

Seasonal Fluctuations in the Diet Composition of *Rhinopoma hardwickei* in the Rajasthan Desert -

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A b s t r a c t

The Small mouse-tailed bat, *Rhinopoma hardwickei*, collected from various districts of Rajasthan is primarily an insectivorous species. Orthoptera, Dictyoptera, Lepidoptera, Hymenoptera, Coleoptera and Diptera are preferred in all main four seasons in varying amounts, while Isoptera are consumed in all but winter season. Occurrence of ground dwelling insects, caterpillars, spiders and water beetles in the stomachs of bats have been discussed in light of behavioural adaptations of this species. Presence of fur of same bat species in stomachs coincides with its breeding season. Presence of various polyphagous insect pest species of crops in feeding menu of bats show that this species plays an important in biological management of harmful insects.

I n t r o d u c t i o n

The Small mouse-tailed bat, *Rhinopoma hardwickei* Gray 1831 (Chiroptera : Rhinopomatidae), is a fairly well distributed species in Rajasthan which is part of the Great Indian Thar desert (24.5–30.5° N; 60–70° E). Associated with arid and semi arid regions, of which it is adapted ecophysiologically, this species is confined to subtropical latitudes. In the Indian subcontinent this bat is absent from forested regions of Ghats. However, it is a wide spread and common bat in Arabia, Erithrea, Sudan and Egypt. In its diurnal roost, it coexists with other bat species of *Rhinopoma microphyllum kinneari* and *Taphozous* sp. inhabiting natural caves, man made cellars, and underground irrigation tunnels.

In spite of occurrence of *R. hardwickei* in abundance, constituting 9.63 per cent of total bat fauna of desert biome of Rajasthan (ADVANI 1981 a), except some reports (ADVANI & VAZIRANI 1981; PRAKASH 1963; SINHA & ADVANI 1976) little is known about the ecology, biology and behaviour of this species. To fill up this gap, the present studies were undertaken to investigate the food composition and seasonal variation in the feeding pattern of this species, as also this aspect has been studied in detail in respect of new world and temperate bats, but no information is available regarding tropical species.

M a t e r i a l s a n d m e t h o d s

The bats were collected during various seasonal and periodical faunistic surveys conducted by Desert Regional Station, Zoological Survey of India of twelve districts — Jodhpur, Barmer, Nagaur, Pali, Dungarpur, Banswara, Jhalawar, Tonk,

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Boondi, Ajmer, Sawai Madhopur and Kota, well distributed in arid and semi arid parts of Rajasthan State. Total 171 individuals were collected and examined. For each season, the break of the sample size (n) is shown in Table 1. After anaesthesia bats were dissected and their alimentary canals were cut open. The stomach contents were taken out with help of brush and forceps and then dried on filter paper at room temperature. After sorting, stomach items were identified to the lowest taxonomic level feasible (Order-Family) through aid of microscope. Later these items were weighed on the balance to calculate their percent frequency of occurrence in the stomach contents following MURTON et al. (1964).

The seasonal fluctuations in the feeding pattern were determined by pooling data among four main seasons occurring in the Indian desert.

Results

The examination and analysis of the stomach contents revealed that the Small mouse-tailed bat, *R. hardwickei*, is primarily an insectivorous species, though some traces of vegetation were also observed in summer and monsoon (rainy) seasons (Table 1). Fur (entangled in muscles) of the same bat species occurred during summer and monsoon, whereas, it was completely absent in stomachs during post-monsoon and winter. There were no remains of other animals except insects and spiders in stomachs, to be considered as its food item.

In the winter season, December to February, *Orthoptera* (gryllids, house crickets) and *Coleoptera* (beetles) combinely constitute more than 45 per cent of the total diet composition. However, *Hymenoptera* (ants), *Lepidoptera* (moths), *Dictyoptera* (cockroaches) and *Diptera* (flies, mosquitoes) are also preferred in appreciable amounts in decreasing order. *Araneida* (spiders) record their occurrence in stomachs in moderate proportions during this season.

In the summer season, there is an increase in the relative occurrence of *Lepidoptera*, while *Isoptera* (termites, *Odontotermes obessus*, *Anacanthotermes* sp.) which are absent in winter, figure in about 11 per cent of total diet. However, survival upon *Hymenoptera*, *Diptera* and spiders reduces considerably. Preference for *Coleoptera*, *Orthoptera* and *Dictyoptera* remains more or less equal as in winter season.

