, since its closest findings in Turkmenistan were made some 70 km from the Iranian border.

Besides the potential members of the Iranian bat fauna suggested by DeBlase (1980) and Karami et al. (2008), two additional bat species may be taken into consideration. *Myotis brandtii* (Eversmann, 1845), a Eurasian forest bat, was recorded in the Lənkəran area on the Iranian-Azerbaijani border (Rahmatulina 2005) and it could be found in the adjacent Iranian areas of forests in the Gilan province (similarly as *P. nathusii*). *Myotis bucharensis* Kuzâkin, 1950 is an endemic of the arid western foothills of the Tien Shan / Pamir-Alai / Pamir mountain complex (see Benda et al. 2011c). Very theoretically, it could be found also in the north-eastern corner of Iran; however, it has been recorded neither in Turkmenistan nor Afghanistan so far.

In conclusion, the number of 50 species in the Iranian bat fauna is probably not yet final. The margins of distribution ranges of several other bat species are positioned relatively close or even very close to the Iranian borders. In the north-western part of Iran, *Myotis myotis*, *M. brandtii* and *Pipistrellus nathusii* could be recorded, in the south-western Iran *Pipistrellus rueppellii*, and in the north-eastern Iran *Rhinolophus bocharicus*, *R. lepidus*, *Myotis bucharensis*, *Eptesicus gobiensis*, and *Plecotus turkmenicus*.

Zoogeography

DeBlase (1980) stressed the prevailing Palaearctic affinities of the Iranian bat fauna and this conclusion remains true also in the present time when the taxonomic and geographical extent of numerous species has been restricted. Only nine species (18%) have a stronger affinity to other biogeographic regions than to the Palaearctic, viz. three species to the Oriental fauna (*Rhinopoma hardwickii*, *Hipposideros fulvus*, *Eptesicus pachyomus*), two species to the Saharo-Sindic and Oriental fauna (*Rhinopoma microphyllum*, *Taphozous nudiventris*), and four species to the Afro-tropical fauna with limited distributional extensions to the Palaearctic and Oriental regions (*Rousettus aegyptiacus*, *Rhinolophus blasii*, *Taphozous perforatus*, *Nyctinomus aegyptiacus*). DeBlase (1980: 264) concluded: "Many mammals in other orders have come to Iran from the Oriental region, e.g. *Funambulus*, *Selenarctos*, and *Gazella* […], but none of the 38 species of bats presently known from Iran is primarily Oriental in distribution." This statement is here changed, at least 6% of the Iranian bat species "come from the Oriental region".

All other species (82%) can be regarded as the Palaearctic or mostly Palaearctic species. A certain exception is represented by a pair of widespread species of the Saharo-Sindic zone, which have very small extensions also to the Afro-tropics (*Asellia tridens*, *Otonycteris hemprichii*). The most numerous group among Iranian bats represents the widespread Mediterranean fauna (with marginal extensions to the mountains of the Oriental region in some cases) – eleven species (22%; *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale*, *R. mehelyi*, *Myotis emarginatus*, *M. capaccinii*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *P. kuhlii*, *Nyctalus leisleri*, *Tadarida teniotis*). A similar distribution pattern in Iran as in the preceding group is also found in eight species of the widespread Palaearctic fauna (*Myotis blythii*, *M. mystacinus*, *M. davidii*, *Vespertilio murinus*, *Eptesicus serotinus*, *E. nilssonii*, *Nyctalus noctula*, *Barbastella darjelingensis*). Seven species belong to the European forest fauna (*Myotis bechsteinii*, *M. nattereri*, *Pipistrellus pygmaeus*, *N. lasiopterus*, *Barbastella barbastellus*, *Plecotus auritus*, *P. macrobullaris*) and occur namely in the northern forest zone of Iran. These two groups create altogether 30% of the Iranian bat species. A quarter of the bat fauna (26%) is composed of endemics; four species are the Central Asian endemics (*Eptesicus bobrinskoi*, *E. ognevi*, *Otonycteris leucophaea*, *Plecotus strelkovi*) and nine species are endemics of the Middle East (*Rhinopoma muscatellum*, *Triaenops persicus*, *Myotis schaubi*, *M. hyrcanicus* sp. n., *Eptesicus anatolicus*, *E. bottae*, *Rhyneptesicus nasutus*, *Hypsugo arabicus*, *Miniopterus pallidus*).

The crucial geographical position of the Iranian territory on the crossroad of biogeographical regions of Eurasia is also documented by the presence of margins of distribution ranges in most of the species; only two bats have no margin of their ranges in Iran (*Rhinolophus blasii*, *Pipistrellus kuhlii*). For most of bat species (62%), Iran is a part of the southern margin of their distribution ranges, which indicates clear affiliations to the Palaearctic in these bats; *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis blythii*, *M. mystacinus*, *M. davidii*, *Vespertilio murinus*, *Eptesicus serotinus*, *E. nilssonii*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *Nyctalus noctula*, *N. leisleri*, *Plecotus auritus*, *Miniopterus pallidus*, and *Tadarida teniotis* reach the southern margin of their distribution in Iran, *Rhinolophus euryale*, *R. mehelyi*, *Myotis bechsteinii*, *M. nattereri*, *M. schaubi*, *M. capaccinii*, *Eptesicus anatolicus*, *Pipistrellus pygmaeus*, *Nyctalus lasiopterus*, *Bar-*

bastella barbastellus, and *Plecotus macrobullaris* the southern and eastern margins, and *Eptesicus bobrinskoi*, *E. ognevi*, *Otonycteris leucophaea*, *Barbastella darjelingensis*, and *Plecotus strelkovi* the southern and western margins of their distribution ranges. One Palaearctic (Mediterranean) bat reaches the eastern margin of its distribution range in Iran (*Myotis emarginatus*). Almost a third of the bat fauna (30%) have a part of the northern margin of the distribution range in Iran; *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. hardwickii*, *Asellia tridens*, *Triaenops persicus*, *Taphozous perforatus*, *T. nudiventris*, *Rhyneptesicus nasutus*, and *Nyctinomus aegyptiacus* have the northern margin of distribution in Iran, *Rhinopoma muscatellum*, *Hipposideros fulvus* and *Eptesicus pachyomus* the northern and western margins of the range, and *Eptesicus bottae*, *Hypsugo arabicus* and *Otonycteris hemprichii* the northern and eastern margins of the distribution range.

Concerning the general distribution of bat fauna, the territory of Iran comprises several bioregions. DeBlase (1980) divided the Iranian territory into two main regions according to the bat distribution, and the fauna of bats into three groups according to this classification, the northern group, the southern group and the group of widely distributed species extending to both previous regions. DeBlase (1980) assigned nineteen species to the group of northern species (namely of the Mediterranean fauna, European forest fauna and the widespread Palaearctic fauna in the above classification), nine species to the group of southern species (namely the Saharo-Sindic and Afro--tropical faunas), and eight species to the group of widespread (a mixture of species concerning their faunal affiliation).

The markedly higher number of bat records from Iran than was available to DeBlase (1980) perhaps enables to make a more accurate zonation of the Iranian bat fauna. Djamali et al. (2012)

Fig. 222. Bat bug *Stricticimex namru* Usinger, 1960 from the Dehloran cave (Ilam). The record represents the first evidence of this parasite from Iran. Photo by O. Balvín.

divided the territory of Iran into three main biozones (with ten sub-zones), Temperate, Mediterranean and Tropical. With the help of this zonation, detailed in the geographical marking (Djamali et al. 2012: 97), the bat fauna could be divided into the following six types according to the prevailing (80%) distribution of records in the particular species. Nine species (18%) belong to the smallest zone of the Temperate fauna, distributed in the region of the Hyrcanian forests and adjacent areas on the northern slopes of the Talysh and Alborz Mts. along the southern Caspian shore (*Myotis bechsteinii*, *M. nattereri*, *M. hyrcanicus* sp. n., *Eptesicus nilssonii*, *Pipistrellus pygmaeus*, *Nyctalus noctula*, *N. lasiopterus*, *Barbastella barbastellus*, *Plecotus auritus*); the largest group composed of eighteen species (36%) belong to the Mediterranean fauna, distributed in the largest part of the country in the elevated regions of central, western and north-eastern Iran with several extension to mountains in southern Iran (*Rhinolophus ferrumequinum*, *R. euryale*, *R. mehelyi*, *R. blasii*, *Myotis blythii*, *M. schaubi*, *M. mystacinus*, *M. davidii*, *M. capaccinii*, *Vespertilio murinus*, *E. bobrinskoi*, *E. anatolicus*, *E. bottae*, *E. ognevi*, *Hypsugo savii*, *Barbastella darjelingensis*, *Plecotus macrobullaris*, *Miniopterus pallidus*); and thirteen species (26%) belong to the Tropical fauna distributed in the belt of south-Iranian steppes, deserts and arid mountains along Mesopotamia and the shores of the Persian Gulf and Gulf of Oman (*Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. muscatellum*, *R. hardwickii*, *Hipposideros fulvus*, *Asellia tridens*, *Triaenops persicus*, *Taphozous perforatus*, *Eptesicus pachyomus*, *Rhyneptesicus nasutus*, *Hypsugo arabicus*, *Otonycteris leucophaea*, *Nyctinomus aegyptiacus*). Nine species (18%) occur representatively in more than one of the above delineated zones; *Rhinolophus hipposideros*, *Eptesicus serotinus*, *Pipistrellus pipistrellus*, and *Nyctalus leisleri* belong to the Temperate and Mediterranean faunas, *Taphozous nudiventris*, *Pipistrellus kuhlii*, *Otonycteris hemprichii*, and *Tadarida teniotis* to the Mediterranean and Tropical faunas, and *Myotis emarginatus* is a widespread species known from all three zones. Several species are distributed markedly close to the borders of the particular zones, namely between the Mediterranean and Tropical zones (e.g. *Rhinopoma microphyllum*, *R. hardwickii*, *Myotis capaccinii*, *Eptesicus anatolicus*); this may indicate the diffusion environmental character and/or the ecotone effect of the particular zone margins.

Ectoparasites

Along with the review of distribution and biology of bats of Iran, we also present the review of arthropod ectoparasites of bats of the country. Altogether, at least 36 parasite species (almost one third of them new for the country) belonging to twelve families were recorded; viz. Ischnopsyllidae, Pulicidae, Cimicidae, Nycteribiidae, Streblidae, Argasidae, Ixodidae, Macronyssidae, Spinturnicidae, Myobiidae, Trombiculidae, and Chirodiscidae. Occurrence of two of them, Cimicidae and Macronyssidae, is here reported from Iran for the first time, the other families were published previously (Pomerancev 1950, Klein et al. 1963, Theodor 1967, Maa 1968, Farhang-Azad 1969b, Vercammen-Grandjean et al. 1970, Kudrâšova 1975, Filippova et al. 1976, Peus 1976, Kudrâšova et al. 1978, Fain 1982, Kock 1983, Hůrka 1984a, Uchikawa 1985, Sharifi et al. 2008, Vatandoost et al. 2010, Dittmar de la Cruz 2012).

Five species of bat fleas of the Ischnopsyllidae family are known from Iran, *Ischnopsyllus dolosus* (collected from *Myotis blythii*), *I. elongatus* (from *Nyctalus noctula*), *I. octactenus* (from *Pipistrellus pipistrellus* and *P. kuhlii*), *I. petropolitanus* (from *Plecotus macrobullaris*), and *Chiropteropsylla brockmani* s.l. (from *Asellia tridens*). *I. dolosus* and *I. petropolitanus* are here reported from Iran for the first time. Records of *I. dolosus* are rather scarce throughout its range, which perhaps covers only the Caucasus region and the adjacent part of the Middle East. It is parasitic on various bat species from the genera *Myotis*, *Eptesicus*, *Pipistrellus*, and *Plecotus* (Ioff & Argyropulo 1934, Labunec & Deetâreva 1985, Aktaş 1987), see also under *M. blythii*. The distribution range of *I. elongatus* corresponds more or less to the range of its principal host, *Nyctalus noctula* (Hůrka 1963), from which it was collected also in northern Iran (Farhang-Azad 1969b). *I. octactenus* most probably represents a common species in Iran, since it is a parasite of bat species of the genus *Pipistrellus*, namely *P. pipistrellus* (Hůrka 1963), which represent the most common part of the Iranian bat fauna (see above). *I. petropolitanus* is a rather rare parasite, known to occur in West Turkestan, whose record in Iran represents the southernmost evidence of the species. So far it has been documented from various bat species of the arid zone of Asia, such as *Rhinolophus bocharicus*, *Myotis* cf. *mystacinus*, *Eptesicus ognevi*, *Hypsugo savii*, *Barbastella darjelingensis*, etc. (Hůrka 1970, Medvedev et al. 1984, Medvedev 1989, Polkanov 1995). The Iranian record of *Chiropteropsylla brockmani* was reported from *Asellia tridens* by Farhang-Azad (1969b). This species is known mainly from north-eastern Africa and the Middle East, its distribution range is probably restricted to the Saharo-Sindic zone (Hopkins & Rothschild 1956).

A rather unusual record of a flea of the Pulicidae family on a bat is available from Iran, *Xenopsylla nuttalli* was documented from *Pipistrellus pipistrellus* (Dittmar de la Cruz 2012). This flea is adapted to parasitise a different group of mammals (Rodentia) and we consider its collection from this bat as an accidental record. Occurrence of *X. nuttalli* on its main host group, the family Gerbillidae, is common in Iran (cf. Klein et al. 1963, Farhang-Azad 1969c, Tajedin et al. 2009).

Only one member of the family Cimicidae parasitic on bats has been registered in Iran, *Stricticimex namru* (from a mixed colony*); it is the first record for the fauna of Iran (Fig. 222). This bug has been known only from Egypt (Usinger 1966, Ueshima 1968) and India (Advani & Vazirani 1981; host: *Nyctinomus aegyptiacus*). Here presented record thus interconnects the known distant occurrence spots. It is a rather enigmatic taxon, its ecology and zoogeography remains almost unknown.

From the western Palaearctic, altogether 18 species of bat flies of the Nycteribiidae family are known, belonging to five genera (Theodor 1967, Hůrka & Soós 1986a). Fourteen species of this family were confirmed to occur in the Middle East and nine in Iran*; viz. *Nycteribia latreillii* (collected from *Myotis blythii* and *M. capaccinii*), *N. pedicularia* (from a mixed collection), *N. schmidlii* (from *Rhinolophus ferrumequinum*, *Myotis capaccinii*, *Miniopterus pallidus*, and from

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*Records of ectoparasites from unspecified hosts. **Original data**: C i m i c i d a e: *Stricticimex namru*: 1 fa (Fig. 222), 4 larvae (det. O. Balvín), under a mixed colony, Dehloran cave (Ilam Prov.), 17 October 2011. – A r g a s i d a e: *Ornithodoros* sp.: 1 fa under a mixed colony, Bishapur, cave at the Sâsân spring (Fars Prov.), 6 October 2011. – **Published data**: N y c t e r i b i i d a e: *Nycteribia pedicularia*: 6 ma, 5 fa, from a collection mixed of 3 *Hipposideros* sp. [= *Asellia tridens* or *Triaenops persicus*] and 2 *Myotis* sp., Fars Prov., November 1963 (Maa 1968). – *Nycteribia schmidlii*: 6 ma, 5 fa from a collection mixed of *Rhinolophus ferrumequinum*, *R. euryale*, *R. blasii* and *Miniopterus pallidus*, Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.] (Kock 1983). – *Stylidia biarticulata* [= *Phthiridium biarticulatum*]: 1 ma from a collection mixed of *Rhinolophus euryale* and *R. blasii*, Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.] (Kock 1983). – S t r e b l i d a e: *Brachytarsina flavipennis*: 4 ma, 1 fa from a collection mixed of *Rhinolophus euryale* and *R. blasii*, Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.] (Kock 1983); – 3 ma, 1 fa from a collection mixed of *R. ferrumequinum*, *R. euryale*, *R. blasii* and *Miniopterus pallidus*, Mozduran Cave, Khorassan [Khorasan-e Razawi Prov.] (Kock 1983).

The bat bug *Stricticimex namru* Usinger, 1960 was collected from a wall of the Dehloran cave at Dehloran (Ilam) under a colony mixed of *Rhinopoma microphyllum*, *R. hardwickii* and *Asellia tridens*. An adult female of the tick *Ornithodoros* sp. was sampled from bottom of the cave at the Sasan spring at Bishapur (Fars) where colonies of *Rousettus aegyptiacus*, *Rhinopoma microphyllum*, *R. muscatellum*, *Myotis blythii*, and *Minopterus pallidus* were found.

Concerning the ectoparasites gathered as "mixed collections" from more hosts (Maa 1968, Kock 1983), almost all respective groups of hosts contained the most probable host species, considering the available knowledge. The bat fly *Brachytarsina flavipennis* Macquart, 1851 is parasitic mainly on bats of the genus *Rhinolophus* and rarely of the genus *Miniopterus* (Jobling 1934); these two genera were present in the original collection of bats from which the parasites were collected (see above). A similar situation is also in the cases of the bat flies; *Nycteribia schmidlii* Schiner, 1853 is known to parasitise namely the *Miniopterus* bats and more rarely species of the genera *Myotis* and *Rhinolophus*; *Phthiridium biarticulatum* (Hermann, 1804) is an exclusive parasite of the *Rhinolophus* and *Hipposideros* bats; and *Nycteribia pedicularia* Latreille, 1805 prefers mainly bats of the genus *Myotis* (Hůrka 1964, Theodor 1975).

a mixed collection), *N. vexata* (from *Myotis blythii*), *Eucampsipoda aegyptia* (from *Rousettus aegyptiacus*), *Basilia nana* (from *Myotis bechsteinii* and *M. nattereri*), *Phthiridium biarticulatum* (from *Rhinolophus ferrumequinum* and from a mixed collection), *Penicillidia conspicua* (from *Myotis capaccinii* and *Miniopterus pallidus*; Figs. 109, 208) and *P. dufourii* (from *Myotis blythii* and *M. capaccinii*; Fig. 110). Kock (1983) summarised the known records of bat flies from Iran and mentioned six species: *Nycteribia pedicularia*, *N. schmidlii*, *N. vexata*, *Phthiridium biarticulatum*, *Penicillidia dufourii* and *P. conspicua*. Hůrka (1984a) reported another species, *Eucampsipoda hyrtlii* [= *E. aegyptia*] that was expected to occur in Iran already by Kock & Nader (1979) based on the presence of its principal host, *Rousettus aegyptiacus*. Our findings of *Nycteribia latreillii* and *Basilia nana* represent the first records of these bat flies from Iran. Collection of *N. latreillii* could be considered as expected, since the distribution range of this species corresponds with the ranges of its principal hosts, bats of the *Myotis myotis* group (Hůrka 1964) and the parasite was found in neighbouring Afghanistan (Aellen 1959b). *B. nana* occurs throughout continental Europe and the Mediterranean region (Hůrka 1964), its southernmost record is available from Israel (Theodor 1967). The principal hosts of this bat fly are two bat species typical for the forest zone, *Myotis bechsteinii* and *M. nattereri* (Hůrka 1964), the two species from which this parasite was collected also in Iran.

Three species of the family Streblidae were found in Iran, *Brachytarsina flavipennis* (collected from *Rhinopoma microphyllum*, *Rhinolophus ferrumequinum*, *R. blasii*, and from a mixed collection*), *B. diversa* (from *Rhinopoma microphyllum*), and *Raymondia huberi* (from *Asellia tridens* and *Taphozous perforatus*). *B. flavipennis* and *B. diversa* are the only bat flies of the genus *Brachytarsina* Macquart, 1851 known from the western Palaearctic (Hůrka & Soós 1986b). From the Iranian territory, they were reported by Kock (1983) and found also in our material. These parasites are perhaps not rare, since their host bats belong to common fauna members (see above). *Raymondia huberi* belongs to the western Palaearctic and Afro-tropical fauna of bat flies. From the Middle East, it was reported, besides the record from Iran (Hůrka 1984a), also from Egypt, Israel, and Afghanistan (Theodor & Moscona 1954, Aellen 1959b). Two species of the genus *Ascodipteron* Adensamer, 1896 occur in the western Palaearctic, parasitic solely on the bats of the genus *Rhinopoma*; *A. namrui* Maa, 1964 and *A. rhinopomatos* Jobling, 1952. While records of the former species are available only from the eastern Mediterranean region (Maa 1965b), *A. rhinopomatos* could be perhaps found also in Iran. So far it has been recorded in Afghanistan, Israel, Egypt, and Djibouti (Jobling 1952, Theodor & Moscona 1954, Aellen 1959b, Maa 1965, Hůrka & Povolný 1968).

One species of the Argasidae family was found in Iran, *Argas vespertilionis* (Filippova et al. 1976). This soft mite is widespread and common throughout the Old World, reaching the Oriental and Australian regions, parasitic on a variety of bat species inhabiting different habitats (caves, tree hollows, house attics, etc.). In Iran, it was previously recorded from *Pipistrellus pipistrellus* (Filippova et al. 1976) and newly it was documented from four bat species, *Rhinolophus ferrumequinum*, *Pipistrellus pipistrellus*, *P. pygmaeus* and *Miniopterus pallidus*. Occurrence of other species of the genus cannot be excluded in the territory of Iran. *Argas transgariepinus* White, 1846 is primarily distributed in Africa, however, it was documented also in the European Mediterranean, Levant, and Afghanistan, parasitic on *Eptesicus serotinus*, *Hypsugo savii*, *Pipistrellus nathusii*, and *Plecotus austriacus* (Dusbábek 1970). *Argas boueti* occurs in Africa and the Middle East up to Afghanistan (Hoogstraal 1955, Dusbábek 1970). Most of the findings originated from bats of the superfamilies Emballonuroidea and Rhinolophoidea (Hoogstraal 1955). *Argas confusus* Hoogstraal, 1955 is distributed in north-eastern Africa and the Levant (Hoogstraal 1955, Benda et al. 2010). Its records are available from a variety of bats occurring in arid habitats, namely from the genera *Rhinopoma*, *Taphozous*, *Nycteris*, *Otonycteris*, and *Tadarida* (Hoogstraal 1955, Benda et al. 2010). One specimen of a soft mite of the genus *Ornithodoros* was collected from the roost of five bat species; it belongs to an unidentified species, its description and taxonomic affiliations will be discussed elsewhere.

