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Seasonal fluctuations in the feeding ecology of the Indian false vampire, Megaderma lyra lyra (Chiroptera: Megadermatidae) in Rajasthan

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Abstract

Investigations were carried out on the seasonal pattern of feeding of the Indian false vampire bat, *Megaderma lyra lyra* Geoffroy, collected from several districts of Rajasthan. The species consumes insects in all seasons, but only Coleoptera in the winter. It also feeds upon a variety of vertebrate animals like amphibia, pisces, reptiles and even active birds. In winter and then summer, in absence of insects in abundance in nature, the diet is mainly composed of vertebrates. The species devours a number of serious polyphagous insect pest species of crops in Rajasthan and thus has a promising role in biological control.

Introduction

The family Megadermatidae is represented by only one species in Rajasthan, the Indian false vampire, *Megaderma lyra lyra* (Prakash, 1963). Among all the 18 species occurring in Rajasthan the false vampire is quite a celebrated species because it has been observed catching and devouring a variety of vertebrate prey besides insects. In this respect it is unique even amongst all the bat species inhabiting the Indian subcontinent. Except some reports (Prakash 1959; Sinha and Advani 1976), relatively little is known about the composition and seasonal fluctuations in the food of this species in nature.

Material and methods

For the purpose of study, during the years 1975 to 1977, various faunistic surveys of Rajasthan State were undertaken and bats were collected from 8 districts namely Jodhpur, Banswara, Dungarpur, Jhalawar, Tonk, Boondi, Ajmer and Kota. Climatologically the study area falls under the arid and semi arid category. In all 150 examples of bats were collected and examined. The sample size during each season is shown in the Table 1. After anaesthesia their alimentary canals were dissected and the parts of insects and other animals were sorted out groupwise. Later these were weighed separately on the physical balance to calculate their respective percentages of total gut contents, following the method adopted by Murton et al. (1964). The observations were pooled among four main seasons occurring in India.

Results

The bats of the species *M. lyra lyra* are essentially carnivorous, thriving upon insects and other animals throughout the year. There were no traces of any vegetation found in the guts. Coleoptera among insects and reptiles (lizards) among vertebrates were consumed during all seasons (Table).

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Winter season

During December, January and February months, the total vertebrate diet was much higher (77.8%) in comparison to that of insects (22.2%). Among insects, beetles constituted 12.2 percent while the unidentified mixed insect parts were 10 percent. Vertebrates were mainly represented by reptiles (the wall lizard, *Hemidactylus flaviviridis)* constituting 30.5% followed by fishes and birds. The unsortable bones, muscles and scales of vertebrates were 20.6%.

Summer season

From March to June, the four months of summer in the hot desert, the ratio of insects and vertebrates in the diet was about equal, 46.7 and 53.3% respectively. The Coleoptera were mainly represented by scarabids, curculionids and carabids, occurring in abundance in Rajasthan. Winged termites (Isoptera) constituted 10 percent. Grasshoppers and crickets (Orthoptera) which are comparatively more abundant during summer months also fared in appreciable amount. In this season also lizards were in higher proportions (18.3%) to other vertebrate groups, followed by birds, fishes and then frogs (amphibia) constituting 10.4, 10.2 and 9.2% respectively of the total diet.

Seasonal fluctuations in the feeding composition of M. lyra lyra in nature

Season and months	Insect diet (%)						Vertebrate diet (%)				
	Iso.	Lepido.	Coleo.	Hymeno.	Ortho.	Misc. (mixed)	Amph.	Fishes	Rep.	Birds	Misc. (mixed)
Winter (Dec.-Feb.) N = 30	–	–	12.2	–	–	10.0	–	15.5	30.5	11.2	20.6
Summer (Mar.–June) N = 35	10.0	–	15.6	0.5	15.0	5.6	9.2	10.2	18.3	10.4	5.2
Monsoon (July-Sept.) N = 45	26.0	10.0	24.6	4.0	3.0	2.4	4.5	–	10.0	2.5	13.0
Post-monsoon (Oct.–Nov.) N = 40	5.0	13.2	14.4	17.8	–	8.7	21.5	10.0	5.5	–	3.9

Rainy (monsoon) season

July, August and September are rainy months in the Rajasthan. During this season insects were consumed more than double times (70%) of the total vertebrates (30%). This coincides with the availability of various insects of various orders during and after rains. Among insects, the proportion of termites and beetles increased to 26 and 24.6% respectively. It was found that this bat species was devouring the adults of white grub, *Holotrichia* sp. which is a serious coleopteran pest of many crops in Rajasthan and adjoining States. The major isopteran species (which are equally harmful to the Indian agriculture) identified from the guts of bats were *Odontotermes obesus, Microtermes obesii* and *Anacanthotermes* sp. In this season again reptiles were preferred to amphibians and birds, though in low proportions.

