



Seasonal variations in feeding ecology of *Megaderma lyra* bats in Udaipur region of southern Rajasthan

Dr. Rekha Salvi¹, Dr. Shashi Parmar²

¹ Assistant Professor, Department of Zoology, Seth Mathuradas Binani Government P.G. College, Nathdwara, Rajasthan, India

² Department of Zoology, Shree Bhogilal Pandya Govt. College, Dungarpur, Rajasthan, India

Abstract

The present study investigates the seasonal dietary composition of *Megaderma lyra* in the Udaipur region of southern Rajasthan. Fecal samples were collected weekly from beneath bat roosts over one year (2008–2009) at 12 different sites. Prey remains were identified through morphological analysis of these samples, combined with examining culled parts found beneath feeding roosts. Microphotographs were used to confirm the identification of insect parts from the fecal pellets, with insect prey classified up to the order level based on authenticated literature.

Results indicate that the Indian false vampire bat predominantly feeds on insects from the orders Coleoptera, Orthoptera, and Hemiptera. Analysis of guano revealed undigested insect remains, such as body sclerites, claws, elytra, leg segments, and various other body parts from these orders. In Coleoptera, remains included claws, elytra, tarsal segments, and tibia-tarsi, while Orthoptera remains consisted of legs, wings, and damaged maxillae. Hemiptera fragments included antennal segments. These findings suggest that *Megaderma lyra* exhibits a preference for these insect orders across different seasons in the study area.

Keywords: *Megaderma lyra*, insectivorous bats, feeding, guano

Introduction

Bats serve vital ecological functions by providing key ecosystem services, including seed dispersal, pollination, insect control, and nutrient recycling. As both predators and prey, they help regulate arthropod populations. Economically, bats offer both benefits and drawbacks. They contribute significantly to biological pest control, plant pollination, and seed dispersal. Additionally, bats are valuable in guano mining, bushmeat, traditional medicine, tourism through bat-watching, and scientific research and education.

Microchiropteran bats represent approximately 20% of the world's mammal species (Hutson *et al.*, 2001) [6]. They are widespread on every continent, except Antarctica, and are important components of most ecosystems, ranging from tropical forests to arid shrublands. They fulfill a range of ecological roles. In temperate climates, the most of species are aerial insectivores and also primary predators of nocturnal invertebrates.

The feeding habits of bats as a whole are as varied as that of other mammals, and this dietary variation is proportional to much of the morphological, physiological, and ecological diversity seen in bats (Altringham 1996) [1]. Most of the bats are relatively stereotyped in their feeding ecology. They feed on insects, fish, frogs, or blood and roost in places such as Temple, Caves, Mines, Buildings, and Trees (Bates PJJ, 1997) [3]. Bats have an also functional important role in supporting global ecosystems with their dietary preferences. This is evidenced primarily through the consumption of nocturnal insects and the dispersal of nutrients, pollen, and seeds. Trophic linkages can strongly influence ecosystem functioning and diversity and diet studies within predator communities can supply information on prey types and quality as well as prey overlap among predator species. Local diet studies are especially beneficial for understanding

the roles that prey availability and competition play in trophic status in ecosystems—foraging strategies from the gleaning level to the aerial hawking level of flight. The factors for the flight of bats were well discussed by Fenton *et al.*, (1987) and Norberg & Rayner 1987) [11].

Insectivorous bats use their high-frequency sounds not only to avoid stationary obstacles but also to locate and capture flying insects. Evaluation of this hypothesis requires accurate information about the sizes and sound-reflecting properties of bats' insect prey (Griffin 1953) [5]. These carnivorous bats have many morphological adaptations and acoustic cues that allow them to capture and handle prey. They forage and feed insects throughout their geographic range. Their dietary adaptations are commonly reflected in the skull (feeding apparatus) and wing (flight apparatus) morphology (Jeyaprabha, 2008) [7].

Insectivorous bats also play a significant role in nutrient transfer, by distributing their nitrogen-rich guano widely through the landscape when they defecate in flight, while also concentrating it around roosting sites (Pierson, 1998) [12]. In the neotropics, microchiropterans are also involved in the pollination of plants and the dispersal of seeds.

