Vespertilio 8: 99–104, 2004
ISSN 1213-6123

Distribution of bats in and around Jaisalmer of the Great Indian Desert, India

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Abstract. A recent survey conducted to explore present status of bats in and around Jaisalmer of Great Indian Desert (The Thar), India revealed that this region had seen remarkable change with respect to number of chiropteran species reported four decades back. Out of three microchiropteran species (*Rhinopoma microphyllum*, *Rhinopoma hardwickii* and *Taphozous perforatus*) reported from the region during the early sixties of twentieth century, *Taphozous perforatus* had been vanished while one new species (*Taphozous nudiventris*) has occupied the various sites of the region in due course of time.

Chiropterans, demographic changes, Jaisalmer, Thar Desert

Introduction

The Thar is one of the smallest desert of the world. It occupies nearly 9% of India's total geographical area and covers more than 804,000 sq. km., which extends into the Pakistan. Nearly 62% of Thar desert is located in twelve districts of Western-Rajasthan and parts of Kutch (Rahmani 1997). It lies between 25° to 30° N latitude and 69.5° to 76° E longitudes. A major portion of the Thar desert is occupied either by dry open lands or smalls patches of grasslands interspersed with trees and thorny bushes (Gupta 1975). Topographically, at certain places, it has low hillocks, with surface covered with sand-dunes and well-rounded quartz grains, hornblende, feldspar and foraminiferous shells (Shankarnarayan 1988). The rainfall is low and erratic with ninety percent of rains during the monsoon season, from July to September. Heat during the summer is quite intense (Prakash 1981).

Out of 114 species of bats (17 megabats and 97 microbats) reported from India, one of the smallest desert of the world, the Thar has been found blessed with the eleven microbats, viz., *Rhinopoma microphyllum*, *Rhinopoma hardwickii*, *Taphozous perforatus*, *Taphozous nudiventris*, *Rhinolophus lepidus*, *Scotophilus heathii*, *Pipistrellus mimus* (*tenuis*), *Megaderma lyra*, *Hipposideros fulvus*, *Tadarida aegyptiaca* and *Pipistrellus dormeri*, and three mega-chiropteran species viz., *Pteropus giganteus*, *Cynopterus sphinx* and *Rousettus leschenaulti* in its recent past (Chakravarthy & Girish 2003, Prakash 1963, Sinha 1979, Gaur 1981).

Surprisingly out these 114 species bat in India, one the major component of the Great Indian Desert, the Jaisalmer (26° 54' 47" N, 70° 54' 52" E) were known to have only three microchiropterans (*Rhinopoma microphyllum*, *Rhinopoma hardwickii* and *Taphozous perforatus*) in the early sixties of twentieth century (Prakash 1963). All three microchiropteran species were reported from the premises of sonar fort. *Rhinopoma hardwickii* was observed in four unattended rooms of a building while *Rhinopoma microphyllum* were found inhabited in two other rooms of the same; the later was not a numerous as the former. In two other rooms of another building, specimens of *Taphozous perforatus* were found (Prakash 1963). After sixties till mid of 2001 no

work has been carried out to know the distribution and ecology of the bats of this region. In these four decades, this arid region of Thar Desert has seen tremendous change in its eco-biogeography. Rapid increase in human population, introduction of Indira Gandhi Nahar in the district of Jaisalmer, implementation of advanced technology to enhance agricultural production, massive growth in construction of new buildings, renovation of historical monuments and urbanization are the reasons which leads the inhospitable changes in distribution and availability of the bat species in this area. Thus this work has undertaken to find out the present position of bats in this region of the Great Indian Desert.

Material and methods

We have undertaken an intensive survey from October 2001 – September 2003 to locate the chiropteran roosts in and around Jaisalmer with the circumference of 20 km radius. Specimens were collected from the different roosting sites and preserved in seventy percent alcohol and identified on the basis of the key of Bates and Harrison (1997). The identification were further confirmed at Conservation Assessment and Management Plan Workshop for South Asian Chiropteran, held at Madurai Kamaraj University, Madurai in the month of February 2002. Information about the various bat roost was collected from the local people and a bat detector is used to locate the small roosts. We used a Global Position System (GPS) to assess the global position of the roosting sites. Microclimatic parameters were also recorded following standard techniques. We used a Digital Minimum-Maximum Thermo-hygrometer temperature and relative humidity and used a Digital Lux Meter for the light intensity. Population dynamics of bat roosts were studied by Visual Emergence Count (Easterla & Watkins 1970, Humphrey & Cope 1976, Swift 1980) and Capture-Mark-Recapture method (Kunz 1988) but Photographic Count (Thomas & LaVal 1988), Surface Area Estimate (Dwyer 1966) and Direct Roost Count method (Thomas et al. 1979) were also used in some cases.