Records of one species of hard tick of the family Ixodidae that regularly parasitises bats are available from Iran, *Ixodes vespertilionis*, collected from *Rhinolophus blasii* and *Myotis blythii*. It was first reported from the country by Pomerancev (1950), later also by Vatandoost et al. (2010) who first mentioned its host and site of collection (*Myotis blythii* from the Mahidasht cave). However, its records are not unusual, this widespread tick species prefers cave-dwelling bats, namely of the genus *Rhinolophus* (Dusbábek 1972); its distribution range covers Europe, Africa, Middle East, south-eastern Asia and Far East, and Pacific islands (Kolonin 2007). Occurrence of another hard tick species, *Ixodes simplex* Neumann, 1906, in Iran is also very likely; it is a monoxenic parasite of bats of the genus *Miniopterus* in the western Palaearctic (Dusbábek 1972).

In the case of hard ticks, there also is a general possibility of accidental and/or exceptional records caused by lateral transfer of the species preferring small terrestrial mammals (insectivores, carnivores, rodents), e.g. in common habitats or even roosts. Four such species were already documented from Iran by Filippova et al. (1976), viz. *Ixodes redikorzevi* and *Dermacentor marginatus* (both collected from *Pipistrellus pipistrellus*), *Haemaphysalis erinacei* (from *Nyctalus noctula* and *Otonycteris leucophaea*), and *H. sulcata* (from *Eptesicus ognevi* and *O. leucophaea*).

One species of the mite family Macronyssidae was recorded in Iran, *Steatonyssus periblepharus* which was found in *Pipistrellus kuhlii* in the Fars province. This mite species is parasitic mainly on bats of the genus *Pipistrellus*, but it was also found on species of the genera *Myotis*, *Plecotus* and *Eptesicus* (Till & Evans 1964). Closer unidentified specimens of the genus *Steatonyssus* were found on *Pipistrellus pipistrellus*. From this host, *Steatonyssus periblepharus* and *S. spinosus* were previously mentioned from Europe and Transcaucasia (Till & Evans 1964, Ogandžanân & Arutûnân 1974).

Four species of the family Spinturnicidae, mesostigmatic mites, were collected from Iran; viz. *Meristaspis lateralis* (collected from *Rousettus aegyptiacus* and *Pipistrellus kuhlii*), *Spinturnix myoti* (from *Myotis blythii*), *S. psi* (from *Myotis capacinii* and *Miniopterus pallidus*) and *Spinturnix* sp. *acuminata* group (from *Pipistrellus kuhlii*). Although these species are here reported from Iran for the first time, their occurrence in the country cannot be considered as unusual (with the exception of the latter form which seems to represent a yet undescribed species of the *S. acuminata* group). These obligatorily haematophagous or lymphophagous ectoparasites are mostly monoxenic and their distribution corresponds with that of their hosts. Some other spinturnicid species of the western Palaearctic can thus be expected in Iran, whose preferred host species occur in the country; e.g. *Spinturnix bechsteini* Deunff, Walter, Bellido et Volleth, 2004 (principally parasitic on *Myotis bechsteinii*), *S. emarginata* (Kolenati, 1856) (on *Myotis emarginatus*), *S. mystacina* (Kolenati, 1857) (on *Myotis mystacinus*), *S. nobleti* Deunff, Volleth, Keller et Aellen, 1990 (on *Hypsugo savii*), *S. punctata* (Sundevall, 1833) (on *Barbastella barbastellus*); some of these species were already confirmed from the neighbouring countries of Transcaucasia and West Turkestan (Stanyukovich 1997). Among spinturnicid mites, there are several oligoxenic species parasitic on more species of the respective genus; *Eyndhovenia euryalis* (Canestrini, 1884), *Paraperiglischrus rhinolophinus* (Koch, 1844) (on the genus *Rhinolophus*), *Spinturnix acuminata* s.str. (on *Nyctalus noctula*), *S. kolenati* Oudemans, 1910 (on the genus *Eptesicus*), *S. plecotina* (Koch, 1839) (on the genus *Plecotus*). These parasitic taxa could be thus theoretically also found in Iran, considering the wide occurrence of their host genera there.

One species of the mite of the family Myobiidae is known from Iran, Uchikawa (1985) described *Calcaromyobia dusbabeki* based on the finding from *Miniopterus pallidus* (see above). However, presence of more myobiid species could be expected in Iran, e.g. in bats of the genera *Rhinolophus*, *Myotis*, *Pipistrellus*, and *Barbastella* (see Bochkov 1996).

Despite the numerous published records of the chigger mites of the Trombiculidae family (Vercammen-Grandjean et al. 1970, Kudrâšova 1975, Kudrâšova et al. 1978), no new records are available from Iran. Altogether, only five species were reported from the country, viz. *Neoschoengastia elegans* (collected from *Asellia tridens*), *Chiroptella vavilovi* Kudrâšova, 1975 (from *Rhinopoma hardwickii* or *R. muscatellum*; cf. DeBlase 1980), *Schoutedenichia chilmirica* (from *Pipistrellus pipistrellus*), *Willmannium aelleni* (from *Rhinolophus ferrumequinum*) and *W. cavum* (from *Eptesicus ognevi*). Based on the evidence from Afghanistan, Daniel et al. (2010) stressed a high level of endemism among the bat chigger mites, whereas only one mite is known in a wider area, *Willmanium aelleni*; the latter species was found in Iran, Afghanistan and Kirghizstan (Vercammen-Grandjean 1963, Dusbábek 1970, Kudrâšova 1998).

In Iran, only one mite species of the family Chirodiscidae was found; *Alabidocarpus calcaratus* Lawrence, 1952 (Fain 1982). It is a cosmopolitan species, parasitic mostly on bats of the genus *Myotis* (see the summary by Anciaux de Faveaux 1985), a common faunal element in Iran. Therefore, we do not consider this finding unusual; regarding the cosmopolitan distribution of this group of mites, findings of other Chirodiscidae species can be expected in Iran, namely of the genera *Alabidocarpus* and *Olabidocarpus* (on *Rhinolophus*, *Myotis*, and/or *Eptesicus*; cf. Anciaux de Faveaux 1985).

Bats in owl diet

We collected owl pellets in Iran during several field trips in the last fifteen years (1996, 1997, 1998, 2000, 2002, 2007; Table 40). We detected remains of bats in the diet of seven owl species; *Bubo bubo* (Linnaeus, 1758), *Tyto alba* (Scopoli, 1769), *Athene noctua* (Scopoli, 1769), *Athene brama* (Temminck, 1821), *Strix aluco* Linnaeus, 1758, *S. butleri* (Hume, 1878), and *Asio otus* (Linnaeus, 1758). Altogether 14,418 prey items were found in the diet of these owl species (Table 40), however, the proportion of bats was extremely low, only 127 individuals (0.88%) were detected among the prey. Such a proportion is quite different from that observed in some Levantine countries with landscape composition similar to that of Iran (e.g. Syria, Benda et al. 2006), where bats made up almost 8% of the whole owl diet.

The highest proportion of bats in the diet among the Iranian owls was found in the pellets of *Strix aluco*, where bats made up 1.06% of the whole diet and 2.62% of the mammal items. This limited sample of the diet of this owl (659 prey items as a whole) came from only one site, the large cave above the Sasan spring at Bishapur, a cave where colonies of four bat species are found to roost (see above) and six other species were found in the pellet material from two owl species (Table 40). The owls roosting at this cave were undoubtedly specialised to catch bats from the cave. Such behaviour was reported also from other parts of the distribution range of this owl species (Obuch 1992, 1998, Benda et al. 2010). A large proportion of bats within the mammal part of the diet was found also in the diet of *Strix butleri* (25.0%), however, such high value is certainly affected by the small size of the sample (170 items). A relatively high proportion of bats within the mammal prey was detected also in the diet of *Athene noctua* (4.29%) and *A. brama* (3.28%), but mammals including bats represent only additional prey items in these insect-specialised owls (see e.g. Obuch & Krištín 2004) and bats are perhaps hunted only randomly. In the diet of the other owl species, the proportion of bats did not exceed 2% of the mammal prey items examined per owl species despite the size of the analysed diet sample (*Asio otus* 1.85%, *Bubo bubo* 1.34%, *Tyto alba* 1.24%).

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Table 40. Presence of bat remains in owl pellets from Iran. Explanations: year = year of the sample collection (for exact date see Records), B = bat items, M = mammal items, P = whole prey items

sample \ item	year	*Raeg*	*Rmic*	*Rmus*	*Rfer*	*Reur*	*Rbla*	*Hful*	*Atri*	*Tnud*	*Mbly*	*Mema*	*Mcap*
Bubo bubo													
Dashtak	1996	–	–	–	–	–	–	–	–	–	1	–	–
Deh Zireh	1996	–	–	–	–	1	–	–	–	–	–	–	–
Gonbad	1996	–	–	–	–	–	–	–	–	–	–	–	–
Gholaman	1996	–	–	–	–	–	–	–	–	–	1	–	–
Shahpur	1996	–	–	–	1	–	–	–	–	–	–	–	–
Sivand	1996	–	–	–	1	–	–	–	–	–	9	–	–
Badamstan	1997	–	–	–	–	–	–	–	–	–	1	–	–
Bazangan	1997	–	–	–	–	–	–	–	–	–	–	–	–
Emamzadeh	1997	–	–	–	–	–	–	–	–	–	–	–	–
Bastam	1998	–	–	–	1	–	–	–	–	–	2	–	–
Bisotun	1998	–	–	–	–	–	–	–	–	1	–	–	–
Chuplu	1998	–	–	–	2	–	–	–	–	–	1	–	–
Sarkan at Izeh	1998	–	2	–	2	–	–	–	–	–	5	–	–
Lenje Abad	1998	–	–	–	–	–	–	–	–	–	2	–	–
Soltan Abad	1998	–	–	–	1	–	–	–	–	1	–	–	–
Taq-e Bostan	1998	–	–	–	–	–	–	–	–	–	–	–	–
Bishapur	2000	2	–	–	–	5	–	–	–	–	6	–	2
Deh Bakri	2000	–	–	–	–	–	–	–	–	–	3	–	–
Mach Gur	2000	–	–	–	–	–	–	–	–	–	1	–	–
Sarvestan	2000	–	–	–	–	–	–	–	–	–	1	–	–
Shangar	2000	–	–	–	–	–	–	–	–	–	1	–	–
Bazangan	2002	–	–	–	–	–	–	–	–	–	–	1	–
total *Bubo bubo*		2	2	0	8	6	0	0	0	2	34	1	2
Tyto alba													
Chahak	1996	–	–	–	–	–	–	–	–	1	–	–	–
Chahak	1998	–	–	–	–	–	–	–	–	1	–	–	–
Bisotun	1998	–	–	–	–	–	–	–	–	–	3	–	–
Haft Tappeh	2002	–	–	–	–	–	–	–	–	–	–	–	–
Choqazanbil	2002	–	–	–	–	–	–	–	2	1	–	–	–
Bandar Anzali	2007	–	–	–	–	–	–	–	–	–	–	–	–
total *Tyto alba*		0	0	0	0	0	0	0	2	3	3	0	0
Athene noctua													
Deh Zireh	1996	–	–	–	–	–	–	–	–	–	–	–	–
Rubat-e Chah G.	1997	–	–	–	–	–	–	–	–	–	–	–	–
Rubat-e Sharaf	1997	–	–	–	–	–	–	–	–	–	–	–	–
Firuz Abad	2000	–	–	–	–	–	–	–	–	–	–	–	–
Sarvestan	2000	–	–	–	–	–	–	–	–	–	–	–	–
total *Athene noctua*		0	0	0	0	0	0	0	0	0	0	0	0
Athene brama													
Espakeh	2000	–	–	–	–	–	–	–	1	–	–	–	–
Tis	2000	–	–	–	–	–	–	–	–	–	–	–	–
Tujak	2000	–	–	1	–	–	–	1	–	–	–	–	–
total *Athene brama*		0	0	1	0	0	0	1	1	0	0	0	0
Strix aluco													
Bishapur	2000	–	–	–	–	–	–	–	–	–	2	–	–
total *Strix aluco*		0	0	0	0	0	0	0	0	0	2	0	0
Strix butleri							–	–					
Dehbarez	2000	1	–	–	–	–	–	–	–	–	–	–	–
total *Strix butleri*		1	0	0	0	0	0	0	0	0	0	0	0
Asio otus													
Persepolis	2000	–	–	–	–	–	1	–	–	–	–	–	–
total *Asio otus*		0	0	0	0	0	1	0	0	0	0	0	0
total Chiroptera		3	2	1	8	6	1	1	3	5	39	1	2
number of owl species		2	1	1	1	1	1	1	2	2	3	1	1

species acronyms: *Raeg* = *Rousettus aegyptiacus*, *Rmic* = *Rhinopoma microphyllum*, *Rmus* = *R. muscatellum*, *Rfer* = *Rhinolophus ferrumequinum*, *Reur* = *R. euryale*, *Rbla* = *R. blasii*, *Hful* = *Hipposideros fulvus*, *Atri* = *Asellia tridens*, *Tnud* = *Taphozous nudiventris*, *Mbly* = *Myotis*

Eser	*Eana*	*Ppip*	*Pkuh*	*Ohem*	*Oleu*	*Mpal*	*Naeg*	Σ B	Σ M	Σ P	% M	% P
–	–	–	–	–	–	–	–	1	49	73	2.04	1.37
–	–	–	–	2	–	–	–	3	32	88	9.38	3.41
–	–	–	–	–	–	1	–	1	44	58	2.27	1.72
–	–	–	–	–	–	–	–	1	74	93	1.35	1.08
–	–	1	–	–	–	1	–	3	6	15	50.00	20.00
–	–	–	–	–	–	2	–	12	120	201	10.00	5.97
–	–	–	–	–	–	–	–	1	12	13	8.33	7.69
–	–	–	–	–	6	–	–	6	79	118	7.60	5.08
–	–	–	–	1	–	–	–	1	14	37	7.14	2.70
–	–	–	–	–	–	–	–	3	747	845	0.40	0.36
–	–	–	–	–	–	–	–	1	35	77	2.86	1.30
–	–	–	–	–	–	–	–	3	1033	1226	0.29	0.24
–	–	–	–	–	–	–	–	9	135	311	6.67	2.89
–	–	–	–	–	–	–	–	2	863	1068	0.23	0.19
–	–	–	–	–	–	–	–	2	99	128	2.02	1.56
–	–	–	–	1	–	–	–	1	50	61	2.00	1.64
–	–	2	–	–	–	3	–	20	71	87	28.17	22.99
–	1	–	–	–	–	–	–	4	130	206	3.08	1.94
–	–	–	–	–	–	–	–	1	4	4	25.00	25.00
–	–	–	–	–	–	–	–	1	2	9	50.00	11.11
–	–	–	–	–	–	–	–	1	44	65	2.27	1.54
–	–	–	–	–	3	–	–	4	105	146	3.81	2.74
0	1	3	0	4	9	7	0	81	6056	7864	1.34	1.03
–	–	–	–	–	–	–	–	1	79	174	1.27	0.57
–	–	–	–	1	–	–	–	2	93	144	2.15	1.39
–	–	–	1	–	–	–	–	4	249	281	1.61	1.42
–	–	–	7	–	–	–	–	7	88	96	7.95	7.29
–	–	–	–	–	–	–	–	3	315	323	0.95	0.93
–	–	1	3	–	–	–	–	4	63	64	6.35	6.25
0	0	1	11	1	–	0	0	21	1687	2197	1.24	0.96
–	–	–	2	–	–	–	–	2	24	166	8.33	1.20
1	–	–	–	–	–	–	–	1	28	167	3.57	0.60
–	–	–	1	–	–	–	–	1	9	83	11.11	1.20
–	–	5	2	–	–	–	–	7	11	57	63.64	12.28
–	–	–	1	–	–	–	–	1	19	92	5.26	1.09
1	0	5	6	0	0	0	0	12	280	1929	4.29	0.62
–	–	–	–	–	–	–	–	1	48	230	2.08	0.43
–	–	–	–	–	–	–	1	1	54	195	1.85	0.51
–	–	–	–	–	–	–	–	2	18	679	11.11	0.29
0	0	0	0	0	0	0	1	4	122	1492	3.28	0.27
1	2	1	–	–	–	1	–	7	24	199	29.17	3.52
1	2	1	0	0	0	1	0	7	267	659	2.62	1.06
–	–	–	–	–	–	–	–	1	4	170	25.00	0.59
0	0	0	0	0	0	0	0	1	4	170	25.00	0.59
–	–	–	–	–	–	–	–	1	48	85	2.08	1.18
0	0	0	0	0	0	0	0	1	54	107	1.85	0.93
2	3	10	17	5	9	8	1	127				
2	2	4	2	2	1	2	1	7				

blythii, *Mema* = *M. emarginatus*, *Mcap* = *M. capaccinii*, *Eser* = *Eptesicus serotinus*, *Eana* = *E. anatolicus*, *Ppip* = *Pipistrellus pipistrellus* s.l., *Pkuh* = *P. kuhlii*, *Ohem* = *Otonycteris hemprichii*, *Oleu* = *O. leucophaea*, *Mpal* = *Miniopterus pallidus*, *Naeg* = *Nyctinomus aegyptiacus*

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APPENDIX I

Gazetteer

Coordinates and altitudes of particular sites were determined mostly by the GPS receiver in the field or localised with help of Google Earth web application; in some cases the data were taken from literature, mostly from the gazetteer by DeBlase (1980: 347–353; marked by †); alt. = altitude [m a. s. l.]

site	province (ostan)	coordinates	alt.
1 km N Tis, 8 km N Chabahar	Sistân va Baluchestân	25° 22’ N, 60° 37’ E	15
1 km S Razjerd, 16 km NE Qazvin	Qazvin	36° 20’ N, 50° 10’ E	1610
1.6 km east of Kerman	Kermân	–	–
1.6 km S Khurramabad	Lorestan	–	–
1.6 km SE Maku	Âzarbâijan-e Gharbi	–	–
1.6 km west of Jahrom	Fârs	–	–
2 km E Maku	Âzarbâijan-e Gharbi	–	–
2 km SE Mansorabad	Fârs	–	–
2 km N Hashtjin	Ardabil	37° 23’ N, 48° 20’ E	1011
2 km NE Jelugir, 19 km SE Pol-e Dokhtar	Lorestan	33° 00’ N, 47° 48’ E	415
2 km NE Sang-e-Sar	Semnân	–	–
2 km NE Si Mili, 26 km SSE Masjed Soleyman	Khuzestân	31° 42’ N, 49° 24’ E	285
2 km NW Karim Ishan, 28 km SW Maraveh Tappeh	Golestan	37° 42’ N, 55° 46’ E	470
2 km S Dorbadam, 16 km S Bajgiran	Khorasân-e Razawi	37° 29’ N, 58° 28’ E	1550
2 km S Kareh, 18 km W Shahreza	Esfahân	31° 59’ N, 51° 40’ E	1998
2 km S Nasran [at Espidan], 12 km ESE Natanz	Esfahân	33° 27’ N, 52° 02’ E	1385
2 km S Sarkan, 9 km SW Izeh	Khuzestân	31° 45’ N, 49° 48’ E	880
2 km SE Garmab	Zanjân	35° 50’ N, 48° 13’ E	1615
2 km SSE Ali Âbâd	Golestan	36° 53’ N, 54° 53’ E	215
2 km west of Maku	Âzarbâijan-e Gharbi	–	–
2.6 km W Razi, 40 km NE Meshginshahr, Kânkahul cave	Ardabil	38° 37’ N, 48° 01’ E	1290
3 km E Ilka, 34 km W Baladeh	Mâzandaran	36° 14’ N, 51° 26’ E	2920
3 km N Durna	Khorasân-e Janubi	–	–
3 km N Meymand, 24 km N Pataveh	Kohgiluye va Boyer Ahmad	31° 10’ N, 51° 16’ E	1606
3 km NW Nach, 18 km E Baladeh	Mâzandaran	36° 12’ N, 52° 01’ E	1810
3 km S Lenje Abad, 9 km SW Dorud	Lorestan	33° 25’ N, 49° 00’ E	1375
3 km S of the Tangeh Road at Mohammed Reza Shah National Park	Khorasân-e Shomâli	–	–
3 km SSE Ziaz, 32 km S Rudsar	Gilân	36° 51’ N, 50° 14’ E	680
3 km SW Dasht	Khorasân-e Shomâli	–	–
3 km SW Isfehden	Khorasân-e Janubi	–	–
3 km SW Serizjan, 10 km N Firuz Abad	Fârs	28° 56’ N, 52° 32’ E	1450
3 km SW Tahir Abad, 45 km NE of Mashhad	Khorasân-e Razawi	36° 35’ N, 60° 01’ E	1035
3 km to Shushtar	Khuzestân	–	–
3.2 km N Khurramabad	Lorestan	–	–
3.2 km W Jahrom	Fârs	–	–
3-N salt cave, south-eastern part of Namakdân, 12 km ENE Kani, Qeshm island	Hormozgân	26° 37’ N, 55° 31’ E	80
4 km S Espakeh, 68 km SW Irânshahr	Sistân va Baluchestân	26° 48’ N, 60° 10’ E	808
4 km SE Bavineh, 42 km WNW Kuhdasht	Lorestan	33° 36’ N, 47° 12’ E	1175
4 km SE Emamqoli, 30 km N Quchan	Khorasân-e Razawi	37° 22’ N, 58° 32’ E	1725
4 km SE Suzesh, 18 km W Maraveh Tappeh	Golestan	37° 52’ N, 55° 45’ E	145
4 km W Abhar	Zanjân	–	–
4 km west of Maku	Âzarbâijan-e Gharbi	–	–
4 km WSW Jahrom	Fârs	–	–
4 miles N Lar	Fârs	–	–
4.8 km. west of Pahlavi Dezh	Golestan	–	–
5 km E Shangar, 50 km NW Shiraz	Fârs	29° 59’ N, 52° 12’ E	2190
5 km E Sivand, 64 km NE Shiraz	Fârs	30° 05’ N, 52° 58’ E	1905
5 km E Tunel-e Golestan, 44 km E of Kalaleh	Golestan	37° 22’ N, 55° 59’ E	825