During monsoon months, when there is abundant insect life in nature, there is a significant rise in the consumption of winged soft-bodied termites (*Microtermes obesii*, *O. obessus*, *Anacanthotermes* sp.), slightly lesser than three times (28.2 per cent of the summer season). Relative per cent frequency of *Coleoptera* and *Orthoptera* declines further, while that of *Hymenoptera*, *Diptera* and *Lepidoptera* increases slightly. However, drastic reduction is observed with regard to relative occurrences of *Dictyoptera* and spiders in the diet.

In the two months of post monsoon season, October and November, beetles mainly belonging to families *Scarabaeidae* (while grubs, *Holotrichia* sp.), *Curculionidae* and *Carabidae* constitute major proportion of the diet of bats. Occurrence of ants also increase considerably in the stomachs. The share of *Isoptera* reduces abruptly. Whereas, moderate decline is found regarding consumption of *Orthoptera* and *Lepidoptera*, spiders, bat's own fur and plant parts do not figure at all in this season.

Table 1. Seasonal fluctuations in stomach contents of *Rhinopoma hardwickei*, expressed in percent of total dry mass

Stomach items	Seasons			
	Winter (Dec.—Feb.) n = 36	Summer (Mar.—June) n = 43	Monsoon (July—Sept.) n = 45	Post monsoon (Oct.—Nov.) n = 47
<i>Orthoptera</i>				
<i>Gryllidae</i>	22.2	15.1	12.1	10.4
<i>Acrididae</i>	4.0	8.5	5.5	2.9
<i>Isoptera</i>				
<i>Termitidae</i>	—	10.0	28.2	6.8
<i>Dictyoptera</i>	10.9	11.8	1.3	4.7
<i>Lepidoptera</i>				
<i>Noctuidae</i>	4.5	8.1	3.8	4.4
<i>Arctidae</i>	6.1	8.2	10.1	8.2
Unidentified	1.2	—	1.0	0.5
Caterpillars	—	1.2	3.2	1.1
<i>Hymenoptera</i>				
<i>Vespidae</i>	1.2	5.0	5.8	8.8
<i>Formicidae</i>	14.2	4.3	4.5	7.4
<i>Neuroptera</i>				
<i>Mantispidae</i>	2.4	—	1.4	1.3
<i>Diptera</i>				
<i>Chironomidae</i>	3.7	—	—	2.2
<i>Culicidae</i>	4.5	1.2	1.3	—
Unidentified	1.0	—	1.1	0.5
<i>Coleoptera</i>				
<i>Scarabaeidae</i>	8.5	4.9	8.3	14.1
<i>Curculionidae</i>	3.4	7.3	3.2	11.5
<i>Carabidae</i>	4.1	2.0	2.0	12.2
<i>Bruchidae</i>	2.0	1.0	—	—
<i>Dytiscidae</i>	1.2	4.0	—	—
Unidentified	—	1.3	2.2	3.0
<i>Araneida</i> (spiders)	4.9	1.2	—	—
Bat's own fur	—	4.9	3.8	—
Plant parts	—	0.5	1.2	—

Discussion

The Small mouse-tailed bat, *R. hardwickei*, is primarily an element of the cave and rocky habitat occurring at a tune of 64 per cent, while about 16 per cent population roosts near or midst of human settlement habitat (ADVANI 1981 a). Its roosting habitats has certainly an impact on its feeding behaviour particularly in deciding composition and seasonal relative occurrence of various insect orders like *Diptera*, *Dictyoptera*, *Hymenoptera* and *Orthoptera* which are available in and

around human environment and *Coleoptera* (bruchids, scarabaeids, carabids). *Isoptera* and *Lepidoptera* which occur in abundance in agro-ecosystems and forested rocky habitat. However, it appears that feeding habits of this species are also probably a combination of opportunism and selective predation, varying with local ecobiotic conditions such as relative abundance of different kinds of vegetation patterns on which a different and diversified insect fauna exists as primary consumer. Occurrence of traces of plant parts in the stomachs of bats during summer and monsoon is perhaps due to the remains of undigested gut content of insects eaten by bats. The presence of orthopterans, caterpillars of *Lepidoptera*, spiders and some ground beetles suggests that this species fed by picking these animals from the ground or other surfaces, rather than by aerial pursuit of preys. Likewise, as observed the drinking behaviour of *R. hardwickei* of skimming over the water surfaces is also very similar to those of allied species *R. microphyllum* (ADVANI 1981 b). However, the requirement of water is also compensated in the desert by the almost exclusive diet of the insects which contain 80–90% water (ROBINSON 1928). Presence of water beetles (dytiscids: *Lacconectus* sp., *Agabus* sp., *Rhantus* sp.) in the stomachs indicate the ability of bats to swoop over the water surfaces and pick up these one of the most active insects. Regarding composition of food items, *R. hardwickei* markedly differ from those of the Indian false vampire, *Megaderma lyra lyra*, which depends upon an equal proportion of insect as well as the vertebrate (lizards, fishes, birds etc.) animal diet (ADVANI 1981 c) on an annual basis.