The purpose of this paper is to summaries information useful for evaluating and quantifying the foraging habits of insectivorous bats. A study on the feeding behavior of *Megaderma lyra* was conducted in the Udaipur region of Southern Rajasthan to observe the seasonal variation in the food preference of *Megaderma lyra*. The present study also provides information of the pest manager behaviour of *M. lyra* in the forest and agroecosystem. The current research also highlights that vampire bats play a key role in bio-resource management and thereby help to conserve biodiversity in the forest and agroecosystem and also in ecosystem equilibrium.

Materials and methods

Surveyed sites

The study was conducted in different locations in the Udaipur region of South Rajasthan during the summer and monsoon winter seasons in November 2007 to February 2008. Study sites were selected based on the distribution of vampire bats. Mostly the bats were observed from the different habitats such as abandoned houses, ruins old houses and many other sites from selected zones of Girva, Kotra, Lasadia, and Salumber regions of the Udaipur region of South Rajasthan (Figure 1).

Requirements

Papers, polythene, Fine needles, a Fine brush, 70 percent alcohol, a Petri dish, and a microscope were used to observe the feeding preference of insectivorous bats in selected seasons.

Sampling and Identification

To study the feeding behaviour of insectivore bates the paper sheets were spread over the selected spots for collecting guano in separate seasons. Fecal pellets were collected for insect prey properly labeled with an indication of location and time of collection and preserved in 70% alcohol for further analysis with the help of a microscope (as per methods of Whitaker. The pellets were soaked in a

Petri dish having 70 percent alcohol, each pellet was searched for the partially digested insect parts such as leg, wings, antenna, and mouth parts and were identified according to their morphological characters. The overall percentage volume of feeding preference according to different body parts and order wise calculated.

Result

After a detailed analysis of the feeding ecology of *Megaderma lyra*, the study indicates that *Megaderma lyra* commonly feeds on various orders of phylum Arthropoda. A total of 3 insect orders were identified from the collected guano: Coleoptera, Orthoptera, and Hemiptera. The collected fecal pellet analysis and the identified insect parts from undigested remains dietary items helped to finalize insect consumption up to order level. Figures represent a sample of identified insect parts from the fecal pellet analysis (Figure 2 A to E). Maximum undigested body parts such as Body sclerite, claw, elytra-remain, leg parts, leg tarsal-claw, tarsal segment, damaged elytra, hind wing, tibia-tarsi, clypeus, maxillae identified from guano of order Coleoptera (68.42 %) and Leg, wing, antennal, damage maxilla from order Orthoptera (21.05 %) and minimum portion from order Hemiptera (10.52 %) of Antennal segments (Table 1, Fig 3).