site	province (ostan)	coordinates	alt.
5 km N Rubat-e Chah Gonbad	Yazd	33° 30' N, 57° 58' E	1120
5 km NE Isfehden	Khorasân-e Janubi	–	–
5 km NNE Deh Bakri, 40 km W Bam	Kermân	29° 05' N, 57° 56' E	1930
5 km S Mina, 20 km SW Dargaz	Khorasân-e Razawi	37° 18' N, 58° 58' E	1075
5 km S Qal'eh Bin, 60 km S Astara	Gilân	37° 53' N, 48° 54' E	15
5 km S Tutaki, 37 km SE Rasht	Gilân	37° 02' N, 49° 54' E	305
5 km SE Chah Reza, 74 km E Manujan	Kermân	27° 18' N, 58° 14' E	420
5 km southeast of Pol-i-Abgineh	Fârs	–	–
5 km W Arjank, 52 km SE Dorud	Lorestan	33° 09' N, 49° 28' E	2424
5 km W Chenarbu, 13 km SE Qalandar Abad	Khorasân-e Razawi	35° 30' N, 60° 00' E	1590
5.3 km (3.3 miles) SW Jahrom	Fârs	–	–
6 km E Maku	Âzarbâijan-e Gharbi	–	–
6 km E Tujak, 53 km SSE Sirik	Hormozgân	26° 04' N, 57° 18' E	33
6 km north of Bandar Mahshahr, resp. Olbuhardân, N Bandar-e Mâhshahr	Khuzestân	30° 40' N, 49° 09' E	9
6 km SW Galugah, 19 km E Behshahr	Mâzandaran	36° 41' N, 53° 46' E	580
6 miles NW Kuh Rang	Chahâr Mahâl va Bakhtiâri	–	–
6.4 km N Kermanshah	Kermânshah	–	–
6.4 km W Jahrom	Fârs	–	–
7 km E Bazangan, 14 km NNW Mazdavand	Khorasân-e Razawi	36° 17' N, 60° 31' E	745
7 km SE Chuplu, 10 km NW of Takab	Âzarbâijan-e Gharbi	36° 28' N, 47° 02' E	1760
7 km SE Gishan, 50 km N Bandar Abbâs	Hormozgân	27° 38' N, 56° 13' E	420
7 km W Kalatah Chenar, 27 km N Ashkaneh	Khorasân-e Shomâli	37° 48' N, 56° 56' E	810
7.2 km N Kermanshah	Kermânshah	–	–
8 km E Qasr-e Shirim	Kermânshah	–	–
8 km N Eshq Abad, 22 km N Ashkhaneh	Khorasân-e Shomâli	37° 46' N, 56° 57' E	915
8 km N Kermanshah	Kermânshah	–	–
8 km north of Gorgan	Golestan	–	–
8 km northwest of Maku	Âzarbâijan-e Gharbi	–	–
8 km NW Kuh Rang	Chahâr Mahâl va Bakhtiâri	–	–
8 km NW Meher, 48 km. W Sebzavar	Khorasân-e Razawi	–	–
8 km W Estahbanat	Fârs	–	–
8 km W Pul, 26 km SSE Chalus	Mâzandaran	36° 26' N, 51° 31' E	1015
9 km north of Gorgan	Golestan	–	–
10 km E Bazangan, 14 km N Mazdavand	Khorasân-e Razawi	36° 17' N, 60° 33' E	720
10 km E Chah Moslem	Hormozgân	–	–
10 km NW Hesar, 66 km NW Marv Dasht	Fârs	30° 20' N, 52° 22' E	1913
10 km SE Kâzerun	Fârs	–	–
10 km southwest of Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–
10 km WNW Bastak	Hormozgân	–	–
10 km N Malavy	Lorestan	–	–
11 km NW Darab	Fârs	–	–
11 km SE Sarvestan, 80 km SE Shiraz	Fârs	29° 13' N, 53° 20' E	1780
11 km SW Mormori, 29 km E Dehlorân	Ilâm	32° 40' N, 47° 34' E	347
12 km NNE Chah Mosallam, 42 km NE Bandar Lengeh	Hormozgân	26° 50' N, 54° 35' E	85
12 km west, 2 km south of Chalus	Mâzandaran	–	–
13 km NW Masjed Hazrat Abolfazl	Sistân va Baluchestân	28° 23' N, 59° 27' E	775
13 km SE Shiraz	Fârs	–	–
13.7 km SW Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–
14 km NW Pol-e Tang, 33 km SE Pol-e Dokhtar	Lorestan	32° 55' N, 47° 55' E	420
14.5 km NE Kermanshah	Kermânshah	–	–
15 km S, 6 km. E Yazd	Yazd	–	–
15 km SW Nosrat Abad, 100 km WNW Zahedan	Sistân va Baluchestân	29° 46' N, 59° 52' E	1345
15 km W Chalus, Khoshamian Forest	Mâzandaran	–	–
15 miles northwest of Ravansar	Kermânshah	–	–
16 km NNW Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–
16.1 km NNW Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–

site	province (ostan)	coordinates	alt.
18 km southwest of Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–
19.3 km. south of Shush	Khuzestân	–	–
20 km S Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–
20 km southwest of Zabol (Kuh-i-Khwjah)	Sistân va Baluchestân	–	–
20 km W Meshad	Khorasân-e Razawi	–	–
20 km W Tabus	Yazd	–	–
20 miles southeast of Ilam	Ilâm	–	–
20.6 miles SE Ilam, Porcupine Cave	Ilâm	–	–
22 km south southeast of Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–
26 km E Haft Tappeh	Khuzestân	–	–
27 km W Derregaz [= Dargaz]	Khorasân-e Razawi	–	–
28 km S Qum [= Qom]	Qom	–	–
28 km W Gorgan	Golestan	–	–
30 km NE Bijar	Kordestân	–	–
33 km SSE Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	–	–
36 km NE Bijar	Kordestân	–	–
37 km E Chalus, Sisangon Forest Park	Mâzandaran	–	–
40 km E Bam	Kermân	–	–
[about] 50 km E Sa’idabad	Kermân	–	–
44 km southeast of Maku	Âzarbâijan-e Gharbi	–	–
64, resp. 65 km. S Ilam	Ilâm	–	–
71 km SE Mashhad	Khorasân-e Razawi	–	–
105 km east of Teheran, Roud-Afshan cave	Tehrân	–	–
137 km SE Sebzavar	Khorasân-e Razawi	–	–
Ab-i-khurramabad River	Lorestan	–	–
Abbar, Kızılöz [= Kyzyluzen] River	Zanjân	36° 54’ N, 48° 59’ E	500
Âbbârik Farm, 10 km NW Lâr, Âbbârik cave	Fârs	27° 43’ N, 54° 19’ E	840
Abdanan river 15 km SW Mormori, 25 km E Dehlorân	Ilâm	32° 39’ N, 47° 32’ E	245
Âbgarm, 20 km S Qir	Fârs	28° 18’ N, 53° 03’ E	636
Abhar	Zanjân	36° 09’ N, 49° 13’ E	1530
Afghan Cave, 110 km SE Tehran	Semnân	–	–
Âftâbi cave	Kordestân	35° 50’ N, 47° 40’ E	–
Ahmad Beiglu, 10 km W Meshginshahr	Ardabil	38° 23’ N, 47° 34’ E	1147
Ahmad Mahmoudi	Fârs	28° 15’ N, 53° 37’ E	826
Ahmad Mahmoudi, 1 mi NW	Fârs	–	–
Ahram	Bushehr	28° 53’ N, 51° 16’ E	63
Ahram, Zâr Ahmadi Mts. and Zangi Mts.	Bushehr	28° 53’ N, 51° 16’ E	63
Ahwaz	Khuzestân	31° 19’ N, 48° 40’ E	20
Alavijeh	Esfahân	33° 03’ N, 51° 05’ E	1875
Alavice [= Alavijeh]	Esfahân	33° 03’ N, 51° 05’ E	1875
Alborz Mts., Kulak, Cave I, on the road to Shemshek	Tehrân	35° 58’ N, 51° 47’ E	3190
Al’horšir’ [= Ala Khworshid, 6 km NW Bagh-e Malek]	Khuzestân	31° 32’ N, 49° 52’ E	630
Ala Khworshid, 6 km NW Bagh-e Malek	Khuzestân	31° 32’ N, 49° 52’ E	630
Âli Âbâd, NE Darpahn	Hormozgân	26° 39’ N, 57° 34’ E	540
Ali Sadr cave	Hamadân	35° 18’ N, 48° 18’ E	1980
Alisard [= Ali Sadr] cave, Kabutar-Ahand near Hamedan	Hamadân	35° 18’ N, 48° 18’ E	1980
[between] Âlni and Jahâd Âbâd, 10 km NE Meshginshahr	Ardabil	38° 27’ N, 47° 46’ E	1345
Altinkosh, 25 km SW Rudbâr, Katale Khor cave	Qazvin	36° 45’ N, 49° 08’ E	570
Amir Âbâd	Zanjân	35° 42’ N, 48° 25’ E	2192
Amirabad	Ilâm	33° 21’ N, 46° 17’ E	357
Anbarân, 10 km NW Namin	Ardabil	38° 31’ N, 48° 27’ E	1711
Âq Bolâq, 40 km W Mâhneshân	Zanjân	36° 44’ N, 48° 06’ E	1358
Aq Qala	Golestan	37° 01’ N, 54° 27’ E	–14
Âqâ Mohammad Beglu, 35 km SSE Aslânduz	Ardabil	39° 11’ N, 47° 33’ E	306
Arac Langri, Malayer area	Hamadân	34° 18’ N, 48° 49’ E	1725
Arbab Kandi, 33 km ENE Meshginshahr, at the Qarah Su river	Ardabil	38° 30’ N, 48° 02’ E	1125

site	province (ostan)	coordinates	alt.
[between] Arbâbkandi and Naqdi, 32 km NE Meshginshahr	Ardabil	38° 29’ N, 48° 00’ E	1333
Ardakân	Esfahân	32° 17’ N, 54° 01’ E	1054
Aresht, 15 km W Âbbar, Aresht cave (Salt cave)	Zanjân	36° 58’ N, 48° 55’ E	522
Arg-e Bam, Bam	Kermân	29° 06’ N, 58° 24’ E	1045
Âsemân Âbâd, 30 km N Ilâm, Tange Rad cave	Ilâm	33° 53’ N, 46° 24’ E	1235
Ashuradeh island	Mâzandaran	36° 54’ N, 54° 01’ E	–26
Asporis village near Sari [= Esburez, 8 km SE Sâri]	Mâzandaran	36° 32’ N, 53° 08’ E	97
Ašref’ k’ ûgu ot’ Astrabadskago zaliva [= Behshahr]	Mâzandaran	36° 42’ N, 53° 33’ E	93
Assalem	Gilân	37° 41’ N, 48° 51’ E	270
Assalem, edge of small clearing in forest, 1250 m	Gilân	37° 39’ N, 48° 49’ E	1250
Astrabad’ [= Gorgan]	Golestan	36° 51’ N, 54° 26’ E	136
Âzâd-Khân cave in Mahalat [= Senje Bâshi, 12 km W Mahallât]	Markazi	33° 51’ N, 50° 21’ E	1760
Bâbâ-Jâber cave in Mahalat [= Judân, 18 km S Mahallât]	Markazi	33° 44’ N, 50° 25’ E	1618
Babol	Mâzandaran	36° 33’ N, 52° 41’ E	1
Babolsar [= Babol]	Mâzandaran	36° 33’ N, 52° 41’ E	1
Badamestan, 32 km ENE Zanjân	Zanjân	36° 45’ N, 48° 50’ E	1748
Badžistan’ (gor.), Horasan’, V. Persiâ [= Bajestan]	Khorasân-e Razawi	34° 31’ N, 58° 11’ E	1253
Bagh Mizathahami, Shiraz	Fârs	29° 37’ N, 52° 32’ E	1540
Bagh-i-Jaffarani	Fârs	29° 37’ N, 52° 32’ E	1540
Bajestan	Khorasân-e Razawi	34° 31’ N, 58° 11’ E	1253
Bam	Kermân	29° 06’ N, 58° 24’ E	1045
Bampúr, Balúchistán	Sistân va Baluchestân	27° 12’ N, 60° 27’ E	516
Bamrud channel, Zirkuh country	Khorasân-e Janubi	33° 38’ N, 60° 05’ E	930
Bumrudskij aryk’ [= Bamrud channel, Zirkuh country]	Khorasân-e Janubi	33° 38’ N, 60° 05’ E	930
Bamu National Park, NE Shirâz	Fârs	–	–
Bandamir	Fârs	29° 47’ N, 52° 51’ E	1590
Bandar Anzali	Gilân	37° 28’ N, 49° 28’ E	–24
Bandar-e Anzali	Gilân	37° 28’ N, 49° 28’ E	–24
Bandar Siraf, 30 km SE Bandar Kangan	Bushehr	27° 40’ N, 52° 20’ E	40
Bandar-e Emam Khomeyni	Khuzestân	30° 27’ N, 49° 05’ E	5
Bandar-e Gaz	Golestan	36° 47’ N, 53° 57’ E	–17
Bandar-e-Pahlavi [= Bandar-e Anzali]	Gilân	37° 28’ N, 49° 28’ E	–24
Bandar-e-Shahpur [= Bandar-e Emam Khomeyni]	Khuzestân	30° 27’ N, 49° 05’ E	5
Banelar, Lâhrud, Dastkand cave, 25 km NE Meshginshahr	Ardabil	38° 27’ N, 47° 52’ E	1606
Banelar, Lâhrud, Qaranuh kahul cave, 25 km NE Meshginshahr	Ardabil	38° 27’ N, 47° 52’ E	1624
Bânuj cave, 15 km SE Dârâb	Fârs	28° 40’ N, 54° 35’ E	–
Barandaq, 45 km S Khalkhâl	Ardabil	37° 13’ N, 48° 35’ E	1357
Barforoush [= Babol]	Mâzandaran	36° 33’ N, 52° 41’ E	1
Barfurush [= Babol]	Mâzandaran	36° 33’ N, 52° 41’ E	1
Basht, Shulistan	Kohgiluye va Boyer Ahmad	30° 22’ N, 51° 09’ E	812
Basket Mountain, 26 km. northeast of Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	†37° 45’ N, 45° 12’ E	–
Bastak	Hormozgân	27° 12’ N, 54° 22’ E	402
Bastam, 6 km W Qarah Ziya’oddin	Âzarbâijan-e Gharbi	38° 53’ N, 44° 57’ E	1145
Bazangân, 75 km SW Sarakhs, Bazangân cave	Khorasân-e Razawi	36° 17’ N, 60° 26’E	1030
Behbahan	Khuzestân	30° 36’ N, 50° 14’ E	330
Behshahr	Mâzandaran	36° 42’ N, 53° 33’ E	93
Benmâr, 25 km W Ardabil	Ardabil	38° 13’ N, 48° 01’ E	2010
Besha Daraz [= Bisheh Deraz]	Ilâm	32° 49’ N, 46° 58’ E	374
Biboneh cave, 60 km NE Eslâm Âbâd	Kermânshah	34° 29’ N, 46° 58’ E	–
Bijar	Kordestân	35° 52’ N, 47° 36’ E	1930
Bishapur, 19 km NW Kâzerun, Sâsân spring	Fârs	29° 47’ N, 51° 35’ E	860
Bishapur, 20 km NW Kâzerun, Shahpur cave	Fârs	29° 48’ N, 51° 37’ E	1280
Bisheh Derâz, 30 km NW Dehloran, Bisheh Derâz cave	Ilâm	32° 49’ N, 46° 58’ E	374
Bishehderaz	Ilâm	32° 49’ N, 46° 58’ E	374
Bisoton	Kermânshah	34° 23’ N, 47° 26’ E	1320
Bisotun, 28 km E Kermanshah	Kermânshah	34° 23’ N, 47° 26’ E	1320

site	province (ostan)	coordinates	alt.
Biston	Kermânshah	34° 23’ N, 47° 26’ E	1320
Bongaru, 16 km W Dehbârez	Hormozgân	27° 27’ N, 57° 02’ E	590
Borazjan	Bushehr	29° 16’ N, 51° 13’ E	66
Bouchir, Brazjan [= Bushehr, Borazjan]	Bushehr	29° 16’ N, 51° 13’ E	66
Bushehr	Bushehr	28° 55’ N, 50° 50’ E	27
Bushigân Deilami, 15 km NW Kâzerun	Fârs	29° 41’ N, 51° 31’ E	950
Bushire [= Bushehr]	Bushehr	28° 55’ N, 50° 50’ E	27
Canae Gabru Cave, near the village of Tar Divon, ca. 65 km NE Jahrom [= Tâdovân, Tâdovân cave]	Fârs	28° 51’ N, 53° 20’ E	1190
Cara Tarik, about 20 miles N Divandarreh near village of Qareh	Kordestân	–	–
Cara Tarik cave, about 20 miles north of Divandarrah	Kordestân	–	–
caves near the NW sea shore, 4 km SW Hormoz, Hormoz island	Hormozgân	27° 05’ N, 56° 27’ E	19
Chagazniel [= Choqâzanbil], Dezful	Khuzestân	32° 01’ N, 48° 32’ E	80
Chabahar	Sistân va Baluchestân	25° 18’ N, 60° 39’ E	18
Chah Bahar	Sistân va Baluchestân	25° 18’ N, 60° 39’ E	18
Chah Moslem, about 57 km. north of Bandar-e-Lengeh	Hormozgân	26° 44’ N, 54° 32’ E	23
Chahak, 8 km NW Bandar Genaveh	Bushehr	29° 39’ N, 50° 27’ E	10
Chahâr Dahaneh, 12 km ENE Dehbârez	Hormozgân	27° 28’ N, 57° 19’ E	370
Chalus	Mâzandaran	36° 39’ N, 51° 25’ E	25
Chaman Bid	Khorasân-e Shomâli	37° 26’ N, 56° 41’ E	1110
Chazan, near Sarbâz	Sistân va Baluchestân	26° 38’ N, 61° 08’ E	–
Chehar-Zanbil, Dezful	Khuzestân	32° 01’ N, 48° 32’ E	80
Chehel Zari, 30 km SE Abadeh	Fârs	31° 00’ N, 52° 55’ E	1832
Chel Taghâr, Siâhkuh Protected Area, 90 km NE Ardakân	Esfahân	32° 50’ N, 54° 40’ E	–
Chelmir	Khorasân-e Razawi	37° 24’ N, 58° 54’ E	910
Chelzari, 40 km [= Chehel Zari, 30 km] SE Abadeh	Fârs	31° 00’ N, 52° 55’ E	1832
Cheshmeh Gerduk, 4 km S Nowshar	Mâzandaran	36° 37’ N, 51° 29’ E	44
Chirâ pool, Qeshm island	Hormozgân	26° 49’ N, 56° 03’ E	17
Chope Darag, ca. 30 km W Kalibar	Âzarbâijan-e Sharqi	38° 54’ N, 46° 39’ E	498
Choqa Zambil (Ziggurat), near Shush	Khuzestân	32° 01’ N, 48° 32’ E	80
Choqâzanbil, 33 km SE Shush	Khuzestân	32° 01’ N, 48° 32’ E	80
Choqâzanbil ziggurat, 42 km SW Dezful	Khuzestân	32° 01’ N, 48° 32’ E	80
cliff 1 km N Tis, 8 km N Chabahar	Sistân va Baluchestân	25° 22’ N, 60° 37’ E	70
Dach Bourom au N. de Gombad e Qabous, Bord de l’Atrek [= Dashli Burun]	Golestan	37° 38’ N, 54° 48’ E	38
Dafâri Pool, Qeshm island	Hormozgân	26° 57’ N, 56° 12’ E	13
Dagbageh bei Khoi	Âzarbâijan-e Gharbi	38° 33’ N, 44° 57’ E	1154
Dakal, near Sar Pol-e Zahâb	Kermânshah	34° 27’ N, 45° 52’ E	551
Dakhmeh-e Zartoshtiyun, SW edge of Yazd	Yazd	31° 49’ N, 54° 21’ E	1320
Damen, 30 km N Iranshahr	Sistân va Baluchestân	27° 24’ N, 60° 49’ E	764
Damin	Sistân va Baluchestân	27° 24’ N, 60° 49’ E	764
Daneshyu salt cave, 4 km SW Hormoz, Jazireh Hormoz	Hormozgân	27° 03’ N, 56° 26’ E	22
Dangezli, 18 km E Sisakht, Dangezli cave	Esfahân	30° 52’ N, 51° 38’ E	2210
Dârâb	Fârs	28° 45’ N, 54° 33’ E	1134
Daraq ruin, Âdâ kahuli cave, 35 km E Meshginshahr	Ardabil	38° 27’ N, 48° 04’ E	1241
Daraq ruin, Qaranukh kahul cave, 35 km E Meshginshahr	Ardabil	38° 27’ N, 48° 05’ E	1317
Daraq ruin, Qorbân Darasi valley, 35 km E Meshginshahr	Ardabil	38° 28’ N, 48° 04’ E	1248
Darband, 46 km W Isfahan [= Esfahan]	Esfahân	32° 44’ N, 51° 11’ E	1920
Dargaz	Khorasân-e Razawi	37° 27’ N, 59° 06’ E	476
Dârhamreh cave, 40 km NW Dehlorân	Ilâm	32° 55’ N, 46° 58’ E	–
Darkhovin, 45 km N Abadan	Khuzestân	30° 45’ N, 48° 25’ E	6
Darkhwein [= Darkhovin], 45 km N Abadan	Khuzestân	30° 45’ N, 48° 25’ E	6
Darre Duâli cave, 15 km SE Shahr-e Kord	Chahâr Mahâl va Bakhtiâri	32° 18’ N, 51° 06’ E	2358
Darukhan, 25 km NNE Nikshahr	Sistân va Baluchestân	26° 25’ N, 60° 19’ E	890
Darvish Kâkmorâd cave, 30 km N Kerend Gharb	Kermânshah	34° 35’ N, 46° 15’ E	–
Darvishi, 55 km SE Khormuj	Bushehr	28° 18’ N, 51° 47’ E	43
Dâshkasan, 17 km SE Meshginshahr	Ardabil	38° 26’ N, 47° 52’ E	1920

