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Coexistence Patterns among *Chiroptera* Species in their Roosting Habitats in the Indian Desert

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Abstract

Seven types of coexistence patterns among eight species of bats inhabiting the Indian desert, showed that minimum two and maximum seven species of bats compose mixed colonies at the same roosting habitat. Two rhinopomatids, *Rhinopoma microphyllum kinneari* and *R. h. hardwickei*, recorded their share in all, but one inter-specific association, followed by the emballonurid, *Taphozous k. kachhensis*, which occured in five such associations. Presence of the Indian false vampire, *Megaderma l. lyra*, had an adverse effect on relative occurences of *R. m. kinneari*. Peculiar coexistence of the fruit bat, *Rousettus l. leschenaulti*, and insectivorous bat, *R. m. kinneari*, is reported for the first time from this region. Patterns of coexistence are discussed in the light of various morphobiological adaptations of bats.

Introduction

Order *Chiroptera*, comprising two suborders, seven families and sixteen species, form a conspicuous part of the mammalian fauna of the Indian desert (24.5–30.5° N; 60–70° E). Inspite of the occurence of bats in abundance with respect to both in numbers and species represented, except few mentionable investigations (ADVANI 1981 a, b, c; ADVANI and VAZIRANI 1981; SINHA and ADVANI 1976), insufficient information is available on ecological, biological and behavioural aspects of this dominant mammalian group. Present communication deals with the field observations on interspecific associations among various species of bats in their roosting habitats.

Material and Methods

Bats were collected during various faunistic surveys conducted by the Desert Regional Station, Zoological Survey of India and Central Arid Zone Research Institute, Jodhpur from 1975 to 1977. To work out species composition and relative per cent occurences, populations of bats were sampled through removal method (ADVANI 1981 a) at several habitats in the districts of Jodhpur, Boondi, Dungarpur, Sirohi and Jhalawar, wherever mixed populations of bats comprising two or more species were found to roost together.

After killing bats with chloroform, they were identified after BROSSET (1962 a, b, c) and later preserved in 90 per cent alcohol and registered in records of D.R.S., Z.S.I., Jodhpur.

Results and Discussion

Among sixteen species (3 fruit eating, 13 insectivorous) of bats collected, eight species (50 per cent) were found to exist in exclusive colonies, not sharing their roost with any other species. These included all the four vespertilionid species:

Table 1. Variations in interspecific associations and relative abundance of bats in Rajasthan

Type and locality		species composition and relative abundance							
		R. m. k.[1]	*R. h.*[2]	*T. k.*[3]	*T. p.*[4]	*M. l. l.*[5]	*H. f. p.*[6]	*R. l. l.*[7]	*R. leschenaulti*
I	Mand-ore, Jodhpur (26°20′ N; 73°3′ E)	89.5	1.3	4.3	2.7	—	2.2	—	—
II	Bhimbarak, Jodhpur (26°19′ N; 73°0′ E)	79.1	1.1	19.8	—	—	—	—	—
III	Taragarh Fort, Boondi (25°28′ N; 75°40′ E)	68.3	9.5	22.2	—	—	—	—	—
IV	Jhalarpatan, Jhalawar (24°40′ N; 76°18′ E)	56.6	12.0	10.1	2.5	16.3	2.0	0.5	—
V	Old temple, Sirohi (24°55′ N; 72°55′ E)	41.6	3.3	25.0	2.2	25.0	1.4	1.5	—
VI	Gagron Fort, Jhalawar (24°38′ N; 76°18′ E)	17.5	—	—	—	—	—	—	82.5
VII	Old Palace, Dungarpur (23°50′ N; 73°45′ E)	—	4.4	—	4.4	90.2	—	—	—

[1] *Rhinopoma microphyllum kinneari;* [2] *Rhinopoma hardwickei;* [3] *Taphozous kachhensis;* [4] *Taphozous perforatus;* [5] *Megaderma lyra lyra;* [6] *Hipposideros fulvus pallidus;* [7] *Rousettus leschenaulti leschenaulti*

Desert Scotophilus, *Scotophilus h. heathi;* Yellow bat, *S. temmincki wroughtoni;* Dormer's bat, *Pipistrellus dormeri;* Indian pygmy pipistrelle, *P. mimus;* one emballonurid, Oriental bat, *Taphozous longimanus;* one molossid, Egyptian free-tailed bat, *Tadarida aegyptiaca thomasi,* and two fruit eating bats, Indian flying fox, *Pteropus g. giganteus,* and Short-nosed fruit bat, *Cynopterus s. sphinx.* Remaining eight species (one fruit eating, seven insectivorous) occured in association with each other in various combinations and relative abundances. These associations were made up of minimum two and maximum of seven bat species (Table 1).