Fig 1: *Megaderma lyra*

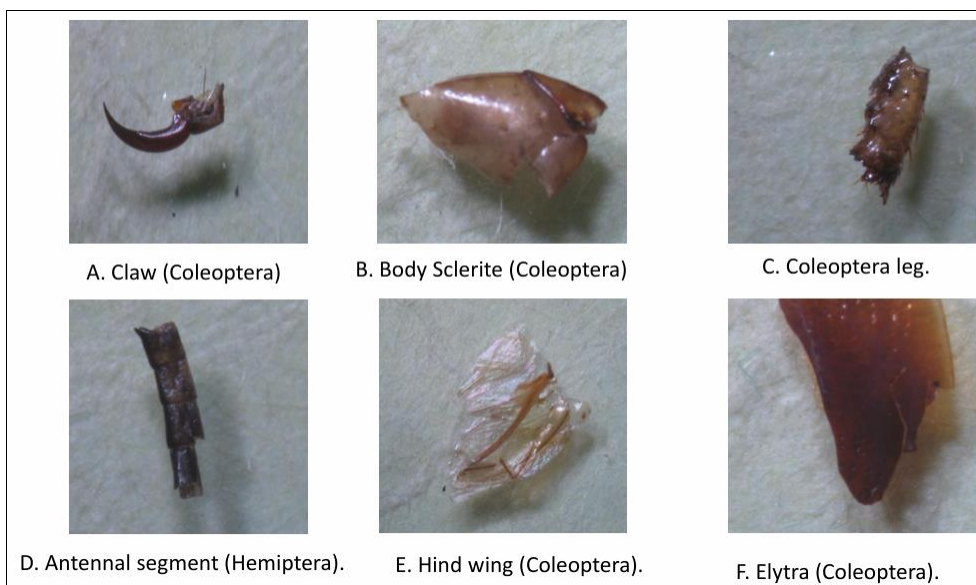


Fig 2: Undigested Insects body part identified from Guano

Table 1: An overall detailed survey of the feeding ecology of *Megaderma lyra*

Latin name	Common name	Location	Part of insect	Insect order	Percentage
<i>Megaderma lyra</i>	Indian false vampire bat	Girva, Kotra, Lasadia, Salumber	Body sclerite, claw, elytra-remain, leg parts, leg tarsal-claw, tarsal segment, damaged elytra, hind wing, tibia-tarsi, clypeus, maxillae	Coleoptera	68.42
			Antennal segments	Hemiptera	10.52
			Leg, wing, antennal, damaged maxilla	Orthoptera	21.05

Analysis of the seasonal survey, the fecal pellets of *Megaderma lyra* had representatives of two insect orders, namely, Coleoptera and Orthoptera during the summer seasons. Coleopterans ranked higher in percentage volume

(66.66%) of remaining undigested parts were Body sclerite, claw, elytra-remain, and leg parts and similarly Orthoptera (33.33%) were Leg, and wing (Table 2).

Table 2: An overall detailed survey of the feeding ecology of *Megaderma lyra* in summer seasons

Latin name	Common name	Location	Part of insect	Insect order	Percentage
<i>Megaderma lyra</i>	Indian false vampire bat	Girva, Kotra, Lasadia, Salumber and 36.36	Body sclerite, claw, elytra-remain, leg parts,	Coleoptera	66.66
			Leg, wing,	Orthoptera	33.33

During Monsoon seasons the fecal pellets of *Megaderma lyra* had representatives of three insect orders Coleoptera, Orthoptera, and Hemiptera. The maximum portion of order Coleoptera (70 %) remains were leg tarsal-claw, tarsal

segment, damaged elytra, hind wing, tibia-tarsi, clypeus, maxillae and Antennal segments of Hemiptera (10 %) and Antennal, damage maxilla of Orthoptera were 20 % (table 3).

Table 3: An overall detailed survey of the feeding ecology of *Megaderma lyra* in Monsoon seasons

Latin name	Common name	Location	Part of insect	Insect order	Percentage
<i>Megaderma lyra</i>	Indian false vampire bat	Girva, Kotra, Lasadia, Salumber and 36.36	leg tarsal-claw, tarsal segment, damaged elytra, hind wing, tibia-tarsi, clypeus, maxillae	Coleoptera	70
			Antennal segments	Hemiptera	10
			Antennal, damage maxilla	Orthoptera	20

Discussion

Megaderma lyra (Indian false vampire bat) belongs to the order Chiroptera, divided into two sub-orders, Megachiroptera and Microchiroptera. Microchiropterans are found throughout the world and comprise 17 diverse families with 169 Genera and 824 Species (Bates PJJ,1997) [3]. Efficient knowledge of food habits and feeding behaviour is required to adaptive the significance of different bat echolocation call types in the environment (Neuweiler 1984) [9, 10].

In the present study, the significance observation provides a clue about the feeding preference of *Megaderma lyra* that they consume mostly coleopterans, orthopteran, and hemipteran groups of insects, which were related to the study (Antony EIP, 1977) The micro chiropterans use high-frequency echolocation as their major locational sense. *Megaderma lyra* is a carnivorous bat that belongs to an ancient family Megadermatidae The main diet of many microchiropteran bats includes coleopterans, lepidopteran, dipteran, orthopteran, and hemipteran groups of insects. All the major dietary items, Coleopteran insects were consumed more by *Megaderma lyra* the pestiferous insects are the major ones causing great damage to forest and agricultural fields and reducing the bioresource (Krishnan NT, 1993) [8]. In the present study coleopterans were the major food sources for *Megaderma lyra* which is also reported by (Balasingh and Ramanujam *et al.*, 2004) [13]. This is not surprising because coleopterans form the largest insect order in the world comprising of one third of all insect species and their hard chitinous exoskeleton passes undigested when compared to the soft-bodied insects. Bates and Harrison

(1997) [3] stated that *M. lyra* is a semi-carnivorous species as it feeds both on insects and vertebrates and hence has a high proportion of prey category which is very obvious in the present study.