site	province (ostan)	coordinates	alt.
Dashli Burun	Golestan	37° 38’ N, 54° 48’ E	38
Dasht	Khorasân-e Shomâli	37° 18’ N, 56° 01’ E	998
Dashtak, 32 km SSW Yasuj	Fârs	30° 23’ N, 51° 30’ E	1670
Deh Zireh, 35 km SE Kashan	Esfahân	33° 45’ N, 51° 45’ E	1205
Dehlorân	Ilâm	32° 41’ N, 47° 16’ E	220
Dehlorân cave, 5 km NE Dehlorân	Ilâm	32° 44’ N, 47° 18’ E	357
Dehlorân, Khoffâsh cave (Natural Monument)	Ilâm	32° 44’ N, 47° 18’ E	357
Derbent [= Darband], 50 mi. [= 46 km] W. Isfahan	Esfahân	32° 44’ N, 51° 11’ E	1920
Derregaz [= Dargaz]	Khorasân-e Razawi	37° 27’ N, 59° 06’ E	476
Dezful	Khuzestân	32° 23’ N, 48° 24’ E	145
Divandarreh	Kordestân	35° 55’ N, 47° 01’ E	1837
[between] Diz and Karin, 45 km SE Khalkhâl	Ardabil	37° 19’ N, 48° 41’ E	1519
Dizehjin, 50 km E Zanjân, Dizehjin cave	Qazvin	36° 38’ N, 49° 04’ E	1997
Dizful, near Ahwaz	Khuzestân	32° 23’ N, 48° 24’ E	145
Doroh	Khorasân-e Janubi	32° 17’ N, 60° 30’ E	1151
Durna [= Doroh]	Khorasân-e Janubi	32° 17’ N, 60° 30’ E	1151
Elburs, Höhle I b. Koolak (Strasse nach Shemshak) [= Alborz Mts., Kulak, Cave I, on the road to Shemshek]	Tehrân	35° 58’ N, 51° 47’E	3190
Elburz Mts., near Resht	Gilân	–	–
Emamzadeh, 15 km W Kashan	Esfahân	33° 59’ N, 51° 17’ E	1195
Emamzadeh Mousa, 3 km E Razmiyan	Qazvin	36° 32’ N, 50° 14’ E	1090
Endgan, Arak	Markazi	33° 59’ N, 50° 02’ E	2000
Enjedân, 37 km SE Arâk, Enjedân cave	Markazi	33° 59’ N, 50° 02’ E	2000
Esburez, 8 km SE Sâri	Mâzandaran	36° 32’ N, 53° 08’ E	97
Esfahan	Esfahân	32° 39’ N, 51° 40’ E	1580
Esfedan	Khorasân-e Janubi	33° 39’ N, 59° 47’ E	1205
Eshgeft-Raana cave 5 kms. north of Kazerun	Fârs	–	–
Eshkaf Dareze Cave, W edge of Khurramabad	Lorestan	33° 28’ N, 48° 21’ E	1180
Eslâm Âbâd	Kermânshah	34° 07’ N, 46° 32’ E	1336
Esma’ilabad, Nehbandan country	Khorasân-e Janubi	32° 03’ N, 59° 49’ E	1396
Espar cave, 45 km N Gachsârân	Kohgiluye va Boyer Ahmad	30° 36’ N, 50° 45’ E	–
Espidan, 12 km ESE Natanz	Esfahân	33° 27’ N, 52° 02’ E	1398
Eyvâzlu, 3 km S Aslânduz	Ardabil	39° 26’ N, 47° 26’ E	182
Famur lake [= Parishan lake]	Fârs	29° 31’ N, 51° 47’ E	965
Faraman	Kermânshah	34° 13’ N, 47° 18’ E	1251
Fereshteh Jân, 50 km SE Jahrom	Fârs	28° 13’ N, 53° 56’ E	850
Firuz Abad	Fârs	28° 51’ N, 52° 34’ E	1331
foot of the Elburz Mountains., S. E. Caspian [= vicinity of Bandar-e-Gaz]	Golestan	36° 47’ N, 53° 57’ E	–17
Gachsârân	Kohgiluye va Boyer Ahmad	30° 21’ N, 50° 48’ E	717
Gâjereh, 45 km NE Karaj, Hamalun cave	Alborz	36° 03’ N, 51° 23’ E	2510
Galateppeh	Esfahân	†33° 13’ N, 51° 45’ E	–
Gandab, 11 km NW Aftar, 31 km NW Semnan	Semnân	35° 41’ N, 53° 03’ E	2104
Gandoman wetland, Eshkaft-e Zolaikhâ (Zolaikhâ crevice)	Chahâr Mahâl va Bakhtiâri	31° 50’ N, 51° 07’ E	2581
Ganjah Kuh Cave, 3 km north of Jochdi [= Joghdi]	Khorasân-e Shomâli	†37° 20’ N, 56° 55’ E	–
Gara Tarik, about 4 km N Qareh	Kordestân	–	–
Garmkhâneh, 20 km SW Khalkhâl, Haftkhâneh cave	Ardabil	37° 33’ N, 48° 24’ E	1606
Ghaladidar cave	Hamadân	–	–
Ghalah Kord Cave	Zanjân	35° 45’ N, 48° 50’ E	–
Ghassre Shirin [= Qasr-e Shirin]	Kermânshah	34° 32’ N, 45° 35’ E	360
Ghezel Ghan, 22 km NNE Bojnurd	Khorasân-e Shomâli	37° 40’ N, 57° 25’ E	1020
Gholaman, 16 km W Khoramabad	Lorestan	33° 26’ N, 48° 13’ E	1190
Gilân-e Qarb	Kermânshah	34° 09’ N, 45° 55’ E	805
Golgik, 25 km W Zanjân, Golgik cave	Zanjân	36° 42’ N, 48° 06’ E	2191
Gombad-i-Kabous [= Gondbad-e Kavus]	Golestan	37° 15’ N, 55° 10’ E	38
Gonbad, 25 km SE Hamadân	Hamadân	34° 41’ N, 48° 45’ E	2034
Gondbad-e Kavus	Golestan	37° 15’ N, 55° 10’ E	38

site	province (ostan)	coordinates	alt.
Gorgan	Golestan	36° 51' N, 54° 26' E	136
Gotvand, 25 km NW Shushtar, Gotvand cave	Khuzestân	32° 15' N, 48° 49' E	85
Gug Tappeh, 20 km SE Bilasavâr	Ardabil	39° 16' N, 48° 08' E	243
Guter-Su [= Qutur Su], Sulphur Caves	Ardabil	38° 20' N, 47° 51' E	2585
Haft Tappeh, 20 km SSE Shush	Khuzestân	32° 05' N, 48° 20' E	78
Hamadan, Tomb of Alivion [= Gonbad-e Alaviân]	Hamadân	34° 47' N, 48° 31' E	1845
Harasam, Biboneh cave, 60 km NE [= SE] Eslâm Âbâd	Kermânshah	33° 52' N, 46° 50' E	1307
Hasan Âbâd, Eshkaft-e Zolaikhâ (Zolaikhâ crevice), N Gandomân Wetland, 4 km S Gandomân	Chahâr Mahâl va Bakhtiâri	31° 51' N, 51° 06' E	2217
Hashilan	Kermânshah	34° 35' N, 46° 53' E	1310
Hendel Âbâd, 40 km NE Mash'had, Hendel Âbâd cave	Khorasân-e Razawi	36° 25' N, 59° 59' E	1220
Hessar near Loft-abad	Khorasân-e Razawi	37° 26' N, 59° 24' E	284
Hormoz island, caves near the NW sea shore, 4 km SW Hormoz	Hormozgân	27° 05' N, 56° 27' E	19
Hormoz island, Hormoz, Portuguese fortress	Hormozgân	27° 06' N, 56° 27' E	3
Hotu cave, 3 km W Behshahr	Mâzandaran	36° 41' N, 53° 30' E	30
Hur-e Pâsefid, Fâriâb, Jiroft	Kermân	28° 12' N, 57° 23' E	665
Ilam	Ilâm	33° 38' N, 46° 25' E	1390
Iranshahr, Baluchistan	Sistân va Baluchestân	27° 12' N, 60° 41' E	573
Irânzamin cave, Qeshm island	Hormozgân	26° 58' N, 56° 16' E	–
Isfehden [= Esfedan]	Khorasân-e Janubi	33° 39' N, 59° 47' E	1205
Isin, 15 km N Bandar Abbâs	Hormozgân	27° 19' N, 56° 17' E	85
Isin, southern foot of Kukhaye Genu Mts.	Hormozgân	27° 19' N, 56° 17' E	85
Izeh	Khuzestân	31° 50' N, 49° 52' E	845
Izmail-abad', str. Nè-i-bendun', Kirman' [= Esma'ilabad, Nehbandan country]	Khorasân-e Janubi	32° 03' N, 59° 49' E	1396
Jabdaragh, 15 km N Meshginshahr	Ardabil	38° 31' N, 47° 35' E	935
Jabdaragh, 15 km N Meshginshahr, Boyukkahul cave	Ardabil	38° 32' N, 47° 36' E	1085
Jahrom	Fârs	28° 30' N, 53° 34' E	1050
Jahrom, Sang Eshkan	Fârs	28° 29' N, 53° 35' E	1102
Jahrom, Simakân, Sisân garden	Fârs	28° 31' N, 53° 19' E	1018
Jalk, Balúchistán	Sistân va Baluchestân	27° 36' N, 62° 43' E	866
Jalq	Sistân va Baluchestân	27° 36' N, 62° 43' E	866
Jamâb, Chenârân, Parde Rostam cave	Khorasân-e Razawi	36° 34' N, 59° 06' E	1290
Jamâirân, 25 km NW Ardabil	Ardabil	38° 27' N, 48° 10' E	1322
Jangeh, 25 miles from Kuh Rang on Shahkord Road	Chahâr Mahâl va Bakhtiâri	–	–
Jarghun [= Zarqan]	Fârs	29° 48' N, 52° 44' E	1600
Jâshak, 20 km N Âbdân, Namak cave	Bushehr	28° 16' N, 51° 43' E	95
Jask	Hormozgân	25° 45' N, 57° 46' E	12
Jazireh-ye-Quyun [= Kabudan]	Âzarbâijan-e Sharqi	37° 28' N, 45° 38' E	1420
Jiroft	Kermân	28° 40' N, 57° 44' E	685
Jochdi [= Joghdi]	Khorasân-e Shomâli	37° 21' N, 56° 49' E	1310
Joghdi	Khorasân-e Shomâli	37° 21' N, 56° 49' E	1310
Jomâyrân, 40 km E Meshginshahr	Ardabil	38° 27' N, 48° 10' E	1656
Judân, 18 km S Mahallât	Markazi	33° 44' N, 50° 25' E	1618
junction of the River Dinevar with the River Gamasiab, at Bisotun	Kermânshah	34° 24' N, 47° 27' E	1284
Juyom, Hasan Âbâd	Fârs	28° 15' N, 53° 59' E	860
Kâboli orchard, Qeshm island	Hormozgân	26° 57' N, 56° 13' E	18
Kâboli pool, Qeshm island	Hormozgân	26° 57' N, 56° 13' E	18
Kabudan	Âzarbâijan-e Sharqi	37° 28' N, 45° 38' E	1420
Kah'nuj	Kermân	27° 57' N, 57° 42' E	504
Kahnuge, S Kerman	Kermân	27° 57' N, 57° 42' E	504
Kamarij, Dashistan	Fârs	29° 37' N, 51° 29' E	866
Kangâvar	Kermânshah	34° 30' N, 47° 57' E	1500
Karafto cave	Kordestân	36° 20' N, 46° 53' E	2040
Karaftu, 45 km NW Divândarreh, Karaftu cave	Kordestân	36° 20' N, 46° 53' E	2040
Karaftu, about 32 miles N Divandarreh near village of Dashbologh	Kordestân	36° 20' N, 46° 53' E	2040

site	province (ostan)	coordinates	alt.
Karaftu cave, 22 km WSW Takab	Kordestân	36° 20’ N, 46° 53’ E	2040
Karaj	Alborz	35° 49’ N, 50° 59’ E	1327
Karaj river valley	Alborz	–	–
Karasf, 5 km SW Qeydâr, Barfi cave	Zanjân	36° 05’ N, 48° 33’ E	2570
Karasf, 12 km SW Qeydâr, Karasf cave	Zanjân	36° 05’ N, 48° 29’ E	2170
Karmán	Kermân	30° 17’ N, 57° 04’ E	1765
Kashkan River	Lorestan	–	–
Kasre-Širin [= Qasr-e Shirin]	Kermânshah	34° 32’ N, 45° 35’ E	360
Katak, 25 km WNW Shahr-e Kord	Chahâr Mahâl va Bakhtiâri	32° 24’ N, 50° 36’ E	2299
Kataleh Khor Cave	Zanjân	35° 50’ N, 48° 10’ E	1725
Kataleh Khur cave, 2 km SW Garmab	Zanjân	35° 50’ N, 48° 10’ E	1725
Kazeron	Fârs	29° 37’ N, 51° 38’ E	843
Kâzerun	Fârs	29° 37’ N, 51° 38’ E	843
Kazur, 50 km S Ardabil	Ardabil	37° 48’ N, 48° 20’ E	1499
Kazvin [= Qazvin]	Qazvin	36° 17’ N, 50° 00’ E	1306
Kazwin [= Qazvin]	Qazvin	36° 17’ N, 50° 00’ E	1306
Kelârdasht	Mâzandaran	36° 30’ N, 51° 09’ E	1240
Kerend cave, 5 km W Kerend-e Gharb	Kermânshah	34° 17’ N, 46° 13’ E	–
Kerend Gharb	Kermânshah	34° 17’ N, 46° 15’ E	1570
Kerman	Kermân	30° 17’ N, 57° 04’ E	1765
Kermânshah	Kermânshah	34° 19’ N, 47° 04’ E	1355
Khafr, 50 km S Semirom	Esfahân	30° 59’ N, 51° 29’ E	2200
Khalaf farm, 5 km W Meshginshahr	Ardabil	38° 22’ N, 47° 35’ E	1308
Khanbebin, Shirabad cave	Golestan	36° 57’ N, 55° 02’ E	390
Kharanaq	Yazd	32° 21’ N, 54° 40’ E	1765
Khâyeez Mts., SE Ahram	Bushehr	†28° 52’ N, 51° 16’ E	–
Khesht, 30 km W Kâzerun	Fârs	29° 34’ N, 51° 20’ E	484
Khorazan cave [= Tafrijân, Khorzeneh cave]	Hamadân	34° 46’ N, 48° 35’ E	1940
Khorin	Kermânshah	34° 46’ N, 47° 04’ E	1775
Khoy	Âzarbâijan-e Gharbi	38° 31’ N, 44° 58’ E	1130
Khorramabad	Lorestan	33° 29’ N, 48° 21’ E	1190
Khwoy [= Khoy]	Âzarbâijan-e Gharbi	38° 31’ N, 44° 58’ E	1130
Kilasefid, 30 km NE Qasr-e Shirin, Kilasefid cave	Kermânshah	34° 40’ N, 45° 52’ E	–
Kishm [= Qeshm island]	Hormozgân	26° 37’ N, 55° 32’ E	16
Klidar, 65 km NW Neishâbur, Palangi cave	Khorasân-e Razawi	36° 43’ N, 58° 32’ E	1680
Kojanagh, 20 km NW Meshginshahr, Kojanagh cave	Ardabil	38° 30’ N, 47° 29’ E	922
Konar-Takhteh, Kazerun	Fârs	29° 32’ N, 51° 23’ E	505
Kuh-e Jahani, 13 km ENE Khurab	Fârs	28° 38’ N, 52° 27’ E	1130
Kuh-e Namak, 8 km S Esmâil Mahmudi, 52 km SE Khormuj	Bushehr	28° 17’ N, 51° 44’ E	90
Kuh-i-Khwaja	Sistân va Baluchestân	30° 56’ N, 61° 15’ E	528
Kuh-i-Khwjah	Sistân va Baluchestân	30° 56’ N, 61° 15’ E	528
Kuhe-Khaje (Zabol)	Sistân va Baluchestân	30° 56’ N, 61° 15’ E	528
Kuh Rang	Chahâr Mahâl va Bakhtiâri	†32° 18’ N, 50° 13’ E	–
Kul-e Farah, 7 km NE Izeh	Khuzestân	31° 52’ N, 49° 56’ E	850
Kuli Alireza, Ramhormoz	Khuzestân	31° 17’ N, 49° 36’ E	167
Kulyâr	Ardabil	38° 24’ N, 47° 24’ E	1090
Kusheh, western slope of the Kuh-e Taftan Mt.	Sistân va Baluchestân	28° 34’ N, 61° 00’ E	2095
Kuveh’i Pool, Qeshm island	Hormozgân	26° 56’ N, 56° 00’ E	11
Kyzyluzen river, Abbar	Zanjân	36° 54’ N, 48° 59’ E	500
Lâhrud, 17 km NE Meshginshahr	Ardabil	38° 30’ N, 47° 50’ E	1282
Lake Famur [= Parishan lake]	Fârs	29° 31’ N, 51° 47’ E	965
Lâr	Fârs	27° 41’ N, 54° 20’ E	790
Leisâr, 20 km N Hashtpar	Gilân	37° 58’ N, 48° 55’ E	–22
Lenje Abad, 6 km SW Dorud	Lorestan	33° 27’ N, 49° 01’ E	1396
Loft-abad	Khorasân-e Razawi	37° 31’ N, 59° 20’ E	248
Loft Abad village, 27 km W Dargaz	Khorasân-e Razawi	37° 31’ N, 59° 20’ E	248

site	province (ostan)	coordinates	alt.
Ma'dan (Sabzkuh Protected Area)	Chahâr Mahâl va Bakhtiâri	31° 41' N, 50° 52' E	1992
Mach Gur, 63 km SE Irânshahr	Sistân va Baluchestân	26° 45' N, 61° 05' E	1160
Mâhidasht Cave, 30 km SW Kermânshâh	Kermânshah	34° 16' N, 46° 48' E	1364
Mahmudabad	Mâzandaran	36° 38' N, 52° 16' E	–23
Mahvid, 26 km NE Ferdows	Khorasân-e Razawi	34° 11' N, 58° 23' E	1901
Maku	Âzarbâijan-e Gharbi	39° 18' N, 44° 31' E	1200
Mala-i-Mir, 70 mi. N.E. of Ahwaz [= Izeh]	Khuzestân	31° 50' N, 49° 52' E	845
Malavy [= Malavi]	Lorestan	33° 16' N, 47° 46' E	723
Maleki pool, Qeshm island	Hormozgân	26° 46' N, 55° 42' E	11
Mâniân, 33 km WNW Jahrom, Mâniân cave	Fârs	28° 35' N, 53° 14' E	1077
Mansorabad	Fârs	28° 15' N, 54° 02' E	858
Mar Ab Canyon, 57 km. W Shahabad on Baghdad Rd.	Kermânshah	–	–
Mashhad	Khorasân-e Razawi	36° 18' N, 59° 37' E	983
Mâzhin, 55 km NE Dehlorân, Mâzhin cave	Ilâm	46° 16' N, 33° 49' E	1185
Mazra'eh, 25 km SW Khalkhâl	Ardabil	37° 30' N, 48° 15' E	1414
Mehran	Ilâm	33° 07' N, 46° 10' E	150
Meighun, Nehbandan country	Khorasân-e Janubi	31° 49' N, 59° 28' E	1449
Mejgun' (sel.), str. Nè-i-bendun', Kirman' [= Meighun, Nehbandan country]	Khorasân-e Janubi	31° 49' N, 59° 28' E	1449
Meshed [= Mashhad]	Khorasân-e Razawi	36° 18' N, 59° 37' E	983
Meshrageh, about 85 km. SW Ahvaz	Khuzestân	31° 00' N, 49° 26' E	15
Minab	Hormozgân	27° 08' N, 57° 05' E	49
Minân, 15 km E Mâhneshân, Qara Dâgh cave	Zanjân	36° 46' N, 47° 47' E	2016
Mir Âkhor	Zanjân	36° 39' N, 48° 26' E	2016
Mishan	Khuzestân	†30° 23' N, 49° 51' E	–
Moghân, 30 km SW Mash'had, Moghân cave	Khorasân-e Razawi	36° 10' N, 59° 18' E	1760
Mohamed Reza Shah National Park	Golestan	–	–
Mohammerah	Khuzestân	30° 25' N, 48° 11' E	3
Moqân, 20 km SW Pârs Âbâd	Ardabil	39° 32' N, 47° 45' E	112
Mozdooran	Khorasân-e Razawi	36° 09' N, 60° 35' E	950
Mozduran	Khorasân-e Razawi	36° 09' N, 60° 35' E	950
Mozdurân, 2 km N Mazdâvand, Mozdurân cave	Khorasân-e Razawi	36° 09' N, 60° 35' E	950
Mozduran cave 110 kms. east of Meshhad	Khorasân-e Razawi	36° 09' N, 60° 35' E	950
Nag	Sistân va Baluchestân	27° 08' N, 61° 43' E	125
Namakdún, on the south coast of the island of Kishm	Hormozgân	26° 37' N, 55° 31' E	80
Nâmnik, 30 km E Minoodasht, Sam cave	Semnân	37° 08' N, 55° 41' E	1602
Narkor near Pârs Âbâd	Ardabil	39° 39' N, 47° 54' E	43
Nasriè [= Ahwaz]	Khuzestân	31° 19' N, 48° 40' E	20
Nâz Island, 22 km SW Qeshm	Hormozgân	26° 49' N, 56° 07' E	4
Niâz, 22 km W Meshginshahr	Ardabil	38° 24' N, 47° 25' E	1013
Nik Shahr	Sistân va Baluchestân	26° 13' N, 60° 13' E	465
Nikshahr	Sistân va Baluchestân	26° 13' N, 60° 13' E	465
Niku-e Jahan, Geh	Khorasân-e Janubi	26° 03' N, 60° 10' E	290
[between] Nir and Sarâb, 15 km E Nir	Ardabil	38° 02' N, 48° 09' E	1760
Niriz, east of Shiraz	Fârs	29° 12' N, 54° 19' E	1625
Nojivarân cave, 10 km N Bisotun	Kermânshah	34° 29' N, 47° 29' E	–
Nukedžaga, strana Gè, Pers. Belûčistan' [= Niku-e Jahan, Geh country]	Khorasân-e Janubi	26° 03' N, 60° 10' E	290
Nusi	Khorasân-e Razawi	†35° 48' N, 58° 26' E	–
o-v'Ašur'-ade [= Ashuradeh island]	Mâzandaran	36° 54' N, 54° 01' E	–27
okr. Nasriè i Ahvaza [= vicinity of Nasrieh and Ahwaz]	Khuzestân	31° 19' N, 48° 40' E	20
Olbuhardân, N Bandar-e Mâhshahr	Khuzestân	30° 40' N, 49° 09' E	9
Omid Âbâd, 42 km W Shahr-e Kord, Sarâb cave	Chahâr Mahâl va Bakhtiâri	32° 18' N, 50° 24' E	2581
Oromiyeh	Âzarbâijan-e Gharbi	37° 33' N, 45° 04' E	1350
Oromiyeh lake bank, 3 km S Soltan Abad, 28 km N Oromiyeh	Âzarbâijan-e Gharbi	37° 49' N, 45° 02' E	1360
Pahlavi Dezh [= Aq Qala]	Golestan	37° 01' N, 54° 27' E	–14
Parangin, Chameh, 45 km E Zanjân, Esm Gholâm cave	Zanjân	36° 40' N, 48° 59' E	1682