Results and Discussion

Our study has revealed that a new species of Microchiroptera, *Taphozous nudiventris*, has been introduced here in due course of time while one species reported earlier viz., *Taphozous perforatus* was not found during this survey. Yet to be non-megachiropteran species was recorded here. Total eight microchiropteran roots were explored during this survey (Fig. 1) of which five namely, Patawa Haveli, Amar Sagar garden, Shri Adinath Jain temple, Gajroop Sagar tunnel, Public Well, Gajroop Sagar are the roosts which were reported for the first time from this area. The detailed account of every roosting site of chiropterans explored during this survey from in and around Jaisalmer is provided below.

(1) Annapurana Bhandar, Sonar Fort (26° 54' 45" N, 70° 54' 58" E). It is one of the ruined and unattended buildings of the Sonar fort, which is a noteworthy historical tourist place of Jaisalmer. It harbours two microchiropteran species namely Greater Mouse-tailed bat, *Rhinopoma hardwickii* and Naked-rumped Tomb bat, *Taphozous nudiventris*. Basically it is a triple storey building meant to store food grains for the soldiers and other workers of the king ruled Jaisalmer. Since long back it has been unattended and not being repaired, as a result of which it has become a permanent roost for the microchiropterans. Both the species observed roosted separately. Ground and first floor of the building was found dominated by a colony of Lesser Mouse-tailed bat, *Rhinopoma hardwickii* consisting of around 200 individuals while wooden ceiling of the second floor was occupied with around 400 individuals of the Naked-rumped Tomb bat, *Taphozous nudiventris*. Preferably, *Rhinopoma hardwickii* were found to roosted in the corners and fore walls of the building while *Taphozous nudiventris* roosted in between the mini gaps and linings of the wooden ceiling of this building. Copulation was observed in both the species, during the month of March and April followed by parturition in July and August.

(2) Raj Mahal Palace, Sonar Fort (26° 54' 51" N, 70° 54' 48" E). It is the prime attraction for the visitors who come here form India and abroad. In fact it is a triple storey historical building built to use as administrative block at the time of king ruled Jaisalmer. Currently it is being used to run a museum consisted of varieties of tools and goods that were used by the royal family and soldiers of king ruled Jaisalmer. Of course it used

to be quite busy throughout the day but three unattained rooms of this building serve as one of the habitat for the microchiropteran bats. Although it is about 70 ft from the Annapurana Bhandar but instead of the two it was found inhabited with the individuals of three species viz., Greater Mouse-tailed bat, *Rhinopoma microphyllum kinneari* (around 150 individuals), Lesser Mouse-tailed bat, *Rhinopoma hardwickii* (around 20 individuals) and Naked-rumped Tomb bat, *Taphozous nudiventris* (4 individuals).

(3) Rani Mahal Palace, Sonar fort (26° 54' 42" N & 70° 54' 50" E). It is the building of the fort that was used as the residence of woman folk of the royal family. Basically it is a triple storey building consisting of many small rooms and three big galleries. Out of these, five unattended dark rooms and one gallery were found occupied with a colony of Lesser Mouse-tailed bat, *Rhinopoma hardwickii* consisting of around 500 individuals.

Recently, during July 2003 we have also observed here a maternity colony, consisted of about 50 individuals, of *Rhinopoma microphyllum kinneari*. They were roosted in a separate unattended section (one of the staircase corridor of Rani Mahal) of this building.