Conclusion

The conclusion drawn from the present study clearly explains the role of false vampires as bio-control agents in both forest and agroecosystems. The present investigation of feeding behaviours of *Megaderma lyra* indicates that these insectivorous bats commonly consumed coleopterans, orthopteran, and hemipteran arthropods. Collected guano revealed that body sclerite, claw, elytra-remain, leg parts, leg tarsal-claw, tarsal segment, damaged elytra, hind wing, tibia-tarsi, clypeus, maxillae of order Coleoptera and Antennal segments of Hemiptera and Leg, wing, antennal, damage maxilla from order Orthoptera were remain undigested in bats alimentary canal. The seasonal study also indicates that coleopterans were more consumable than other orders by *Megaderma lyra*.

So meanwhile, Indian false vampire bat conservation should be essential for controlling agricultural pests, aiding forest floral health management, and reducing the usage of pesticides in the agroecosystem.

Acknowledgment

The author sincerely thanks Dr. R. Swaminathan, Professor in the Department of Entomology, Rajasthan College of Agriculture, Udaipur MPUAT for his help in identifying the insect prey part and others.

References

1. Altringham JD. Bats: biology and behaviour. Oxford University Press, 1996.
2. Anthony EIP, Kunz TK. Feeding strategies of little brown bat, *Myotis lucifugus* in Southern New Hampshire. *Ecology*,1977;58:775-786.
3. Bates PJJ, Harrison DL. Bats of Indian Subcontinent. Harrison Zoological Museum publication, Kent, England, 1997.
4. Fenton MB. Flight and echolocation in the ecology and evolution Noseleaf morphology and ecological correlates in phyllostomid bats. *J. Mammal*,1997;71:36-47.
5. Griffin DR. Bat sounds under natural conditions, with evidence for the echolocation of insect prey. *Journal of Experimental Zoology*,1953;123:435-66.
6. Hutson AM, Mickleburgh SP, Racey PA. Microchiropteran bats: global status survey and conservation action plan. Gland, Switzerland and Cambridge, UK: IUCN/SSC Chiroptera Specialist Group, 2001.
7. Jeya Praba. Diversity, morphology and roosting ecology of a few bat species in Kalakad Mundanthurai Tiger Reserve, Southern Western Ghats, Tamil Nadu. PhD thesis, Manonmaniam Sundaranar University, Tirunelveli, 2008.
8. Krishnan NT. Economically important pests. In: Krishnan NT, editor. *Economical entomology*. Madurai: J.J. Publications, 1993, 4-78.
9. Neuweiler G. Food habits of the sympatric insectivorous bats *Rhinolophus rouxi* and *Hipposideros lankadiva* from Sri Lanka. *J Zool*,1984;215:729-37.
10. Neuweiler G. Evolutionary aspects of bat echolocation. *J Comp Physiol A*,1984;189:245-56.
11. Norberg UM, Rayner JMV. Ecology, morphology and flight in bats (Mammalia): wing adaptations, flight performance, foraging strategy, and echolocation. *Philos Trans R Soc Lond B Biol Sci*,1987;316:335-427.
12. Pierson ED. Tall trees, deep holes, and scarred landscapes: conservation biology of North American bats. In: Kunz TH, Racey PA, editors. *Bat biology and conservation*. Washington: Smithsonian Institution Press, 1998, 309-25.
13. Ramanujam ME, Verzhutskii B. The prey of the Greater false vampire bat *M. Iyra E. Geoffroy* at Kaliveli, Tamil Nadu. *Zoos' Print J*,2004;19(10):1655-6.
14. Thomas DW, Bell GP, Fenton MB. Variation in echolocation call frequencies recorded from North American vespertilionid bats: a cautionary note. *J Mammal*,1987;68(4):842-7.
15. Whitaker Jr. JO. Food habits analysis of insectivorous bats. In: Kunz TH, Racey PA, editors. *Ecological and behavioral methods for the study of bats*. Washington, DC: Smithsonian Institution Press, 1988, 309-25.