site	province (ostan)	coordinates	alt.
Parishan lake	Fârs	29° 31’ N, 51° 47’ E	965
Pâsorkhi gorge, 4 km E Dehbârez	Hormozgân	27° 24’ N, 57° 17’ E	294
Persepolis	Fârs	29° 56’ N, 52° 53’ E	1634
Persiâ, Nusi [= Iran, Nusi]	Khorasân-e Razawi	†35° 48’ N, 58° 26’ E	–
Pir Sohrab, 54 km NE Chabahar	Sistân va Baluchestân	25° 45’ N, 60° 50’ E	60
Podonu, 10 km E Dehbârez	Hormozgân	27° 24’ N, 57° 19’ E	545
Pol-i-Abgineh	Fârs	29° 33’ N, 51° 46’ E	840
Qal’eh Sefid, 5 km E Dâlaki, Mârâl caves	Bushehr	29° 27’ N, 51° 17’ E	104
Qarah Âqâj, 35 km W Germi	Ardabil	39° 00’ N, 47° 41’ E	943
Qaraqiyeh, 20 km NE Meshginshahr, Qaraqiyeh cave	Ardabil	38° 33’ N, 47° 45’ E	985
Qareh	Kordestân	36° 06’ N, 47° 05’ E	1876
Qasr-e Shirin	Kermânshah	34° 32’ N, 45° 35’ E	360
Qazvin	Qazvin	36° 17’ N, 50° 00’ E	1306
Qeshm, Qeshm island	Hormozgân	26° 58’ N, 56° 16’ E	20
Qeshm island	Hormozgân	26° 50’ N, 55° 54’ E	70
Qeshm island, 3-N salt cave, south-eastern part of Namakdân, 12 km ENE Kani,	Hormozgân	26° 37’ N, 55° 31’ E	80
Qeshm island, Dafâri pool	Hormozgân	26° 57’ N, 56° 12’ E	13
Qeshm island, Irânzamin cave	Hormozgân	26° 58’ N, 56° 16’ E	–
Qeshm island, Chirâ pool	Hormozgân	26° 49’ N, 56° 03’ E	17
Qeshm island, Kâboli orchard	Hormozgân	26° 57’ N, 56° 13’ E	18
Qeshm island, Kâboli pool	Hormozgân	26° 57’ N, 56° 13’ E	18
Qeshm island, Kharbas cave, 11 km S Qeshm	Hormozgân	26° 55’ N, 56° 10’ E	–
Qeshm island, Kuveh’i Pool	Hormozgân	26° 56’ N, 56° 00’ E	11
Qeshm island, Maleki pool	Hormozgân	26° 46’ N, 55° 42’ E	11
Qeshm island, Qeshm	Hormozgân	26° 58’ N, 56° 16’ E	20
Qeshm island, Ramakân	Hormozgân	26° 52’ N, 56° 02’ E	40
Qeshm island, Ramchâh cave	Hormozgân	26° 54’ N, 56° 08’ E	13
Qeshm island, Turgan	Hormozgân	26° 56’ N, 56° 13’ E	30
Qom	Qom	34° 39’ N, 50° 52’ E	935
Qotur Chay canyon, near the town of Khoy	Âzarbâijan-e Gharbi	38° 31’ N, 44° 58’ E	1130
Qutur Su, 17 km SE Meshginshahr, sulphuric caves	Ardabil	38° 20’ N, 47° 51’ E	2585
Quyn Daghi [= Kabudan]	Âzarbâijan-e Sharqi	37° 28’ N, 45° 38’ E	1420
Quyon Daghi [= Kabudan]	Âzarbâijan-e Sharqi	37° 28’ N, 45° 38’ E	1420
Quyun Dâqi Island [= Kabudan]	Âzarbâijan-e Sharqi	37° 28’ N, 45° 38’ E	1420
Rabatak	Fârs	29° 23’ N, 51° 51’ E	753
Radul river, 5 km SW Kuchandar	Hormozgân	27° 33’ N, 57° 19’ E	260
Rafsanjan	Kermân	30° 25’ N, 56° 00’ E	1516
Ramakân, Qeshm island	Hormozgân	26° 52’ N, 56° 02’ E	40
Ramchâh cave, Qeshm island	Hormozgân	26° 54’ N, 56° 08’ E	13
Ramsar	Mâzandaran	36° 54’ N, 50° 39’ E	25
Rasht	Gilân	37° 17’ N, 49° 35’ E	5
Ravânsar, Benjo cave	Kermânshah	34° 43’ N, 46° 39’ E	1351
Reineh, near Mt. Damâvand	Mâzandaran	35° 53’ N, 52° 10’ E	2055
Resht [= Rasht]	Gilân	37° 17’ N, 49° 35’ E	5
Rezaiyeh [= Oromiyeh]	Âzarbâijan-e Gharbi	37° 33’ N, 45° 04’ E	1350
River Cave (= Korie Cowat) about 15 miles NW Ravansar	Kermânshah	–	–
Robat-i-Qarabil	Khorasân-e Shomâli	37° 21’ N, 56° 26’ E	1293
Rostâgh, Sahlak, 65 km SE Dârâb, Mozaffar cave	Fârs	28° 27’ N, 55° 04’ E	1318
Roudan, 80 kms. east of Bandar Abbas	Hormozgân	27° 27’ N, 57° 11’ E	187
Roudsar	Gilân	37° 08’ N, 50° 17’ E	–23
Rubat-e Sharaf caravanserai, 54 km SW Sarakhs	Khorasân-e Razawi	36° 16’ N, 60° 39’ E	615
Rudafshân cave, 30 km SW Firuzkuh	Tehrân	35° 37’ N, 52° 29’ E	1800
Rudan (Minab)	Hormozgân	27° 27’ N, 57° 11’ E	187
Rudsar	Gilân	37° 08’ N, 50° 17’ E	–23
Sa’idabad	Kermân	28° 14’ N, 57° 28’ E	658

site	province (ostan)	coordinates	alt.
Sa'in Caravanserai (between Nir and Sarâb), 10 km NW Nir	Ardabil	38° 00' N, 47° 53' E	2106
Sahulan	Âzarbâijan-e Gharbi	36° 39' N, 45° 57' E	1763
Sakholan [= Sahulan] Cave, near Sakholan [= Sahulan] Village	Âzarbâijan-e Gharbi	36° 39' N, 45° 57' E	1763
Salehabad, 130 km. S Birjand	Khorasân-e Janubi	32° 10' N, 59° 51' E	1368
Sama	Mâzandaran	36° 23' N, 51° 23' E	1110
Samarin, Öch otaqli kahul cave, 20 km NW Ardabil	Ardabil	38° 20' N, 48° 08' E	1566
Sanandaj	Kordestân	35° 19' N, 47° 00' E	1503
Sang-e-Sar	Semnân	35° 43' N, 53° 21' E	1667
Sar Cham	Zanjân	37° 07' N, 47° 55' E	1167
Sar Dasht, near [= 13 km S of] Lordegan	Chahâr Mahâl va Bakhtiâri	31° 23' N, 50° 51' E	2041
Sar Pol-e Zahâb	Kermânshah	34° 27' N, 45° 52' E	551
Saravan	Sistân va Baluchestân	27° 22' N, 62° 20' E	1155
Sarbâz	Sistân va Baluchestân	26° 28' N, 61° 36' E	861
Sarim Ab-Garma Cave, north of Dehloran	Ilâm	32° 44' N, 47° 18' E	357
Sarkhun (Helen Protected Area), 30 km NW Lordegan, Roseh cave	Chahâr Mahâl va Bakhtiâri	31° 45' N, 50° 35' E	1992
Sartschem [= Sar Cham]	Zanjân	37° 07' N, 47° 55' E	1167
Sâveh	Markazi	35° 01' N, 50° 21' E	995
Schiras [= Shiraz]	Fârs	29° 37' N, 52° 32' E	1540
SE Bilasavâr	Ardabil	39° 22' N, 48° 19' E	103
Sebzavar	Khorasân-e Razawi	36° 13' N, 57° 41' E	971
Seistan	Sistân va Baluchestân	[31° 00' N, 61° 30' E]	
Senje Bâshi, 12 km W Mahallât	Markazi	33° 51' N, 50° 21' E	1760
Seqâlaksâr, 12 km S Rasht	Gilân	37° 10' N, 49° 34' E	46
Sev. Persiâ, Ašref [= northern Iran, Behshahr]	Mâzandaran	36° 42' N, 53° 33' E	93
Sev. Persiâ, Astrabad' [= northern Iran, Gorgan]	Golestan	36° 51' N, 54° 26' E	136
Shabarparak	Khuzestân	†30° 23' N, 49° 51' E	–
Shah Abbas Caves, Kuh Rang	Chahâr Mahâl va Bakhtiâri	–	–
Shah Abbasi Caravanserai	Âzarbâijan-e Sharqi	38° 26' N, 45° 46' E	1328
Shâhneshin, 10 km SE Âbbar, Kharmanesar cave	Zanjân	36° 54' N, 49° 03' E	1600
Shahpur Cave	Fârs	29° 48' N, 51° 37' E	1280
Shahr-Âbâd village 10 kms. east of Mash'had	Khorasân-e Razawi	36° 16' N, 59° 43' E	938
Shahrabad Kaur	Khorasân-e Shomâli	37° 29' N, 56° 44' E	879
Shahrud	Semnân	36° 25' N, 54° 58' E	1389
Shahsavâr [= Tonekâbon]	Mâzandaran	36° 49' N, 50° 52' E	–20
Shanbeh, 47 km SE Khormuj	Bushehr	28° 24' N, 51° 46' E	62
Shandiz village 34 kms. west of Meshhad	Khorasân-e Razawi	36° 09' N, 59° 17' E	1400
Shâl, 40 km SE Khalkhâl	Ardabil	37° 17' N, 48° 46' E	1434
Shapour cave (near Kazerun, south Iran)	Fârs	29° 48' N, 51° 37' E	1280
Sharif Âbâd cave, 5 km S Eslâm Âbâd	Kermânshah	34° 05' N, 46° 32' E	–
Shastun, Dizak District, Persian Beluchistan [= Saravan]	Sistân va Baluchestân	27° 22' N, 62° 20' E	1155
Shehrenjân at the Lake Parishân, 15 km SE Kâzerun, Gap spring	Esfahân	29° 32' N, 51° 47' E	840
Shir Âbâd cave, 20 km NE Ali Âbâd	Golestan	36° 57' N, 55° 02' E	390
Shirabad Cave (5 km SE Shirabad, 60 km E Gorgan)	Golestan	36° 57' N, 55° 02' E	390
Shiraz	Fârs	29° 37' N, 52° 32' E	1540
Shurlaq, 53 km WSW Sarakhs	Khorasân-e Razawi	36° 19' N, 60° 38' E	575
Shush	Khuzestân	32° 11' N, 48° 15' E	87
Shushtar	Khuzestân	32° 03' N, 48° 51' E	63
Siahkal	Gilân	37° 09' N, 49° 52' E	47
Sib, S. E. Persia	Sistân va Baluchestân	27° 15' N, 62° 05' E	1145
strana Zirkuh [= Zirkuh country]	Sistân va Baluchestân	33° 37' N, 60° 02' E	980
Sultanabad area, near Malayer in the Zagros Mts.	Hamadân	34° 18' N, 48° 54' E	1984
Sultaniye, Kumbet of Molla Hasan Kâshi	Zanjân	36° 26' N, 48° 48' E	1790
Sulzabad, Bushire [= Bushehr]	Bushehr	28° 55' N, 50° 50' E	27
SZ Iran, uŝ. Kotur-Čaâ, bl. gor. Hoâ [= Qotur Chay canyon, near the town of Khoy]	Âzarbâijan-e Gharbi	38° 31' N, 44° 58' E	1130

site	province (ostan)	coordinates	alt.
Tabnaq, 20 km NW Meshginshahr, Qushâ Dahaneh cave	Ardabil	38° 31’ N, 47° 34’ E	825
Tabriz	Âzarbâijan-e Sharqi	38° 04’ N, 46° 17’ E	1395
Tabus	Yazd	33° 36’ N, 56° 55’ E	671
Tâdovân, 44 km NW Jahrom, Tâdovân cave	Fârs	28° 51’ N, 53° 20’ E	1190
Tafrijân, Khorzeneh cave	Hamadân	34° 46’ N, 48° 35’ E	1940
Tagi-a-bad	Khorasân-e Janubi	32° 22’ N, 59° 03’ E	1676
Tak Takâb, 5 km SE Shushtar	Khuzestân	32° 02’ N, 48° 54’ E	150
Takht-e Jamshid (Persepolis), 11 km NE Marvdasht	Fârs	29° 56’ N, 52° 53’ E	1634
Takht-e Soleyman, 25 km NNE Takab	Âzarbâijan-e Gharbi	36° 36’ N, 47° 14’ E	2195
Takhteduzi, 7 km NW Mâku	Âzarbâijan-e Gharbi	39° 21’ N, 44° 29’ E	1360
Talk, Baluchistan	Sistân va Baluchestân	27° 36’ N, 62° 43’ E	866
Tamishan, 20 km. W Mahmudabad	Mâzandaran	–	–
Tang-e Tekhe, 34 km NW Jahrom	Fârs	28° 44’ N, 53° 19’ E	1415
Tang-e Zorok, 40 km NW Jahrom	Fârs	28° 46’ N, 53° 15’ E	–
Taq-e Bostan, Kermanshah	Kermânshah	34° 24’ N, 47° 08’ E	1390
Tar Divon, ca. 65 km NE Jahrom [= Tâdovân, Tâdovân cave]	Fârs	28° 51’ N, 53° 20’ E	1190
Tafrijân, Khorzeneh cave	Hamadân	34° 46’ N, 48° 35’ E	1940
Tâzeh Kand, 15 km SE Pârs Âbâd	Ardabil	39° 34’ N, 48° 02’ E	74
Tâzeh Kand-e Angut, 28 km W Germi	Ardabil	39° 01’ N, 47° 41’ E	861
Teheran	Tehrân	[35° 40’ N, 51° 25’ E]	
Tehran	Tehrân	[35° 40’ N, 51° 25’ E]	
Tekya Qiyasi, 35 km NE Zanjân, Tekya Qiyasi cave	Zanjân	36° 51’ N, 48° 48’ E	571
Telespid, Shulistan	Khuzestân	†30° 21’ N, 50° 19’ E	–
Tir Tash	Mâzandaran	36° 43’ N, 53° 44’ E	94
Tis, 8 km N Chabahar	Sistân va Baluchestân	25° 21’ N, 60° 37’ E	11
Tiss, 9 km north of Chahbahar	Sistân va Baluchestân	25° 21’ N, 60° 37’ E	11
Tiss, Châh’bahâr	Sistân va Baluchestân	25° 21’ N, 60° 37’ E	11
Tonekâbon	Mâzandaran	36° 49’ N, 50° 52’ E	–20
Turbat-i-Haidari	Khorasân-e Razawi	35° 17’ N, 59° 13’ E	1363
Turgan, Qeshm island	Hormozgân	26° 56’ N, 56° 13’ E	30
Urmi [= Oromiyeh]	Âzarbâijan-e Gharbi	37° 33’ N, 45° 04’ E	1350
Valiabad, 15 km SE Behbahan	Khuzestân	30° 27’ N, 50° 19’ E	313
Varamin, Alâ’ed’din tower	Tehrân	35° 19’ N, 51° 39’ E	914
Varamin, 37 kms. south east of Teheran	Tehrân	35° 19’ N, 51° 39’ E	914
Vâyqân, 25 km W Kalibar, Vâyqân cave	Âzarbâijan-e Sharqi	38° 54’ N, 46° 45’ E	1070
Vind-e Kalkhorân, 10 km S Sare’ain, Âghâ Mohammad cave	Ardabil	38° 06’ N, 48° 06’ E	1588
Weyser, south of Nowshar	Mâzandaran	36° 30’ N, 51° 32’ E	1150
Yazd	Yazd	31° 53’ N, 54° 21’ E	1222
Zâbol	Sistân va Baluchestân	31° 02’ N, 61° 30’ E	484
Zahrud-e Bala 70 km S Kerman, Kuh-e Hazar Mts.	Kermân	29° 35’ N, 57° 20’ E	2551
Zamân Sufi, 50 km W Bojnourd	Khorasân-e Shomâli	37° 27’ N, 56° 46’ E	960
Zanjân	Zanjân	36° 40’ N, 48° 29’ E	1656
Zangamar River Cave at Maku	Âzarbâijan-e Gharbi	–	–
Zangârd, 25 km E Bastak	Hormozgân	27° 13’ N, 54° 38’ E	493
Zap. Persiâ, uŝ. Kotur-Čaj, bl. gor. Hoâ [= Qotur-Chay canyon, near Khoy]	Âzarbâijan-e Gharbi	38° 31’ N, 44° 58’ E	1130
Zap. Persiâ, Z. Harsan, Šahrud [= western Iran, western Khorasan, Shahrud]	Semnân	36° 25’ N, 54° 58’ E	1389
Zargende bliz Tegerana [= Zargandeh near Tehran]	Tehrân	35° 47’ N, 51° 26’ E	1420
Zarqan	Fârs	29° 47’ N, 52° 43’ E	1726
Zendgian [= Zanjân]	Zanjân	36° 40’ N, 48° 29’ E	1656
Zendjan [= Zanjân]	Zanjân	36° 40’ N, 48° 29’ E	1656
Zirkuh country, near the Bamrud channel	Khorasân-e Janubi	33° 37’ N, 60° 02’ E	980
Zirkuh, Khorasân	Khorasân-e Janubi	33° 37’ N, 60° 02’ E	980
Zivieh, 40 km E Saqqez, Zivieh cave	Kordestân	36° 17’ N, 46° 43’ E	1850
Zivieh cave, Zivieh Castle, 40 km E Saqqez	Kordestân	36° 17’ N, 46° 43’ E	1850
Zurghum [= Zarqan]	Fârs	29° 47’ N, 52° 43’ E	1726

APPENDIX II
List of the comparative material examined

Rhinopoma muscatellum Thomas, 1903

Afghanistan: 2 ♂♂, 1 ♀ (MHNG 952.075, 952.076 [S+A], 952.074 [A]), Grotte Chamchir, Kandahar, 4 December 1957, leg. K. Lindberg; – 4 inds. (ZFMK 96.458, 96.459, 96.461, 96.463 [S]), Shamshir Gor bei Kandahar, 31° 36' N, 65° 47' E, 28 February 1965, leg. J. Niethammer. – **Oman**: 1 ♀ (NMP 92625 [A]), Al Aqar, 18 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 92626 [S+A]), Al Ghubrah, 18 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 1 ♀ (NMP 92652 [S+A], 92653 [A]), Al Qarbi Ash Sharqiyah, 21 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93747 [S+A]), Al Ghayyan, 6 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93756 [S+A]), Al Hawqain, 7 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂, 1 ♀ (NMP 93770, 93771 [S+A], 93769 [A]), Al Hotta Cave, 8 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 1 ♀ (NMP 93808, 93809 [A]), Al Iraqi, 11 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 1 ♀ (NMP 93820, 93824 [S+A]), Al Zihaymi, 14 & 15 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 4 ♀♀ (NMP 92641–92643 [S+A], 92644 [A]), Ar Rustaq, 19 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 3 ♀♀ (NMP 92635–92637 [S+A]), At Tabaqah, 19 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 92630 [A]), Awabi, 18 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 93768 [S+A]), Bahla, 8 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 93810 [S+A]), Belt, 11 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂ (NMP 93715, 93716 [A]), Birkat Al Mawz, 27 March 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 92780 [S+A]), Dibab, 3 November 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 2 ♀♀ (NMP 92660–92662 [S+A]), Jabrin, 22 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93757 [S+A]), Jamma, 7 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂ (NMP 93744, 93745 [S+A]), Khabbah, 5 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 92785 [S+A]), Mansaft, 4 November 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 93789 [A]), Misfat Al Khawater, 10 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 92769 [S+A]), Muqal, 1 November 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93998 [S+A]), Rawdah, 16 March 2012, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 94000 [S+A]), Wadi Banah, 16 March 2012, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♀♀ (NMP 93758, 93759 [S+A]), Wadi Bani Hani, 7 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (BMNH 94.3.9.17 [S]; type specimen of *Rhinopoma muscatellum* Thomas, 1903), Wadi Bani Ruba, date unlisted, leg. Jayaker; – 1 ♂ (NMP 93792 [A]), Wadi Misfah, 10 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 3 ♀♀ (NMP 92657, 92658 [S+A], 92659 [A]), Yanqul, 22 October 2009, leg. P. Benda, A. Reiter & M. Uhrin.