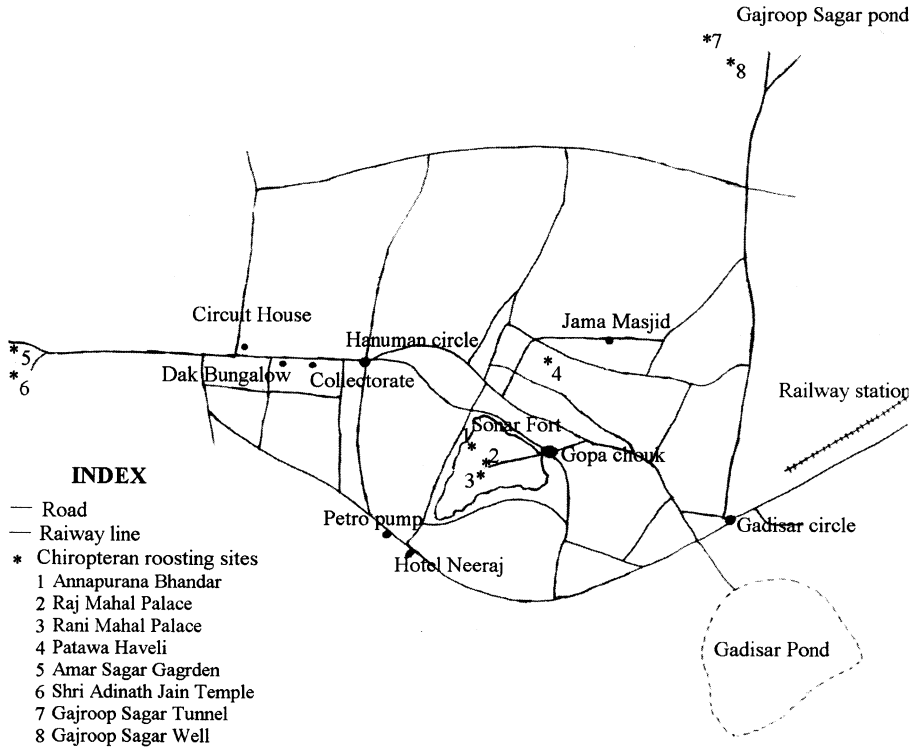

Fig. 1. Map showing the various chiropteran roosting sites in and around Jaisalmer of the Great Indian Desert.
Obr. 1. Mapka ukazující úkryty netopýrů v Jaisalmeru a okolí, Velká Indická poušť.

Recently this building was under resurrection and the administrative staff has tried many to remove these bats but, significantly, they don't evacuate the roost. They were shifted to the other rooms of the building during repair works and re-occupied the original place soon after its completion. But now the authority of the fort is trying to get rid of these bats at any cost from this building. They are of the opinion that although these bats are not doing any harm to them but visitors get frightens by seeing them. Thus they can't afford to leave them inside this building.

(4) Patawa Haveli (26° 54' 58" N, 70° 54' 54" E). Patawa Haveli is another visiting spot of the Jaisalmer city. It is a huge multistorey building consisting five sections. All these sections are unique example of engraving art. This building was the private property of Patawa family of ancient Jaisalmer, but three of its sections are undertaken by the Rajasthan Tourism Department, Govt. of Rajasthan while other two are still with them and being used as the residence. Out of those three, two are open for the visitors while third one is completely ruined and closed from the cautionary point of view. Ceiling and fore walls of few rooms of ground and first floor of both the prior sections were occupied with scattered individuals of *Rhinopoma hardwickii* (around 100 individuals) while all the rooms of the third section was found densely populated (around 1500 individuals) with the same species. These bats would likely to face habitat threat because recently the State Government has sanctioned a major grant to renovate the all these three sections.

(5) Amar Sagar Garden, Amar Sagar Village (26° 55' 55" N, 70° 52' 17" E). Amar Sagar is a village of Jaisalmer district situated 10 km away from the city. At one of the edge of this village, a half-hectare land is maintained for the garden and is owned by the Royal family of the village. Beside one of its fore walls a big water reservoir (Village pond) is there and just aside with that wall it has a ruined building. One of its compartments at the ground floor of this building was found occupied with a colony of Naked-rumped tomb bat, *Taphozous nudiventris* comprising of around 70 individuals.

(6) Shri Adinath Jain Temple, Amar Sagar Village (26° 55' 45" N, 70° 52' 18" E). Shri Adinath Jain Temple, popularly known, as Jain Temple, is an attractive historical monument situated in Amar Sagar village, about 400 meter far from the Amar Sagar Garden. One of its semi underground portions was seen partially occupied with a mix colony of microchiropteran bats viz., *Rhinopoma hardwickii* and *Taphozous nudiventris*. Although their numbers were confined in the range of hundred but their permanent roost in the premises of this temple is biologically significant. Moreover an unattained room attached to the boundary wall of the temple was found inhabited by a colony of *Rhinopoma hardwickii* consisted of approximately 300 individuals.

(7) Gajroop Sagar Tunnel, Gajroop Sagar Village (26° 56' 50" N, 70° 55' 44" E). Gajroop Sagar is another village lying in the close proximity of the Jaisalmer city. It has a big water reservoir, which is well known as the Gajroop Sagar Pond. A line of hillocks surrounds one of the sides of this pond and has a manmade tunnel to drain water from outside to the pond. The ceiling of this tunnel was seen profusely colonized by the Lesser Mouse-tailed bat, *Rhinopoma hardwickii* (Around 2000 individuals). Structurally it is 165 feet long, 4 feet wide and 8 feet high tunnel having two openings. Significantly, during the month of February 2003 we have also observed about 50 individuals of Greater mouse-tailed bat, *Rhinopoma microphyllum kinneari* inhabited in the same tunnel along with the Lesser mouse-tailed bat, *Rhinopoma hardwickii*.