Seven types of coexistence patterns were exhibited by bats. Except one (Type VII), the Rat-tailed bat, *Rhinopoma microphyllum kinneari,* and Small mouse-tailed bat, *R. h. hardwickei,* were present in rest of the six association patterns. This is perhaps due to their occurence in relative highest numbers (40.35%) combinely (ADVANI 1981 a) and secondly, their better eco-physiological adaptations to arid environment, as deposition of fat (SINHA 1976 a) which is used as insulator as well as reserve food matter in extreme winter of desert. Following rhinopomatid species, Kutch-sheath-tailed bat, *Taphozous k. kachhensis,* occured in five types of associations. This species also forms a major part (15.9%) of the bat fauna of the Indian desert (ADVANI 1981 a) and deposits fat during winter season (SINHA 1976 b).

Seven types of bat associations recognised were:

Type I. It was dominated by *R. m. kinneari* which constituted about 90 per cent of the mixed populations. Four bat species coexisted in low relative densities.

Type II. With slight reduction in preponderance of *R. m. kinneari,* this type of habitat in a natural cave (3 kilometres long) at Jodhpur was codominated by *T. kachhensis* which shared about one-fifth of the total bat populations. BROSSET (1962 a) also found mixed populations of both of these species in Tuglakabad (New Delhi), though their relative densities were not mentioned.

Type III. In an abandoned big fort at Boondi (in the forested rocky habitat), three bat species were found to coexist in the pattern, very identical to Type II. However, relative occurence of *R. hardwickei* and *T. kachhensis* were relatively more, whereas, that of *R. m. kinneari* reduced further. Similarly, BROSSET (1962 a) found populations of *R. m. kinneari* and *R. hardwickei* roosting together in almost all localities in Orcha, Sanchi, Agra and Delhi in Central India.

Type IV. Maximum number of species, seven, having diversified feeding and other biological features and belonging to four different families of bats, were collected from an abandoned fort at Jhalarpatan in the Jhalawar district, having maximum mean annual rainfall (1100 mm) in the Rajasthan State.

The Indian false Vampire, *Megaderma l. lyra,* featured in moderate numbers, which was perhaps a main reason for reduction in relative numbers of *R. m. kinneari* populations, upon which *M. lyra* is known to predate besides other vertebrates (ADVANI 1981 b). BROSSET (1962 b) found rhinolophid bats (*Hipposideros fulvus pallidus, Hipposideros speoris, Rhinolophus* sp.) along with *M. lyra* in Elephanta caves (Bombay) and at Pattadkal (Karnataka) in Western India as also observed during present investigations.

Type V. With slight deviation from that of Type IV, relative densities of *R. m. kinneari* further declined perhaps in concurrence within increase in predation pressure of *M. lyra.* Coexistence of *T. kachhensis* along with false vampires in equal proportions may be due to former's relatively heavier bodies and stronger dentition. However, at Aurangabad (Central India), BROSSET (1962 b) observed no other bat species in the huge colonies of *M. lyra.*

Type VI. A peculiar example of coexistence of only two species, the Fulvous-fruit bat, *Rousettus leschenaulti*, and *R. m. kinneari* was witnessed at a height of about 300 metres in an old fort surrounded by thick thorny forest at Jhalawar. Coexistence of both species is explainable on the grounds of distinct feeding habits of *R. m. kinneari* which thrives upon insects only (ADVANI 1981 c) whereas, *R. leschenaulti* is a strictly fruit eating bat (ADVANI 1981 d), thereby lessening the chances of any competition for food in nature with *R. m. kinneari*.

Type VII. The only mixed populations of bats was predominated by *M. lyra* (90.2%), the feeding habits and aggressiveness of which is a primary factor for total disappearance of *R. m. kinneari*.

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Zusammenfassung

7 Typen gemeinsamer Tagesschlafplätze von 8 Chiropterenarten der Indischen Wüste zeigen, daß minimal 2 und maximal 7 Arten gemischte Tagesschlafgesellschaften bilden.

Eine Unterart der Ägyptischen Klappnase, *Rhinopoma microphyllum kinneari*, und die Hardwicke-Klappnase, *Rhinopoma h. hardwickei* (Fam. *Rhinopomatidae*), waren zusammen oder einzeln an allen außer einer interspezifischen Assoziation beteiligt, gefolgt von einer Art der Grabflatterer, *Taphozous k. kachhensis* (Fam. *Emballonuridae*), die in 5 solchen Gesellschaften gefunden wurde.

Wenn die Lyra-Fledermaus, *Megaderma l. lyra*, in einem Quartier vorkam, hatte dies negative Auswirkungen auf die Anzahl der vorhandenen Exemplare von *R. m. kinneari*. Die eigentümliche Vergesellschaftung des fruchtfressenden Flughundes *Rousettus l. leschenaulti* und der insektivoren *R. m. kinneari* wurde erstmalig für diese Region festgestellt.

Die Formen der ermittelten koexistierenden Arten werden unter Berücksichtigung ihrer morphobiologischen Anpasssungen diskutiert.

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