Rhinolophus ferrumequinum (Schreber, 1774)

Afghanistan: 1 ♂ (ZFMK 97.063 [S+B]), Jalalabad, 28 February 1966, leg. J. Niethammer; – 1 ♂ (MHNG 952.087 [S+A]), Grotte Kham Zindan, Beltehiragh, 29 October 1957, leg. K. Lindberg; – 1 ♂ (MHNG 952.084 [S+A]), Grotte Zarmast, Maïmaneh, 18 October 1957, leg. K. Lindberg; – 1 ♂ (ZFMK 97.064 [S+B]), Kabul, Darulaman, 13 May 1966, leg. J. Niethammer; – 2 ♂♂ (ZFMK 97.068, 97.069 [S+A]), Kala-Bust, 2 March 1965, leg. J. Niethammer; – 2 ♂♂, 1 ♀ (ZFMK 97.065–97.067 [S+B]), Kala-Bust, 29 March 1972, leg. J. Niethammer; – 1 ♂ (MHNG 952.090 [S+A]), Qal'eh Bojr, 6 December 1957, leg. K. Lindberg. – **Azerbaijan**: 1 ♂, 1 ♀ (NMP 91453, 91454 [S+B]), Acınohur, steppe, 27 June 1986, ded. V. Hanák; – 1 ♂ (NMP 91275 [S+A]), Qobustan, 20 June 1979, leg. V. Hanák; – 1 ♂ (NMP 91441), Qobustan, 22 June 1987, ded. V. Hanák; – 1 ♂, 6 ♀♀, 1 ind. (NMP 91405–91409, 91411, 91412 [S+A], 91410 [S+B]), Mingəçevir, 25 June 1984, ded. V. Hanák; – 2 ♂♂, 1 ♀ (NMP 91299, 91305 [S+A], 91300 [S+B]), Şamaxı, 26 June 1979, leg. V. Hanák. – **Cyprus**: 1 ♂ (NMP 91235 [S+A]), Afendrika, 17 October 2005, leg. I. Horáček, P. Hulva & R. Lučan; – 1 ♂, 1 ♀ (NMP 91249 [S+A], 91248 [A]), Akamas Pen., Smigies Trail, 27 March 2005, leg. I. Horáček, P. Hulva & R. Lučan; – 2 ♀♀ (NMP 91205, 91206 [S+A]), Akamas Pen., Smigies Trail, 12 October 2005, leg. I. Horáček, P. Hulva & R. Lučan; – 1 ♂ (NMP 90425 [S+A]), Cinarli, Inçirli Cave, 17 April 2005, leg. P. Benda, V. Hanák & I. Horáček; – 1 ♂ (NMP 91234 [S+A]), Cinarli, Inçirli Cave, 15 October 2005, leg. I. Horáček, P. Hulva & R. Lučan; – 1 ♀ (NMP 90432 [S+A]), Kalavasos, 19 April 2005, leg. P. Benda, V. Hanák & I. Horáček; – 1 ♂ (NMP 91225 [S+A]), Troodos Forest, Kakopetria, 14 October 2005, I. Horáček, P. Hulva & R. Lučan. – **Georgia**: 2 ♂♂, 12 ♀♀ (NMP 91519–91521, 91527, 91537, 91542, 91546, 91548, 91549, 91553–91555, 93853 [S+B]), Džali near Suhumi, tunnel, 14 July 1964, leg. V. Hanák. – **India**: 1 ♀ (BMNH 81.3.1.10. [S]; type specimen of *Rhinolophus ferrumequinum proximus* Andersen, 1905), Gilgit, date unlisted, leg. J. Scully; – 1 ♂ (BMNH 79.11.21.153. [S]; type specimen of *Rhinolophus ferrumequinum regulus* Andersen, 1905), Masuri, date unlisted, leg. Capt. Hutton. – **Jordan**: 1 ♂ (NMP 92408 [S+A]), Dibbine, Dibbin Forest, 27 October 2008, leg. P. Benda & J. Obuch; – 1 ♂, 2 ♀♀ (AUB M877, M882 [S+B], M878 [S]), Jarash, 18 October 1964, leg. S. Atallah; – 1 ♂ (NMP 92562 [S+A]), Malka, 28 May 2009, leg. P. Benda, J. Obuch & A. Reiter; – 1 ♀ (NMP 92504 [S+A]), Tabaqat Fahl, 24 May 2009, leg. P. Benda & J. Obuch; – 1 ♂, 1 ♀ (NMP 92403, 92404 [S+A]), Zubiya Cave, 25 October 2008, leg. P. Benda & J. Obuch; – 2 ♂♂ (NMP 92506, 92507 [S+A]), Zubiya Cave, 24 May 2009, leg. P. Benda & A. Reiter. – **Kirghizstan**: 4 ♂♂ (NMP 91706–91708 [S+A], 91705 [S+B]), Kadamžaj, 22 May 1980, leg. J. Gaisler & V. Hanák; – 1 ♂ (NMP 58328 [S+A]), Kara-Kokty, 13 July 1988, leg. J. Červený, A. Červená & J. Obuch; – 1 ♂ (NMP 58778/2 [S+A]), Oš District, 1988, leg. J. Červený, A. Červená & J. Obuch; – 3 ♂♂ (NMP 58326/1, 58326/2, 58327 [S+A]), Samarkandyk, Kanigut, 2 July 1988, leg. J. Červený, A. Červená & J. Obuch; – 3 ♂♂, 2 ♀♀ (NMP 58325/2–6 [S+A]), Toâ-Moûn, Kolodec Fersmana, 12 July 1988, leg. J. Červený, A. Červená & J. Obuch. – **Lebanon**: 1 ♂ (AUB M876 [S+B]), Aamchite, 18 October 1964, leg. S. Atallah; – 1 ♂ (NMP pb4061 [S+A]), Aamchite, 14 March 2009, leg. T. Bartonička, P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP 91791 [S+A]), Aanjar, 24 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♂, 1 ♀ (NMP pb4671, pb4672 [S+A]), Aanjar, 5 June 2010, leg. P. Benda & M. Uhrin; – 1 ♂ (NMP le113 [S+A]), Afqa Cave, 26 June 2006, leg. I. Horáček, P. Hulva & R. Lučan; – 2 ♂♂ (NMP 90895, 90896 [S+A]), Afqa Cave, 15 July 2006, leg. P. Benda; – 1 ♂ (NMP 91781 [S+A]), Afqa Cave, 22 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♀ (NMP 91892 [S+A]), Afqa Cave, 17 January 2008, leg. P. Benda, I. Horáček, R. Lučan & M. Uhrin; – 2 ♀♀ (AUB M1176, M1177 [S+B]), Amchite, 17 April 1965, leg. S. Atallah; – 1 ♂ (NMP 91800 [S+A]), El Qana Cave, 27 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♀ (NMP 91768 [S+A]), Haqel el Azime, 21 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 2 ♂♂, 2 ♀♀ (AUB M145, M146, M149, M150 [S+B]), Hazmiye, 5 August 1960, leg. R. E. Lewis; – 2 ♀♀ (AUB M151, M153 [S+B]), Hazmiye, 13 August 1960, leg. R. E. Lewis; – 1 ♀ (AUB M155 [S]), Hazmiye, 10 September 1960, leg. J. E. Stencel & D. Baroudy; – 1 ♂ (NMP pb4698 [S+A]), Khirbet Anafar, 9 June 2010, leg. P. Benda & M. Uhrin; –2 ♀♀ (NMP 91750, 91751 [S+A]), Mrouj, 19 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP 91788 [S+A]), Qadisha Cave, 23 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP 91796 [S+A]), Ras al Assi, 25 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♂, 4 ♀♀ (NMP le152, le194, le195, le196, le210 [S+A]), Ras el Assi, 29 June 2006, leg. I. Horáček, P. Hulva & R. Lučan; – 1 ♂ (NMP 91767 [S+A]), Tarabulus, 21 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP pb4083 [S+A]), Wadi Jilo, 22 March 2009, leg. T. Bartonička, P. Benda, I. Horáček & R. Lučan. – **Nepal**: 1 ♂, 1 ♀ (BMNH 43.1.12.135., 43.1.12.136. [S]; type specimens of *Rhinolophus ferrumequinum tragatus* Hodgson, 1835), Nepal, date unlisted, leg. Hodgson. – **Russia**: 4 ♀♀ (NMP 91485–91488 [S+B]), Staraâ Macesta near Soči, 24 June 1960, leg. V. Hanák. – **Syria**: 1 ♂ (NMP 48030 [S+A]), As Salishiyah, 18 June 1998, leg. M. Andreas, P. Benda & M. Uhrin; – 2 ♂♂, 3 ♀♀ (NMP 48974–48978 [S+A]), As Salishiyah, 20 April 2001, leg. P. Munclinger & P. Nová; – 1 ♂ (NMP 48804 [S+A]), As Salishiyah, 16 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 5 ♀♀ (NMP 48854–48858 [S+A]), Bosra, 25 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 ♂ (MNHN 1983-1958 [S]), Lattakié, 1900, leg. H. Gadeau de Kerville; – 1 ♂, 5 ♀♀ (NMP 48759–48764 [S+A]), Qala'at Najm, 10 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 ♂ (NMP 48270 [S+A]), Qala'at Nimrod, 18 July 1999, leg. P. Benda; – 1 ♂, 1 ♀ (NMP 48073, 48074 [S+A]), Qala'at Salah ad Din, 30 June 1998, leg. M. Andreas, P. Benda & M. Uhrin; – 1 ind. (NMP 90342 [S]), Qala'at Salah ad Din, 13 October 2004, leg. R. Lučan; – 3 ♀♀ (NMP 48935–48937 [S+A]), Qala'at Samaan, 3 June 2001, leg. M. Andreas, A. Reiter & D. Weinfurtová; – 6 ♀♀ (NMP 48077–48082 [S+A]), Qala'at Sheisar, 1 July 1998, leg. M. Andreas, P. Benda & M. Uhrin; – 1 ♀ (NMP 48892 [S+A]), Qala'at Sheisar, 31 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 ♂, 1 ♀ (NMP 48927, 48928 [S+A]), Qatura, 2 June 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová. – **Turkey**: 1 ♂ (NMW 24577 [S+B]), Ahmetbeyli, 16 February 1969, leg. F. Spitzenberger; – 1 ind. (NMW 68029 [S]), Belikesir Prov., 17 May 1975, leg. M. Cağlar; – 1 ♂, 9 ♀♀ (NMP 47928–47933, 48089–48093 [S+A]), Çevlik, 20 May 1995, leg. P. Benda, J. Flegr & J. Sádlová; – 1 ♂ (NMW 24579 [S+B]), Cobanisa, 15 March 1969, leg. F. Spitzenberger; – 1 ♀ (NMW 20509 [S+B]), Bergama, 17 September 1960, leg. F. Spitzenberger; – 1 ♀ (NMW 24584 [S+A]), Bergama, 1 April 1969, leg. F. Spitzenberger; – 2 inds. (ZFMK 73.425, 73.426 [S+Sk]), Birecik, 13 January 1973, leg. U. Hirsch; – 1 ind. (ZFMK 85.88 [S+B]), Birecik, 29 January 1973, leg. U. Hirsch; – 1 ♂ (CUP T93/61 [S+A]), Derebük, 27 October 1993, leg. P. Benda & I. Horáček; – 4 ♂♂, 1 ♀ (NMW 34322–34326 [S+B]), Egil, 26 July 1984, leg. A. Mayer, F. Spitzenberger & E. Weiß; – 1 ♀ (NMW 11836 [S]), Enez, 4 June 1967, leg. F. Spitzenberger; – 1 ♀ (ZFMK 58.275b [S+B]), Haruniye, 1953, leg. H. Kumerloeve; – 1 ♂ (NMW 24580 [S+A]), Havran, 17 March 1969, leg. F. Spitzenberger; – 1 ♂, 1 ♀ (NMW 24581, 24582 [S+B]), Inkaya Köyü, 18 March 1969, leg. F. Spitzenberger; – 1 ♂ (NMW 24583 [S+B]), Kaya Köyü, 26 March 1969, leg. F. Spitzenberger; – 1 ♂ (HMNH 1438.1 [S+B]), Kisázsia [= Asia Minor], date unlisted, leg. Vétel; – 1 ♂ (NMW 34321 [S+B]), Kiziltas, 19 July 1984, leg. A. Mayer, F. Spitzenberger & E. Weiß; – 1 ♀ (CUP T93/60 [S+A]), Kürtler, 23 October 1993, leg. P. Benda & I. Horáček; – 1 ♂ (NMP 90490 [S+A]), Muradiye, 23 June 2003, leg. J. Hájek & J. Hotový; – 3 ♂♂, 1 ♀ (NMW 37201–37204 [S+B]), Perge (= Aksu), 14 August 1986, leg. F. Spitzenberger; – 1 ♀ (CUP T93/39 [S+A]), Sarpdere, Dupnica Mağara, 16 October 1993, leg. P. Benda & I. Horáček; – 1 ind. (NMW 14622 [S+B]), Verburan, Aprl 1971, leg. Huss; – 4 ♂♂ (CUP T93/69–72 [S+A]), Yalan Dünya Mağara, 30 October 1993, leg. P. Benda & I. Horáček; – 1 ind. (ZFMK 65.206 [S]), Yanikkişla Köy, 19 March 1953, collector unlisted; – 1 ♂ (NMW 24578 [S+B]), Zindan Mağara, 28 February 1969, leg. F. Spitzenberger. – **Turkmenistan**: 1 ♀ (NMP 91606 [S+B]), Baharly Cave, 29 July 1964, leg. V. Hanák. – **Uzbekistan**: 1 ♂, 1 ♀ (NMP 94093, 94094 [S+A]), Aman-Kutan, 1 October 1985, leg. J. Moravec; – 1 ♂, 1 ♀ (NMP 91467, 91468 [S+B]), Toškent, 30 September 1963, leg. V. Hanák.

Rhinolophus bocharicus Kaŝenko et Akimov, 1918

Kirghizstan: 1 ♂ (NMP 58445 [S+A]), Oš District, 1987, leg. J. Obuch; – 3 ♂♂ (NMP 58336/2–4 [S+A]), Samarkandyk, Kanigut, 2 July 1988, leg. J. Červený, A. Červená & J. Obuch. – **Uzbekistan**: 4 ♀♀ (NMP 91458–91461 [S+B]), Samarqand, 28 September 1963, leg. V. Hanák; – 1 ♂, 7 ♀♀ (NMP 91489–91496 [S+B]), Samarqand, 14 October 1963, leg. A. K. Sagitov.

Rhinolophus blasii Peters, 1866

Afghanistan: 1 ind. (MHNG 983.004 [S+A]), Grotte Dahan-Ghon (Tang-la-Landar, W. Kaboul), 27 May 1960, leg. K. Lindberg; – 1 ind. (MNHG 974.006 [B]), Grotte Zarmast, Maïmaneh, 5 July 1959, leg. K. Lindberg. – **Bosnia**: 1 ♂ (NMW 10808 [S+A]), Sarajevo, ~1891, leg. O. Reisler. – **Croatia**: 1 ♀ (NMW 10806 [S+A]), Monte Promina or Biokovo, before 1884, leg. G. Kolombatović. – **Cyprus**: 2 ♂♂ (NMW 23381, 23382 [S+B]), between Pyla and Troulli, June–July 1977, leg. K. Kollnberger. – **Greece**: 1 ♀ (NMP 48590 [S+B]), Aidonohori, Aoos River, 28 August 1988, leg. V. Hanák, Z. Roček & V. Vohralík; – 1 ♂, 1 ♀ (NMW 29717, 29718 [S+B]), Archaea Korinth, 6 August 1979, leg. A. Baar & W. Baar; – 3 ♀♀ (NMP 48634–48636 [B]), Cave of the Cyclops Polyphemos, 18 June 1989, leg. R. Chaloupka, V. Hanák & V. Vohralík; – 1 ♀ (NMW 10805 [S+A]), Morea [= Peloponnese], 12 June 1885, leg. E. Reitter; – 4 ♂♂, 3 ♀♀ (NMP 48593, 48594, 48599, 48601, 48603, 48606, 48607 [B]), Petralona, cave, 28 September 1988, leg. V. Hanák, I. Horáček, Z. Roček & V. Vohralík. – **Morocco**: 10 ♂♂, 26 ♀♀ (NMW 28022–28036 [S+B], 28037–28047, 28049–28058 [S+A]), Kef Azigza Cave, 16 August 1979, leg. E. Hubert, A. Mayer, F. Spitzenberger & J. Wirth. – **Syria**: 11 ♂♂, 3 ♀♀ (NMW 21962–21975 [S+A]), Aleppo [= Halab], 13–23 March 1910, leg. V. Pietschmann; – 1 ♀ (MNHN 1876-339 [S+A]), Lattakié, leg. M. Deyrolles; – 1 ♀ (MNHN 1985-894 [S+A]), Lattakié, leg. H. Gadeau de Kerville; – 6 inds. (MNHN 1860-487A–C, E–G [B, skulls inside]), Syrie, 1860, leg. Blanche; – 1 ind. (MNHN 1921-86 [S+A]), Syrie, leg. D. Siépi; – 1 ♂ (ZFMK 79.627 [S+A]), Syrien, 1894, ded. Schlüter. – **Turkey**: 6 ♂♂ (NMP 47917–47922 [S+A]), Cehennem Cave, 3 August 1992, leg. P. Benda, J. Flegr & J. Sádlová; – 3 ♂♂ (NMP 90297–90299 [S+B]), Cehennem Cave, 2 May 1991, leg. V. Hanzal & P. Horák; – 1 ♂, 11 ♀♀ (CUP T93/83–94 [S+A]), Insuyu Cave, 1 November 1993, leg. P. Benda & I. Horáček; – 3 ♂♂, 4 ♀♀ (NMP 47952, 47954–47958, 47960 [S+A]), Sergen, Safe Suyu Spring Cave, 1 September 1996, leg. M. Andreas, P. Benda & M. Uhrin.

Myotis blythii (Tomes, 1857)

Afghanistan: 1 ♀ (ZFMK 97.138 [S]), Maindar Valley, E of Unai-Pass, 30 April 1965, leg. J. Niethammer; – 1 ♂ (MHNG 952.98 [S+A]), Finidjal, 29 July 1957, leg. K. Lindberg; – 2 inds. (MHNG 974.7, 974.8 [S+Sk]), Maimaneh, Grotte Zarmast, 5 July 1959, leg. K. Lindberg; – 1 ind. (MHNG 953.2 [S]), Qalat, Grotte Boulan, 9 April 1958, leg. K. Lindberg. – **Armenia**: 2 inds. (NMP 91582, 91583 [S+B]), environs of Erewan, date and collector unlisted, ded. V. Hanák; – 1 ♂ (NMP 91749 [S+B]), Armenia (site closely undefined), date unlisted, leg. D. Frynta. – **Azerbaijan**: 1 ind. (NMP 91423Z [S+B]), Qobustan, 20 June 1986, ded. V. Hanák; – 1 ♂ (NMP 91436 [S+B]), Qobustan, 22 June 1987, ded. V. Hanák; – 5 inds. (NMP 91427–91431 [S+B]), Şamaxı, 5 July 1986, ded. V. Hanák; – 1 ♂ (NMP 91310 [S+A]), Şamaxı, 28 June 1979, leg. V. Hanák. – **Georgia**: 2 ♂♂ (NMP 91511, 91512 [S+B]), Mcheta, Svetichoveli, 11 July 1964, leg. V. Hanák. – **India**: 1 m (BMNH 71.14 [S+A]), Bahmajo Bat Cave, 6 miles from Achabal, Kashmir, 5,700 ft, leg. G. LePatourel; – 1 m (BMNH 20.4.24.1. [S]), Balna, W Kumaon, date unlisted, leg. H. L. Tyter; – 1 f (ZFMK 97.137 [S]), Srinagar, Kashmir, August 1962, leg. E. Kollmann; – 1 ind. (BMNH 49.8.16.22. [S+B], holotype specimen of *Vespertilio blythii* Tomes, 1857), Nurshabad, date unlisted, leg. Warwick; – 1 ind. (BMNH 13.10.16.1. [S+A]), Swinla/Simla Dist. (?), date unlisted, leg. P. Dodsworth. – **Jordan**: 1 ♂, 2 ♀♀ (NMP 92528–92530 [S+A]), Khashibah, Al Wardeh Cave, 26 May 2009, leg. P. Benda, J. Obuch & A. Reiter; – 1 ♀ (NMP 92836 [S+A]), Khashibah, Al Wardeh Cave, 14 July 2010, leg. P. Benda & A. Reiter; – 3 ♂♂, 3 ♀♀ (NMP 92544–92546, 92548, 92549 [S+A], 92547 [A]), Kufranja, Iraq al Wahaj Cave, 26 May 2009, leg. P. Benda, J. Obuch & A. Reiter. – **Kazakhstan**: 12 ♀♀ (ZIN 69175–69186 [S]), Andreevka [= Kabanbaj], 18 June 1982, leg. P. P. Strelkov. – **Kirghizstan**: 1 ♀ (CUP CT 84/254 [S+A]), Aravan, Čarvak, 20 August 1984, leg. J. Červený & I. Horáček; – 1 ♂ (CUP CT 84/255 [S+A]), Aravan, Duvahan-Ungur Cave, 21 August 1984, leg. J. Červený & I. Horáček; – 2 ♂♂, 1 ♀ (CUP CT 84/279–281 [S+A]), Aravan, Sasyk-Ungur Cave, 24 August 1984, leg. J. Červený & I. Horáček; – 4 ♂♂ (NMP 58320/13, 58436/1, 58436/2, 58453 [S+A]), Aravan, Sasyk Ungur Cave, 11 July 1988, leg. J. Červený, A. Červená & J. Obuch; – 1 ♀ (NMP 58455 [S+A]), Čauvaj, 26 June 1988, leg. J. Červený, A. Červená & J. Obuch; – 17 ♀♀ (NMP 58310/1–6, 58320/1–5, 58320/7, 58320/8, 58446, 58454, 58456 [S+A], 58320/6 [A]), Kadamžaj, 27 June 1988, leg. J. Červený, A. Červená & J. Obuch; – 3 ♂♂ (NMP 58340/1–3 [S+A]), Kara-Kokty, 13 July 1988, leg. J. Červený, A. Červená & J. Obuch; – 3 ♀♀ (NMP 58310/8, 59324 [S+A], 58310/7 [A]), Kyzyl-Kiâk, 30 June 1988, leg. J. Červený, A. Červená & J. Obuch; – 9 ♂♂, 5 ♀♀ (CUP CT 84/361–374 [S+A]), Nižnaâ Serafimovka, Solânka Cave, 29 August 1984, leg. J. Červený & I. Horáček; – 1 ♂ (CUP CT 84/324 [S+A]), Oš, Sulejman, 26 August 1984, leg. J. Červený & I. Horáček; – 9 ♂♂ (CUP CT 84/67–69, CT 84/116–118, CT 84/246–248 [S+A]), Oš, Toâ-Moûn, 2, 6 and 19 August 1984, leg. J. Červený & I. Horáček; – 27 ♂♂, 30 ♀♀ (CUP CT 84/97–112, CT 84/129–162, CT 84/164–169 [S+A]), Oš, Toâ-Moûn, Aždar-Ungur Cave, 5 and 8 August 1984, leg. J. Červený & I. Horáček; – 8 ♂♂, 7 ♀♀ (CUP CT 84/205–219 [S+A]), Oš, Toâ-Moûn, Barytovaâ Cave, 9 August 1984, leg. J. Červený & I. Horáček; – 7 ♂♂ (NMP 58310/9, 58310/10, 58320/10–12, 58320/14, 58437 [S+A]), Samarkandyk, Kanigut, 2 July 1988, leg. J. Červený, A. Červená & J. Obuch. – **Lebanon**: 1 ♀ (NMP le6 [S+A]), Aalmane, Nahr El Litani, 21 June 2006, leg. I. Horáček, P. Hulva