Post-monsoon season

In October and November months (the flowering season), insects again constituted relatively higher proportions (59.1%) to vertebrates (40.9%). Hymenoptera, mainly represented by swarming wasps and ants constituted highest percentage (17.8) followed by beetles,

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moths and termites. Amongst vertebrates, the proportion of frogs and toads (amphibia) increased abruptly to 21.5%, while the lizards lowered to 5.5% only. Fishes were also fairly represented in the gut contents of bats.

Discussion

Some interesting observations on the food of the Indian false vampire, *M. lyra lyra* have been mentioned previously. Gleadow (1907) observed that the vampires survive upon birds and rodents (mice). Aitken (1907) and Mosse (1931) witnessed the bats eating bird and a lizard respectively. There are also reports of false vampires devouring the minor pipistrel, *Pipistrellus mimus mimus* (Phillip 1922). Prater (1948) reports the species preying upon other small animals as birds, frogs and fishes. In Bombay, Crag Martins (*Hirundo concolor)* and frog legs were found to be regularly included in their diet (Brosset 1962).

During present investigations and surveys, the author also encountered remains of the house sparrows (*Passer domesticus*), a serious avian pest of godowns and millets in Rajasthan, inside the roosting places of bats. On several occasions, partially eaten bodies of other bat species of fairly large sizes like *Rhinopoma microphyllum kinneari, R. hardwickei hardwickei* and *Taphozous perforatus* (which coexist with the vampires in the form of mixed population) were also found in caves etc.

The present studies of gut content analyses also reveal and confirm that besides normal insects diet as of all microchiropteran species of bats, the vampires also prefer and can thrive upon animals like amphibia, reptilia, aves and even pisces. And particularly in winter and summer months (December to May) when the flying insects are relatively less available in nature, the bats bank mostly upon vertebrate diet. While, in monsoon and post monsoon seasons the insect diet composition is nearly two times in the case of former and higher in case of later season to the vertebrate composition. This shows that the *M. lyra lyra* is primarily an insectivorous species but in absence of insects it can shift over or adapt itself to the vertebrate diet also, the feature which is not found in case of other bat species in Rajasthan.

Preference for termites during monsoon and post monsoon months well coincides with their emergence in the form of swarms after first two showers of rains in the desert. The termites are attracted towards the light and ultimately devoured by the bats, hovering on the lamp posts in search of diet. Likewise the swarms of wasps are also easily preyed upon by the vampires.

The occurrence of some prominent polyphagous pest species of crops like termites, adults of white grubs and red hairy caterpillars (Lepidoptera) in the guts of bats, show that this species is playing an important role in managing the population of these harmful insects in the natural ecosystem's food chain. Prakash (1959), observed that these bats in captivity can attack and ultimately devour the rodents (the Indian desert gerbil, *Meriones hurrianae* and common house rat, *Rattus rattus*) of fair large sizes. Thus, the vampires can also play a role in biological control of nocturnal field rodents without inflicting any damage to human population.

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Zusammenfassung

Jahreszeitliche Änderungen in der Futterzusammensetzung der indischen Falschen Vampirfledermaus, Megaderma lyra lyra, in Rajasthan

Untersuchungen über die jahreszeitliche Zusammensetzung der Nahrung der indischen Falschen Vampirfledermaus, *Megaderma lyra lyra,* wurden in verschiedenen Gebieten Rajasthans durchgeführt. Diese Art frißt Insekten zu allen Jahreszeiten, lebt im Winter aber nur von Käfern. Zusätzlich werden verschiedene Vertebraten (Reptilien, Amphibien, Fische und sogar Vögel) erbeutet. Im Winter, und wenn im Sommer Insekten nicht in ausreichender Menge vorhanden sind, besteht die Nahrung vorzugsweise aus Wirbeltieren.

M. lyra lyra frißt eine Reihe von pflanzenpathogenen Insekten. Ihr kommt somit eine bedeutende Rolle in der biologischen Schädlingsbekämpfung zu.

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A survey of gross stomach morphology in Microtinae (Rodentia: Muroidea)

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Abstract

Surveyed the gross stomach morphology of 55 species from 16 genera of Microtinae (Rodentia, Muroidea). Most species represent North American forms in order to complement Vorontsov's coverage of Old World species. Some of the interesting variations in gastric strucutre include: the separation of *Dicrostonyx* from *Synaptomys, Myopus* and *Lemmus*; the contrast between New and Old World *Lagurus*; the similarity of the North American Water Vole to other *Microtus* and its dissimilarity to Old World *Arvicola*; the extensive diversity encountered among specimens of *Clethrionomys gapperi.* In general, data from gastric anatomy is more in accord with a multitribal classification of the Microtinae rather than a dual tribal arrangement. The functional implications of the differences in gastric anatomy are discussed.

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