Seasonwise, during winter when temperature slides down to about 4.5 °C in Rajasthan desert, the bats are relatively inactive and they thrive upon insects available in their near vicinity or home ranges. These include mosquitoes, flies, gryllids, house crickets, cockroaches, ants and beetles, forming major portion of their diet. In this season bats under extreme climatic conditions can also subsist upon their own fat reserves which they accumulate after the monsoon season. During summer and monsoon months preference for termites is quite obvious, as this period coincides with emergence of winged, soft bodied, slowflying termites after first few showers (from mid June onwards) in Rajasthan. Likewise, in post monsoon season occurrence of winged ants and wasps and abundant beetles determine the diet composition of this species.

The occurrence of bats' own fur during summer and then in monsoon in stomachs is explainable on the ground that the peak of the breeding season of *R. hardwickei* is from June to August (SINHA & ADVANI 1976) in the Rajasthan desert, when the inter and intra sexual interactions are quite expected.

On the economic significance of the feeding habits of *R. hardwickei*, the survival of bats upon some of the most prominent and polyphagous insect species of summer as well as winter crops in Rajasthan desert like *O. obessus*, *M. obesii* (termites); white grubs (*Holotrichia* sp.) and curculionids (*Coleoptera*) and several grasshopper species, evidently show that this species is playing an important role in management of the population of these harmful insects in natural crop ecosystem. On the other hand, occurrence of predatory insects like *Neuroptera* in stomachs, though in low relative percentages, points out towards non-beneficial aspect of feeding ecology of this species.

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Zusammenfassung

Kleine Klappnasen, *Rhinopoma hardwickei*, aus verschiedenen Gebieten Rajastans (Indien) stammend, sind hauptsächlich Insektenverzehr. *Orthoptera*, *Dictyoptera*, *Lepidoptera*, *Hymenoptera*, *Coleoptera* und *Diptera* werden in wechselnder Menge während der 4 Hauptjahreszeiten bevorzugt, während *Isoptera* im Winter nicht aufgenommen werden. Das Vorkommen von bodenbewohnenden Insekten, Raupen, Spinnen und Wasserkäfern wird unter dem Aspekt von Anpassungen im Verhalten bei dieser Art diskutiert. Das Vorhandensein von arteigenem Fell in den Mägen fällt mit der Fortpflanzungssaison zusammen. Die Aufnahme verschiedener polyphager Schadinsekten seitens der Fledermäuse zeigt, daß diese Art eine wichtige Rolle bei der biologischen Bekämpfung der schädlichen Insekten spielt.

References

- ADVANI, R. (1981 a): Bioecological evaluation of the chiroptera fauna of desert biome of Rajasthan. *Z. angew. Zool.* **67**, 281–305.
- (1981 b): Food and feeding ecology of the Rat Tailed Bat in the Rajasthan desert. *Acta Ther.* **26**, 269–272.
- (1981 c): Seasonal fluctuations in the feeding ecology of the Indian false vampire, *Megaderma lyra lyra* (Chiroptera : Megadermatidae), in Rajasthan. *Z. Säugetierkd.* **46**, 90–93.
- , and VAZIRANI, T. G. (1981): Studies on ectoparasites of bats of Rajasthan and Gujarat. Records Zoological Survey of India, Delhi, Occasional Paper no. **22**, 1–155.
- MURTON, R. K., WESTWOOD, M. J., and ISAACSON, A. J. (1964): Feeding habits of the Wood pigeon, *Columbia palumbus*, Stockdove, *Columba oenas*, and Turtle dove, *Streptopelia turtur*. *Ibis* **106**, 177–188.
- PRAKASH, I. (1963): Taxonomic and biological observations on the bats of the Rajasthan Desert. *Records Indian Museum* **59**, 149–170.
- ROBINSON, W. (1928): Water conservation in insects. *J. Econ. Entomology* **21**, 897–902.
- SINHA, Y. P., and ADVANI, R. (1976): Notes on food and reproduction of some Rajasthan bats. *Geobios* **3**, 37–40.

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