& R. Lučan; – 1 ♀ (NMP 93695 [S+A]), Aarsal, Chmiss El Emjar, 18 March 2009, leg. T. Bartonička, P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP le112 [S+A]), Afqa Cave, 26 June 2006, leg. I. Horáček, P. Hulva & R. Lučan; – 1 ♂ (NMP 90898 [S+A]), Afqa Cave, 15 July 2006, leg. P. Benda; – 1 ♀ (NMP 93707 [S+A]), Beaufort Castle, 22 March 2009, leg. T. Bartonička, P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP 93557 [S+A]), Beaufort Castle, 6 June 2010, leg. P. Benda & M. Uhrin; – 1 ♂ (NMP 91797 [S+A]), Baalbek, 25 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 2 ♀♀ (NMP le243, le244 [S+A]), El Laboue, 7 July 2006, leg. I. Horáček, P. Hulva, & R. Lučan; – 1 ♂, 4 ♀♀ (NMP 91762–94764, 93539 [S+A], 91760, 91761 [A]), Grotte Raymond, 20 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP 93539 [S+A]), Grotte Raymond, 2 July 2010, leg. P. Benda & M. Uhrin; – 1 ♂, 1 ♀ (AUB M174, M176 [S+B]), Faraya, Natural Bridge, 21 and 29 July 1960, leg. R. E. Lewis; – 2 ♂♂ (NMP 93569 [S+A], 93570 [A]), Jenta, 8 June 2010, leg. P. Benda & M. Uhrin; – 1 ♂ (NMP 91907 [S+A]), Marjaba, 21 January 2008, leg. P. Benda, I. Horáček, R. Lučan & M. Uhrin. – **Syria**: 1 ♂, 7 ♀♀ (NMW 22048–22055 [S+A]), Aleppo [= Halab], 4 July 1914, leg. V. Pietschmann; – 1 ♂ (NMW 21931 [S+B]), Camp Faouar, June 1976, leg. P. Schneider & K. Kollnberger; – 1 ♀ (MNHN 1983-1484 [A]), Djéroud, 1908, leg. H. Gadeau de Kerville; – 2 ♀♀ (MNHN 1876-335A–B [A]), Lattaquié, date unlisted, leg. M. Deyrolle; – 2 ♂♂, 1 ♀ (NMP 47976–47978 [S+A]), Qala'at al Hosn, 15 July 1997, leg. P. Benda; – 1 ♂ (NMP 48057 [S+A]), Qala'at al Hosn, 28 June 1998, leg. P. Benda, M. Andreas & M. Uhrin; – 1 ♂ (NMP 48874 [S+A]), Qala'at al Hosn, 29 May 2001, leg. P. Benda, M. Andreas, A. Reiter, M. Uhrin & D. Weinfurtová; – 1 ♂ (NMP 48917 [S+A]), Qala'at al Marqab, 1 June 2001, leg. M. Andreas, A. Reiter & D. Weinfurtová; – 1 ♂ (NMP 48271 [S+A]), Qala'at Nimrod, 18 July 1999, leg. P. Benda; – 2 ♂♂, 1 ♀ (BMNH 61.388, 61.389 [S+B], 61.390 [S]), Tall Kalakh [= Qala'at al Hosn], 8 December 1952, leg. D. Potter. – **Tajikistan**: 1 ♂ (NMP 58472 [S+A]), Čarku, 3 July 1988, leg. J. Červený, A. Červená & J. Obuch; – 1 ind. (ZIN 32277 [S]), Kulâb, July 1941–1943, leg. B. Vinogradov & S. Stroganov; – 1 ♂ (ZIN 24389 [S]), N slope of the Tissarskij Range, kišlak Kzyl-Tam, 18 July 1933, leg. Vel'gišev. – **Turkey**: 2 inds. (HMSC cam1, cam6 [S]), Çamlimağara Cave, 10 September 1969, leg. H. M. Steiner; – 1 ♂ (NMP 47903 [S+A]), Muradiye, 27 July 1992, leg. P. Benda; – 5 ♂♂, 2 ♀♀ (HMSC 67/261–267 [S+A]), Tuzluca, 14 September 1967, leg. H. M. Steiner; – 4 ♂♂ (NMP 47905–47908 [S+A]), Van, 28 July 1992, leg. P. Benda; – 1 ♂ (NMP 90421 [S+A]), Elaman Hani, 30 June 2003, leg. J. Hájek & J. Hotový. – **Turkmenistan**: 6 ♂♂, 13 ♀♀ (NMP 91587, 91601–91604, 91623–91636 [S+B]), Baharly Cave, 29 July 1964, leg. V. Hanák; – 7 ♀♀ (ZIN 63915–63921 [S]), Duşak Station, Kelat Cave, 20 May 1967, leg. K. Babaev; – 2 inds. (ZIN 48479, 48480 [S]), Tahta-Bazar [= Tagtabazar], 25 June 1930, leg. K. Flerov. – **Uzbekistan**: 4 ♂♂ (NMP 91743–91746 [S+B]), Aman-Kutan, 9 June 1989, ded. V. Hanák; – 1 ♂, 1 ♀ (NMP 91456, 91457 [S+B]), Samarqand, cave, 28 September 1963, leg. & ded. V. Hanák.

Myotis bechsteinii (Kuhl, 1817)

Bulgaria: 1 ♂ (NMP 49349 [B]), Âgodina, 2 August 1971, leg. J. Červený, I. Horáček, A. Taušl & D. Vítek; – 1 ♂ (NMP 49787 [S+B]), Âgodina, 15 August 1978, leg. P. Donát, J. Flegr, K. Hůrka, J. Janda & V. Vohralík; – 1 ♂ (NMP 49651 [S+B]), Karlukovo, 14 June 1977, leg. V. Hanák; – 2 ♀♀ (NMP 50415, 50416 [S+B]), Arkutino, June 1965, leg. Z. Bárta; – 1 ♂ (NMNHS 448 [S+A]), Bov, Izdremec, 14 September 1999, leg. B. Petrov & V. Beškov; – 1 ♂ (NMNHS 449 [S+A]), Bozkite Cave, 10 Aril 1998, leg. B. Petrov; – 1 ♂ (NMNHS 447 [S]), Gara Lakatnik, Svinskata Cave, 24 August 1995, leg. B. Petrov; – 1 ♂ (NMNHS unnumbered [S+A]), Golâma Vapa, 5 October 2006, leg. B. Petrov; – 1 ♂ (NMNHS 119 [S+A]), Graždenica Cave, 28 September 1997, leg. P. Beron & T. Ivanova; – 1 ♂ (NMP 49743 [S+A]), Karlukovo, 6 August 1978, leg. P. Donát, J. Flegr, K. Hůrka, J. Janda & V. Vohralík; – 2 ♂♂ (NMP 49759 [S+B], 49764 [S+A]), Karlukovo, 8 August 1978, leg. P. Donát, J. Flegr, K. Hůrka, J. Janda & V. Vohralík; – 1 ♂, 4 ♀♀ (NMP 49772–49774, 49776 [S+B], 49775 [S+A]), Karlukovo, 9 August 1978, leg. P. Donát, J. Flegr, K. Hůrka, J. Janda & V. Vohralík; – 1 ♂ (NMNHS 118 [S+A]), Mazata Cave, 25 September 1997, leg. T. Ivanova; – 1 ♂ (NMNHS 53 [S+A]), Pejo Âvorov, 5 October 1995, leg. P. Tenčev; – 2 ♀♀ (NMNHS 451, 452 [S+A]), Propada, 27 April 2008, leg. B. Petrov; – 1 ♂ (NMNHS 446 [S]), Ribino, Samara Cave, 19 April 1995, leg. B. Petrov; – 1 ♂ (NMNHS 453 [A]), Ribnovo, Manoilovata Cave, 22 June 2000, leg. B. Petrov; – 1 ♂ (NMNHS 454 [S+A]), Varba, Babta, 5 October 2008, leg. B. Petrov & A. Hubančeva. – **Czech Republic**: 1 ind. (NMP 1/72 [S+B]), Bechyně, 20 January 1972, leg. V. Hanák; – 1 ♀ (NMP 1/73 [B]), Bechyně, 18 January 1973, leg. V. Hanák; – 1 ♂ (NMP 62/59 [S]), Javoříčko, 27 January 1959, leg. V. Hanák; – 1 ♀ (NMP 435/58 [S]), Kašperské Hory, 25 March 1958, leg. V. Hanák; – 1 ♂ (NMP 44/81 [S+B]), Kašperské Hory, 10 September 1981, leg. J. Červený; – 1 ind. (IVB 16/1783 [S+B]), Kateřinská Cave, 27 August 1992, leg. J. Zukal; – 1 ♀ (NMP 1/74 [S+B]), Mořina, 12 February 1974, leg. V. Hanák; – 1 ♂ (NMP 2/75 [S+B]), Nové Město pod Smrkem, 8 February 1975, leg. J. Žalman; – 1 ♂ (NMP 16/70 [S+B]), Nové Město pod Smrkem, January 1970, leg. J. Žalman; – 5 ♀♀ (IVB 1–5/237 [S+B]), Obora u Brna, 15 July 1957, leg. M. Klíma; – 1 ♀ (NMP 219/59 [S]), Rýmařov, 30 January 1959, leg. V. Hanák; – 1 ind. (NMP 11438 [S]), Šumava Mts., leg. J. Červený; – 1 ind. (NMP unnumbered [S+A]), Voděradské bučiny, 12 February 2008, leg. J. Červený. – **France**: 1 ♂ (MHNG 1255.10 [S+B]), Ciron, Bommes, Sauternes, Gironde, 4 April 1964, leg. F. Chanudet; – 1 ♀ (NMP 36/76 [S]), Lurag, 24 November 1963, leg. Brosset; – 1 ♂ (MHNG 949.26 [S+A]), Sarthe, Vouvry-sur-Huisne, 14 February 1953, leg. B. Caubere & V. Aellen. – **Germany**: 1 ♂ (MHNG 949.027 [S+A]), Arlmühlthal, Klammhöhle bei Essing, 28 December 1950, leg. W. Issel & V. Aellen; – 1 ♂ (MHNG 949.28 [S+A]), environs de München, November

1952, leg. W. Issel & V. Aellen. – **Greece**: 1 ♀ (NMP 49018 [S+A]), Spatharis, 24 August 2001, leg. P. Benda. – **Hungary**: 2 inds. (HMNH 2002.32.1., 2002.32.2. [S]), Abaliget, 10 September 2001, leg. I. Dombi; – 1 ind. (HMNH 18403 [S]), Hór-völgy, 7 May 1984, collector unlisted; – 1 ♀ (HMNH 71.2.1. [S]), Kisszépalmapuszta, 26 May 1965, leg. I. Szabó & G. Topál; – 1 ♂ (HMNH 2000.95.3 [S+A]), Macska Cave, 9 September 2000, leg. D. Csanádi, R. Rácz & A. Telegdy; – 1 ♂ (HMNH 71.1.1. [S]), Mánfa, Kőlyuk Cave, 21 December 1967, leg. G. Topál; – 1 ♂ (HMNH 4134 [S+A]), Rángatár, date and collector ulisted; – 4 ♀♀ (HMNH 2404/6-1–3, 6 [S+A]), Zay-Ugrócz, 31 March 1899, leg. A. Lendl. – **Romania**: 1 ♂ (HMNH 2000.105.1. [S]), Băile Bálványos, 2 September 2000, leg. L. Barti & I. Kovács. – **Slovakia**: 1 ♀ (SNMB 218 [S]), Buková, 14 February 1960, leg. F. Matoušek & B. Matoušek; – 1 ♂ (NMP pb2417 [S]), Červená Skala, Ladzianského Cave, 3 February 2003, leg. P. Benda & M. Uhrin; – 1 ♂ (NMP pb2442 [S]), Erňa Cave, 20 April 2003, leg. P. Benda, V. Hanák & M. Uhrin; – 1 ind. (IVB 15/1643 [S]), Silická Brezová, Milada Cave, 19 February 1968, leg. J. Gaisler; – 2 inds. (NMP unnumbered [B]), Štrba, July 1951, leg. Valášková. – **Switzerland**: 1 ♂ (NHMB 1014653 [A]), Bern, Hinderbank, 16 May 1983, leg. L. Geiser; – 1 ♂ (MHNG 1805.023 [S+A]), Col de Jaman, September 1994, leg. J. Lehmann; – 1 ♀ (MHNG 949.29 [S+A]), Commugny, 3 October 1954, leg. J. Steffen; – 1 ♂ (MHNG 949.11 [S+A]), Commugny, Coppet, 6 August 1958, leg. J. Steffen; – 1 ♂ (NHMB 1014654 [S+Sk]), Porrentruy, 7 September 1989, leg. L. Vinciguerra; – 1 ♀ (MHNG 1684.66 [S+A]), Satigny, 16 September 1985, leg. Mme. Rioman; – 1 ♂ (MHNG 1805.024 [S+A]), Vallorbe, 25 July 1987, leg. M. Ruedi.

Myotis alcathoe von Helversen et Heller, 2001

Czech Republic: 2 ♂♂, 2 ♀♀ (NMP 94571–94574 [S+A]), Čížov, Ledové Cave, 1 September 2006, leg. P. Benda & A. Reiter; – 1 ♀ (NMP 94575 [S+A]), Čížov, Ledové Cave, 16 July 2007, leg. P. Benda & A. Reiter; – 2 ♂♂ (NMP 94578, 94579 [S+A]), Čížov, Ledové Cave, 10 July 2008, leg. P. Benda & A. Reiter; – 1 ♂ (SMMZ 6713 [S]), Havraníky, Baštův Mill, 29 June 2001, leg. A. Reiter; – 1 ♂, 1 ♀ (NMP 94580, 94581 [S+A]), Kostelecký les, 9 September 2008, leg. R. Lučan; – 2 ♀♀ (NMP 94569, 94570 [S+A]), Vůznice, date unlisted, leg. R. Lučan; – 1 ♂ (NMP 94586 [S+A]), Šumná, Vlkov fishpond, 1 August 2007, leg. A. Reiter; – 1 ♂ (NMP 94587 [S+A]), Tvořihráz, 2 August 2006, leg. A. Reiter. – **Greece**: 1 ♀ (OHC unnumbered [S]), Arkoudorema, 18 August 1997, leg. O. von Helversen; – 1 ♂ (OHC unnumbered [S]), Loutropygi, 5 June 1991, K.-G. Heller & M. Volleth; – 1 ♀ (OHC MV336 [S+B]; paratype of *Myotis alcathoe* von Helversen et Heller, 2001), Loutropygi, 17 June 1992, leg. O. von Helversen. – **Montenegro**: 1 ♀ (NMP 90228 [S+A]), Plužine, 8 August 2002, leg. P. Benda. – **Romania**: 1 ♂ (MHNG 985.16 [S+B]), Olténie, Avenul 2din Sohodoale, January 1961, leg. A. Burghele. – **Slovakia**: 1 ♂, 1 ♀ (NMP 94576, 94577 [S+A]), Boťany, 21 July 2007, leg. P. Benda & Š. Danko; – 1 ♂, 1 ♀ (NMP 50446, 50447 [S+A]), Šurice, Stĺpová Cave, 8 August 2001, leg. P. Benda & M. Uhrin. – **Switzerland**: 1 ♀ (MHNG 1828.073 [S+A]), Arzier, Vaud, 9 September 2002, leg. M. Ruedi.

Myotis capaccinii (Bonaparte, 1837)

Bulgaria: 1 ♂, 5 ♀♀ (NMP 49668–49673 [S+B]), Devenci, Hajduška Cave, 7 July 1975, leg. J. Červený; – 2 ♂♂ (ZMB 47276, 47277 [S+B], type series of *Leuconoe capaccinii bureschi* Heinrich, 1936), Dorf Karamlek, Strandja Balkan, 2 August 1935, leg. G. Heinrich; – 1 ♂ (NMP 50443 [S+A]), General Todorov, 20 December 2002, leg. P. Benda & T. Ivanova; – 1 ♀ (NMP 50175 [S+B]), Gorna Breznica, 22 July 1981, leg. J. Flousek, R. Fuchs & V. Vohralík; – 1 ♂ (IVB 3 [S+B]), Karlukovo, 7 February 1965, leg. J. Figala, J. Gaisler, V. Hanák & K. Hůrka; – 1 ♀ (NMP 49742 [S+A]), Karlukovo, 6 August 1978, leg. P. Donát, J. Flegr, J. Janda & V. Vohralík; – 1 ♀ (NMP 49442 [S+A]), Karlukovo, 12 June 1977, leg. V. Bejček, J. Škopek, P. Vašák & V. Vohralík; – 1 ♂ (IVB 14 [S+B]), Peštera, Ušatovi dupki Cave, 8 August 1967, leg. J. Gaisler; – 3 ♂♂, 8 ♀♀ (NMP 49190, 49193, 49208, 49209, 49223 [S+B], 49189, 49210, 49211, 49224, 49340, 49344 [S+A]), Primorsko, Maslen Nos, 5 June 1957, leg. V. Hanák; – 1 ♀ (IVB 1 [S+B]), Primorsko, Maslen Nos, 27 August 1961, leg. V. Hanák, B. Král & P. Pithart; – 7 ♂♂ (IVB 4–7, NMP 50098–50100 [S+B]), Zlatna Panega, Panežka izvira Cave, 8 February 1965, leg. J. Figala, J. Gaisler, V. Hanák & K. Hůrka. – **France**: 1 ♀ (ZFMK 97.099 [S+B]), Arles Bouches-du-Rhone, 5 January 1958, leg. J. Niethammer. – **Greece**: 6 ♀♀ (NMP 48658, 48659, 48651–48664 [S+B]), Didimotiho, 22 June 1989, leg. R. Chaloupka, V. Hanák & V. Vohralík; – 1 ♀ (NMP 48626 [S]), Kimmeria, 16 June 1989, leg. R. Chaloupka, V. Hanák & V. Vohralík; – 3 ♂♂, 1 ♀ (NMP 48582–48584, 48616 [S+B]), Kleidonia, 27 September 1988, leg. V. Hanák, Z. Roček & V. Vohralík; – 1 ♂ (NMP 49048 [S+A]), Kria Nera, 4 September 2001, leg. P. Benda; – 5 ♂♂, 4 ♀♀ (NMP 48647–48651, 48653–48656 [S+B]), Maronia, 19 June 1989, leg. R. Chaloupka, V. Hanák & V. Vohralík. – **Iraq**: 11 ♂♂, 6 ♀♀ (HNHM 81.28.1.–81.28.17. [S+Sk+B]), Haditha Cave, 22 October 1977, leg. G. Topál. – **Italy**: 2 ♂♂ (MSNG 7105 [S+B]), Gr. Del Principale (Finalborgo), 26 September 1906, leg. A. Gaggaro; – 1 ♂ (MSNG 27591 [S+B]), Liguria occ., Finalborgo, Grotta Pollera, 3 May 1910, leg. A. Gaggero. – **Lebanon**: 8 ♂♂ (AUB M664/1–5 [S+A], M664 [A]), Amchite, 11 November 1962, leg. R. E. Lewis; – 1 ♂ (NMP 93710 [S+A]), Aamchite, 25 March 2009, leg. T. Bartonička, P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP 93708 [S+A], Beaufort Castle, 22 March 2009, leg. T. Bartonička, P. Benda, I. Horáček & R. Lučan; – 5 ♂♂ (NMP le93–le97 [S+A]), Er Rouais Cave, 26 June 2006, leg. I. Horáček, P. Hulva & R. Lučan; – 1 ♀ (NMP 91774 [S+A]), Haqel El Azime, 21 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♂ (NMP 91901 [S+A]), Haqel El Azime, 18 January 2008, leg. P. Benda, I. Horáček, R. Lučan & M. Uhrin; – 1 ♀ (NMP 91759 [S+A]), Mrouj, 19 January 2007, leg. P. Benda, I. Horáček & R. Lučan; – 1 ♀ (NMP le8 [S+A]), Nahr El Litani, 21 June 2006, leg. I. Horáček, P. Hulva & R. Lučan. – **Spain**: 2 ♂♂, 1 ind. (ZFMK 56.730, 56.731 [S+B], 56.732 [S]), Pyrenaeen bei Tremp, 28 May 1955, leg. J. Niethammer. – **Syria**: 1 ♀ (NMP 48806 [S+A]), Abu Kemal, 16 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 1 ♀ (NMP 48765 [S+A]), Al Ghazli, 11 May 2001, leg. M. Andreas, P. Benda, A. Reiter & D. Weinfurtová; – 2 ♂♂, 10 ♀♀ (NMW 22056–22067 [S+A]), Aleppo [= Halab], 4 July 1914, leg. V. Pietschmann. – **Turkey**: 1 ♀ (NMW S69/519 [S]), Anamas, Zindan Cave, 25 June 1969, leg. F. Spitzenberger; – 4 ♂♂, 5 ♀♀ (NMW S69/520–528 [S+B]), Anamas, Zindan Cave, 26 June 1969, leg. F. Spitzenberger; – 1 ♂, 1 ♀ (NMW S69/90, S69/91 [S+B]), Bereketli, Manyas Gölü, 18 March 1969, leg. F. Spitzenberger; – 1 ind. (ZFMK 73.428 [S+Sk]), Birecik, 1973, leg. U. Hirsch; – 1 ♀ (NMW 24036 [S+B]), Cennet Cehennem Cave at Silifke, 22 March 1973, leg. K. Bauer, F. Spitzenberger, A. Mayer & J. Wirth; – 1 ♀ (NMW 11631 [S+B]), Demirköy, 10 May 1967, leg. F. Spitzenberger; – 1 ♂ (NMW 11714 [S+B]), Iğneada, 13 May 1967, leg. F. Spitzenberger; – 12 ♂♂ (ZFMK 66.631–66.642 [S+A]), Insuyu Cave, 11 April 1966, leg. B. Dobat; – 3 ♂♂, 8 ♀♀ (NMW S69/19, S69/22, S69/29, S69/38, S69/39 [S+B], S69/27, S69/28, S69/32–34 [S], S69/20 [B]), Insuyu Cave, 24 February 1969, leg. F. Spitzenberger; – 4 ♂♂, 1 ind. (NMW S69/488 [S+B], S69/489–492 [S]), Insuyu Cave, 24 June 1969, leg. F. Spitzenberger; – 1 ♀ (NMW 24035 [S+B]), Insuyu Cave, 21 March 1973, leg. K. Bauer, F. Spitzenberger, A. Mayer & J. Wirth; – 1 ♂, 5 ♀♀ (CUP T93/26–30, T93/45 [S+A]), Sarpdere, Dupnisa Mağara Cave, 16 October 1993, leg. P. Benda & I. Horáček; – 1 ♀ (CUP T93/78 [S+A]), Yalan Dünya Mağara Cave, 30 October 1993, leg. P. Benda & I. Horáček.