(8) Gajroop Sagar Well, Gajroop Sagar Village (26° 56' 41" N, 70° 55' 54" E). An unattended well, lying in between the pond and Filter Station of the Gajroop Sagar village, is serving as temporary roost for the microchiropterans of this region. During the winter it used to be occupied with the mix colony of *Rhinopoma microphyllum kinneari* and *Rhinopoma hardwickii* while by the end of February when atmospheric temperature increase they vacate it.

By summarizing the above text we can say that Jaisalmer, one of the biodiversity hotspot of Great Indian Desert, is not bestowed with the chiropteran species. It lags far behind than Jodhpur (the entrance gate of Great Indian Desert) in terms of number of bat species. On one side where Jodhpur is known to have seven microchiropteran (*Rhinopoma microphyllum kinneari*, *Rhinopoma hardwickii*, *Taphozous perforatus*, *Taphozous nudiventris*, *Scotophillus heathii*, *Rhinolophus*

lepidus and *Pipistrellus tenuis*) and one Megachiroptera (*Pteropus giganteus giganteus*) Jaisalmer has only three microchiropteran species viz., *Rhinopoma hardwickii*, *Rhinopoma microphyllum kinneari* and *Taphozous nudiventris* (Purohit & Senacha 2002).

Surprisingly it has added one new species (*Taphozous nudiventris*) in last four decades with the loss of *Taphozous perforatus*. If we analyze this status with that of Jodhpur we will find that the Microchiropteran species of the Great Indian Desert are declining very fast. By last four decades Jodhpur too has lost three microchiropteran species viz., *Megaderma lyra lyra*, *Hipposideros fulvus* and *Tadarida aegyptiaca* (Purohit & Senacha 2002). Moreover both the regions had seen a terrific change in their chiropteran roosts. Five new microchiropteran roosts were located from Jaialmer while Jodhpur has seen broad scale change in this regard and added one megachiropteran and ten microchiropteran roosts with the loss of more than five microchiropteran roosts. Interestingly Jodhpur is dominated with the *Rhinopoma microphyllum kinneari* whereas *Rhinopoma hardwickii* dominates the Jaisalmer (Purohit & Senacha 2002)

Conservation Status

All three microchiropteran species found in this region (*Rhinopoma hardwickii*, *Rhinopoma microphyllum kinneari* and *Taphozous nudiventris*) are the least concern status species in South Asia (Molur et al. 2002). But, if we talk over the conservation status of these microchiropterans in and around Jaisalmer of Great Indian Desert, most of the existing bat roosts would face severe threat in the near future because, out of eight existing roosts, two are under resuscitation (Raj Mahal Palace and Rani Mahal Palace) while two other (Annapurana Bhandar and Patwa Haveli) are supposed to be resurrect very soon. If so they will face the most adverse condition to search new safer roosting sites. One other roost (Gajroop Sagar Tunnel) known to be almost safe for *Rhinopoma hardwickii* might face the threat with wild growth of *Prosopis juliflora* at both the openings of the tunnel.

Overall it seems that roosting sites of all these three species are not safe so far as their threats are concern. Thus, it is obvious to recommend here that a major conservation strategy should be implemented in the region to ensure the bright future of chiropteran biodiversity. Preferably the efforts should be made to have healthy talks with the administration authorities of fort, havelies and temples. Moreover people and youngsters of the region should be educated with regards to the significance and conservation benefits of bats.

Souhrn

Rozšíření netopýrů v Jaisalmeru a okolí, Velká Indická poušť, Indie. Výzkum provedený pro stanovení současného stavu netopýrů v Jaisalmeru a okolí, ve Velké Indické poušti, tzv. Tharu, v Indii, potvrdil, že tento region prošel změnami, které postihly počet druhů letounů oproti stavu známému před čtyřiceti lety. Mimo tři druhy netopýrů (Microchiroptera): *Rhinopoma microphyllum*, *Rhinopoma hardwickii* a *Taphozous perforatus*, které byly nalezeny v této oblasti již na počátku 60. let 20. století, *Taphozous perforatus* nebyl nalezen, zatímco nově byl na řadě míst nalezen *Taphozous nudiventris*.

Acknowledgements

We are extremely thankful to the Department of Science and Technology, New Delhi for providing financial grant through the Project No. SP/SO/C-28/99 for this study. We are also grateful to the management of the wildlife officials of the city for granting permission to conduct the study and Additional Director, ZSI, Jodhpur for providing GPS Unit. We are also thankful to Mr. Vijay Krishna Vantipalli, Mr. Keshav Bihari Vyas and Mr. Amit Sharma of our department for providing valuable help during the study.

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received 9. 4. 2004