Hypsugo arabicus (Harrison, 1979)

Oman: 1 ♂ (NMP 92624 [S+A]), Al Aqar, 17 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂ (NMP 92665, 92666 [S+A]), Al Nakhar, 22 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂, 2 ♀♀ (NMP 93739–93741 [S+A], 93742 [A]), Al-Aqor, Wadi Tiwi, 4 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♀♀ (NMP 93822, 93823 [S+A]), Al Zihaymi, 14 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 92779 [S+A]), Dibab, 2 November 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♀♀ (NMP 93760, 93761 [S+A]), Ghab, Wadi Al Hawasina, 7 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♂♂, 1 ♀ (NMP 92782, 92783 [S+A], 92784 [A]), Mansaft, 3 November 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 2 ♀♀ (NMP 93785, 93786 [S+A], 93787 [A]), Misfat Al Khawater, 9 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 92774 [S+A]), Muqal, 1 November 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93997 [S+A]), Sal Aalah, 15 March 2012, leg. P. Benda, A. Reiter & M. Uhrin; – 3 ♀♀ (NMP 93812, 93813 [S+A], 93814 [A]), Subakh, Hatta Pools, 12 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 2 ♀♀ (NMP 93733, 93734 [S+A]), Wadd, 3 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 94001 [S+A]), Wadi Banah, 16 March 2012, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (BMNH 80.393. [S+B]; holotype of *Pipistrellus arabicus* Harrison, 1979), Wadi Sahtan, 18 March 1979, leg. M. D. Gallagher.

Otonycteris hemprichii Peters, 1859

Oman: 1 ♀ (NMP 92667 [S+A]), Al Nakhar, 22 October 2009, leg. P. Benda, A. Reiter & M. Uhrin. – **Saudi Arabia**: 1 ind. (ZFMK 97.149 [S]), ca. 100 km NE Riad, Thumama NP, March–April 1985, leg. J. Szij; – 1 ♀ (BMNH 40.162. [S+B]), Anaiza (Qasim), Arabia, 10 June 1938, leg. H. St. J. B. Philby; – 1 ♂ (BMNH 24.8.2.2. [S+B]; holotype of *Otonycteris jin* Cheesman et Hinton, 1924), Hufuf, C. Arabia, date unlisted, leg. R. E. Cheesman; – 4 ♂♂ (BMNH 25.4.3.9.–25.4.3.12. [S+B]), Hufuf, C. Arabia, 6, 9 and 11 december 1923, leg. R. E. Cheesman.

Tadarida teniotis (Rafinesque, 1814)

Algeria: 6 ♀♀ (ISEA 9596, 9597, 9599, MUB A514, A515 [S+B], ISEA 9598 [S]), Amentane, Aurès, 8 August 1983, leg. J. Gaisler, K. Kowalski & B. Rzebik-Kowalska. – **Azerbaijan**: 1 ♂ (MUB 1.2.38 [S+B]), Nagornyj Karabah Republic, Šušinskoe Canyon, 17 August 1939, leg. A. Kuzâkin. – **Cyprus**: 1 ♂ (NMP 91831 [S+A]), Paramytha, 31 March 2005, leg. I. Horáček, P. Hulva & R. Lučan. – **Egypt**: 1 ♂, 1 ♀ (BMNH 3.4.1.1., 3.4.1.2. [S+B]), Abu Roash, 27 February 1903, leg. Capt. S. S. Flower; – 2 inds. (BMNH 3.6.3.1., 3.6.3.2. [S+B]), Abu Roash, 31 March 1903, leg. Capt. S. S. Flower; – 1 ♂ (BMNH 15.10.2.1. [S+B]), Aburoash, Giza, March 1914, leg. Bonhote; – 2 inds. (SMF 12379, 12380 [S]; type series of *Dysopes rupelii* Temminck, 1826), Ägypten, before 1822, ded. E. Rüppell; – 1 ♂ (NMW 27416 [S]), Ägypten, date unlisted, leg. Th. von Heuglin; – 1 ♂ (MSNG 44418 [S+A]), Dintorni di Cairo, 15 March 1906, leg. F. W. Innes Bey; – 1 ♂ (BMNH 23.1.14.3. [S+B]), Giza, 26 March 1922, leg. S. S. Flower; – 1 ♀ (BMNH 23.1.14.4. [S+B]), Giza, 28 March 1922, leg. S. S. Flower; – 1 ♀ (BMNH 9.7.1.12. [S+B]), near Giza, 17 November 1908, leg. M. J. Nicoll; – 3 ♂♂ (NMP 90525, 90526 [S+A], 90524 [A]), Sinai, Ein El Furtaga, leg. 16 September 2005, leg. M. Andreas, P. Benda, J. Hotový & R. Lučan; – 5 ♂♂ (NMP 90529–90532 [S+A]), Sinai, Ein El Furtaga, 16 September 2005, leg. M. Andreas, P. Benda, J. Hotový & R. Lučan. – **France**: 3 inds. (MHNG 1325.87–1325.89 [S]), Gorges de la Bourne, Grotte du Bournillon, 28 September 1975, leg. J. F. Desmet; – 1 ind. (MHNG 1625.81 [S]), Isere, Grotte du Bournillon, January 1976, leg. J. F. Noblet; – 1 ind. (SMF 33562 [S]), Süd Frankreich, 30 Remoulin, Pont du Gard, 30 August 1963. – **Greece**: 1 ind.

(NMW 45848 [S+B]), Griechenland, 28 May 1982, collector unlisted; – 1 ♂ (SMF 28221 [S]), Crete, Sitia, 22 March 1958, leg. H. Kahmann. – **Israel**: 2 ♂♂ (MSNG 18233[a, b] [S+B]), Gerusalemme, 1923, leg. Padre Contini. – **Italy**: 1 ♀ (MHNG 975.90 [S+A]), Cagliari, Sardaigne, date unlisted, leg. F. Bona; – 1 ♀ (MZUF 9881 [S]), Castello, Firenze, 29 September 1877, collector unlisted; – 1 ♂, 2 ♀♀ (MZUF 7383, 45084 [A], 7384 [S]), Corigliano Calabro, Torre de Castello Compagna, 30 June 1904, leg. A. Andreini; – 1 ♂, 1 ♀ (MZUF 14663, 5352A [S]), Firenze, 9 July 1908, collector unlisted; – 2 ♀♀ (MZUF 6743, 6744 [S]), Firenze, 2 August 1873, collector unlisted; – 1 ♂ (MZUF 20294 [A]), Firenze, 25 September 2001, leg. S. Bambi; – 1 ♀ (MSNG 54224 [A]), Genova, date unlisted, leg. LIPU; – 1 ♂ (MSNG 44985 [A]), Genova, in citta, date and collector unlisted; – 1 ♀ (MSNG 45097 [A]), Genova, in citta, 4 April 1902, leg. C. Fiori; – 1 ♂ (MSNG 6516 [S]), Genova, Begato, 12 May 1907, leg. B. Borgioli; – 1 ♀ (MSNG 54223 [A]), Genova, via Bellucci, Liceo Colombo, 8 October 2007, leg. LIPU; – 1 ♂ (MSNG 48502 [A]), Genova, Piazza Sarzana, 14 January 1992, leg. E. Tagliarini; – 1 ♀ (MSNG 6518 [S+B]), Isola Giglio, Torre del Campese, 30 November 1909, leg. L. Doria; – 1 ♂ (MSNG 54574 [A]), Leca d'Albenga, May 2008, leg. L. Lamagni; – 1 ♀ (MSNG 51316 [A]), San Remo, 15 February 2000, collector unlisted; – 1 ♂ (MSNG 47121 [A]), Siliqua, Cagliari, June 1906, leg. R. Meloni; – 1 ♂ (MZUF 9879 [S]), Pisa, 20 February 1905, collector unlisted; – 1 ♂ (NMW 23414 [S+B]), Pisa, May 1830, leg. K. Michelhelts; – 1 ind. (NMW 26649 [S+B]), Pisa, 1 June 1830, leg. P. Savi; – 1 ♂ (MZUF 9381 [S]), Sicilia, Catania, 31 May 1974, collector unlisted; – 1 ind. (SMF 11959 [S]), Toscana, before 1846, collector unlisted; – 1 ♀ (MHNG 975.91 [S+A]), Toscane, date unlisted, leg. F. Bona. – **Jordan**: 1 ♂ (RSCN unnumbered [S+A]), Rashah, Mujib Reserve, 20 April 1999, leg. K. A. Al Omari, F. L. Amerian & R. Heil; – 1 ♀ (NMP 92826 [S+A]), Wadi Al Wala, 11 July 2010, leg. P. Benda & A. Reiter; – 1 ♀ (RSCN unnumbered [S+A]), Wadi Zarqa Ma'in, 5 April 1999, leg. K. A. Al Omari & M. A. Abu Baker. – **Kirghizstan**: 1 ♂ (CUP CT84/256 [S+A]), Aravan, Čarvak, 20 August 1984, leg. J. Červený & I. Horáček; – 4 ♂♂, 5 ♀♀, 2 inds. (CUP CT84/293, CT84/297, CT84/301, CT84/304–306, CT84/308, CT84/309, CT84/312 [S+A], CT84/302, CT84/311 [A]), Aravan, Sasyk Ungur Cave, 24 August 1984, leg. J. Červený & I. Horáček; – 2 ♀♀ (NMP 58321, 58322 [S+A]), Aravan, Sasyk Ungur Cave, 11 July 1988, leg. J. Červený, A. Červená & J. Obuch; – 1 ♀ (CUP CT89/034 [S+A]), Aravan, Sasyk Ungur Cave, 8 June 1989, leg. J. Hošek, I. Horáček & J. Mlíkovský; – 3 ♀♀ (CUP CT84/171–173 [S+A]), Oš, Toâ-Moûn, Ažidar-Ungur, 8 August 1984, leg. J. Červený & I. Horáček. – **Lebanon**: 1 ♀ (BMNH 61.407 [S+B]), Faraya, Natural Bridge, 29 July 1960, leg. R. E. Lewis; – 2 ♀♀ (AUB M075, M078 [S+B]), Faraya, Natural Bridge, 25 September 1960, leg. R. E. Lewis; – 1 ♂, 2 ♀♀ (AUB M665, M666 [S+A], M079 [S+B]), Faraya, Natural Bridge, 31 May 1961, leg. R. E. Lewis; – 2 ♂♂ (AUB M667/1–2 [S+A]), Faraya, Natural Bridge, 25 May 1962, leg. R. E. Lewis. – **Libya**: 1 ♂, 1 ♀ (NMP 49928, 49929 [S+A]), Sidi Mohammad Al Mablehut, 22 May 2002, leg. M. Andreas, P. Benda, V. Hanák, A. Reiter & M. Uhrin; – 2 ♂♂, 6 ♀♀ (NMW 30159–30166 [S+B]), Wadi Al Kuf, 9 August 1981, leg. A. Mayer, F. Spitzenberger & E. Weiß; – 1 ♂ (NMW 30167 [S+B]), Wadi Al Kuf, 18 August 1981, leg. A. Mayer, F. Spitzenberger & E. Weiß; – 1 ♂, 1 ♀ (NMW 30168, 30169 [S+B]), Wadi Al Kuf, 22 August 1981, leg. A. Mayer, F. Spitzenberger & E. Weiß; – 2 ♂♂, 1 ♀ (NMP 49912, 49914 [S+A]), Wadi Al Kuf, 20 May 2002, leg. M. Andreas, P. Benda, V. Hanák, A. Reiter & M. Uhrin; – 1 ♂ (NMP 49881 [S+A]), Wadi Darnah, 15 May 2002, leg. M. Andreas, P. Benda, V. Hanák, A. Reiter & M. Uhrin; – 2 ♂♂ (NMW 30157, 30158 [S+B]), Wadi Jarjaroma, 6 August 1981, leg. A. Mayer, F. Spitzenberger & E. Weiß. – **Macedonia**: 1 ♀ (HMNH 2000.46.1. [S+B]), Demir Kapija, 28 September 1975, leg. G. Topál. – **Morocco**: 3 ♂♂, 1 ♀ (BMNH 63.1581.–63.1584. [S]), Figuig, date unlisted, leg. E. D. W. Johnson; – 2 ♂♂, 1 ♀ (NMP 94454–94456 [S+A]), Gorges du Dades, 24 April 2008, leg. P. Benda, J. Červený, A. Konečný & P. Vallo; – 1 ♂ (NMP 90078 [S+A]), Tamtattouchte, 3 November 2003, leg. P. Benda. – **Portugal**: 1 ♂ (MSNG 45091 [A]), Cintra, 1906, collector unlisted. – **Spain**: 1 ♀ (MHNG 1013.37 [S+A]), Cordoba, October–November 1962, leg. P. Lora; – 1 ♂ (MHNG 975.89 [S+B]), Espagne, date unlisted, leg. V. Aellen. – **Switzerland**: 1 ♂ (MHNG 949.7 [S+B]), Col de Bretolet, Val d'Illiez, 27 August 1958, leg. F. Vuilleumier; – 1 ♂ (MHNG 1044.12 [S]), Col de Bretolet, Val d'Illiez, 19 September 1963, leg. A. Meylan; – 1 ♂ (MHNG 1044.13 [S+B]), Col de Bretolet, Val d'Illiez, 22 September 1963, leg. A. Meylan. – **Syria**: 1 ind. (ISEZ M/11781, M/11782 [S]), Kisret Mhamadali, 28 June 1998, leg. A. Shehab. – **Turkey**: 1 ♀ (NMW 37260 [S+B]), Bergama, 5 August 1986, leg. F. Spitzenberger; – 4 ♀♀ (ZFMK 64.699–64.702 [S+B]), Birecik, 26 May 1964, leg. H. Kumerloeve; – 1 ♀ (ZFMK 72.141 [S+B]), Birecik, 11 May 1972, leg. U. Hirsch; – 4 ♀♀ (NMW 20626, 20628, 20629 [S+B], 20627 [S+A]), Göreme, 20 July 1975, leg F. Spitzenberger; – 1 ♀ (NMW 20620 [S+B]), Sarihan at Nevsehir, 17 July 1975, leg. F. Spitzenberger; – 2 ♀♀ (NMW 20618, 20619 [S+B]), Zelve, 16 July 1975, leg. F. Spitzenberger; – 5 ♀♀ (NMW 20622, 20623, 20625 [S+B], 20621, 20624 [S+A]), Zelve, 19 July 1975; leg. F. Spitzenberger.

Nyctinomus aegyptiacus Geoffroy, 1818

Algeria: 1 ♂ (BMNH 66.4081 [S]), Beni Abbes, date unlisted, leg. E. D. W. Johnson. – **Egypt**: 2 inds. (BMNH 3.6.3.3., 3.6.3.4. [S+B]), Abu Roach, 31 Mach 1903, leg. Capt. S. S. Flower; – 5 ♂♂ (NMP 91995–91999 [S+B]), Bir Kohila, Qattar Mts., 30 May 1984, leg. D. Osborn; – 1 ♂ (NMP 92001 [S+B]), Bir Nagat, Qattar Mts., 2 June 1984, leg. D. Osborn; – 1 ind. (MNHN 1986-1084 [S+B]; type specimen of *Nyctinomus aegyptiacus* Geoffroy, 1818), Egypte, date and collector unlisted. – **Morocco**: 1 ♂ (NMP 90065 [S+A]), Anagam, Oued Drâa, 31 August 2003, leg. P. Benda. – **Pakistan**: 1 ♂, 1 ♀ (BMNH 15.11.1.50., 15.11.1.51. [S+B]; type series of *Tadarida sindica* Wroughton, 1919), Kashmor, Sind, 6 March

1915, leg. S. H. Prater. – **South Sudan**: 2 ♂♂ (NMW 8406 [A], 8407 [S+A]; type series of *Nyctinomus tongaënsis* von Wettstein, 1916), Tonga am Weißen Nil, 16 April 1916, leg. O. Wettstein. – **Yemen**: 2 ♂♂ (NMP pb3603, pb3604 [S+A]), Kadamat Al Abali, 24 October 2007, leg. P. Benda & A. Reiter; – 2 ♀♀ (BMNH 54.1018, 54.1019 [S+B]), Thukmein, Hadramaut, 13 May 1953, leg. G. Popov.

Nyctinomus thomasi **(Wroughton, 1919)**

India: 2 ♂♂, 2 ♀♀ (BMNH 12.10.4.30.–12.10.4.33. [S+B]; type series of *Tadarida thomasi* Wroughton, 1919), Bhuj, Cutch, 25 September 1911, purch. Bombay Natural History Society; – 1 ♂ (MHNG 1703.043 [S+A]), Jami Masjid, Mandu, Madya Pradesh, February 1961, leg. A. Brosset; – 2 ♂♂, 3 ♀♀ (BMNH 19.6.3.20.–19.6.3.25. [S+B]; type series of *Tadarida gossei* Wroughton, 1919), Sasson Hospital, Poona, India, 13 March – 1 April 1918, leg. Capt. P. H. Gosse. – **Oman**: 3 ♀♀ (NMP 92737, 92738 [S+A], 92739 [A]), Ain Tabruq, 28 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 4 ♂♂, 7 ♀♀ (NMP 92668–92677 [S+A], 92678 [A]), Al Nakhar, 22 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♀ (NMP 92656 [S+A]), Dhahir Al Fawaris, 21 October 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 3 ♂♂, 3 ♀♀ (NMP 93762, 93764–93766 [S+A], 93763, 93767 [A]), Ghab, Wadi Al Hawasina, 7 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 3 ♀♀ (NMP 92775, 92777 [S+A], 92776 [A]), Muqal, 1 November 2009, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂ (NMP 93795 [S+A]), Rawdah, 10 April 2011, leg. P. Benda, A. Reiter & M. Uhrin; – 1 ♂, 3 ♀♀ (NMP 92631 [S+A], 92632–92634 [A]), Wadi Bani Awf, 18 October 2009, leg. P. Benda, A. Reiter & M. Uhrin. – **Yemen**: 2 ♂♂, 1 ♀ (NMP pb3106–3108 [S+A]), Hammam Ali, 27 October 2005, leg. P. Benda; – 4 ♂♂, 6 ♀♀ (NMP pb2982–2984, pb2986–2990 [S+A], pb2985, pb2991 [A]), Hauf, 12 October 2005, leg. P. Benda; – 2 ♂♂ (NMP pb2992, 2993 [S+A]), Hauf, 13 October 2005, leg. P. Benda; – 1 ♂, 3 ♀♀ (NMP pb3133–3136 [S+A]), Jebel Bura, 30 October 2005, leg. P. Benda.