



## Short communication

# The diet of some insectivorous bats from northern Israel

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The bat fauna of Israel comprises of at least 32 species that range from the desert regions in the south to the Mediterranean habitat in the north. Despite this abundance, little has been published on the diet of insectivorous bats in Israel, and most species studied so far were from desert regions (WHITAKER et al. 1994; FELDMAN et al. 2000). A more detailed knowledge of the diet of bats is important in order to understand community structure and other ecological relationships of the species concerned.

The roosts selected for this work have been checked regularly by the Mammal Information Center of the Society for the Protection of Nature in Israel (SPNI) and found to be single-species roosts for at least two years prior to the collection of feces (A. DOLEV, pers. comm.). The identity of the species occupying each roost was determined by mist-netting a sample of the bats exiting from the roost at dusk, as well as by observation and by recording their calls using a bat detector. One roost (Yardena) was occupied by *Asellia tridens* (Geoffroy, 1838), two (Horvat Migda and En Miemon) by *Rhinopoma microphyllum* Geoffroy, 1818 and one (Nahal Gaf) by *R. hardwickei* Gray, 1831. Although no other species than the above were identified, it is possible that

in the three roosts of *Rhinopoma* spp. there were a few individuals of the other *Rhinopoma* species, as they have similar calls and are similar in appearance. The three roosts of *Rhinopoma* spp. were comprised of several hundred individuals each, while the *Asellia tridens* roost had about 70 individuals. One collection was made in each cave, and all collections were made between August–October 2000. The floor of each roost was covered with several cm of guano. Dry feces were collected from the top layer of the guano (estimated to be 1–2 years old) in several places in the roost, and placed in a plastic bag where they were mixed. A sample of 100 fecal pellets was selected from each roost for microscopical analysis in a method described by WHITAKER (1988). Each pellet was examined separately and insect remains were identified to the lowest taxonomic level possible, usually to family, and the percentage volume was estimated visually. The results were then summarized as percent volume (sum of individual volumes of each food/sum of total volume X 100).

All roosts are in the Jordan Valley: En Miemon at 33°08' N 35°40' E, 300 m above sea level, Nahal Gaf at 32°53' N 35°33' E, 200 m below sea level, Yardena 32°35' N 35°34' E, 230 m below sea level and Horvat

**Table 1.** Diet composition of *Rhinopoma microphyllum* (2 localities), *Rhinopoma hardwickei* and *Asellia tridens*. Data are means and standard deviation (M and SD) of percent volume of each taxon. Sample size is of 100 feces from each locality. The four orders from which the largest volume was found are marked in bold.

Order	Family	<i>R. hardwickei</i>		<i>R. microphy</i>		<i>R. microphy</i>		<i>A. tridens</i>	
		Nahal Gaf		Horvat Migda		En Miemon		Yardena	
		M	SD	M	SD	M	SD	M	SD
Coleoptera	Carabidae	4.4	17.8	6.4	22.5	6.1	19.1	3.1	15.6
	Chrysomellidae	0.5	3.5			0.6	4.2	2.9	13.5
	Scarabidae	14.25	28.3	65.3	40.8	60.2	37.6	22.2	36.4
	Other	32.6	37.2	7.5	19.7	13.8	26.8	7.1	16.1
<b>Total Coleoptera</b>		<b>51.75</b>	37.5	<b>79.2</b>	30.6	<b>80.7</b>	23.3	<b>35.3</b>	38.1
Diptera	Chironomidae			0.1	0.7			10.6	25.6
	Cuculidae								
	Tipulidae			0.2	2.0				
	Other	1.6	10.6	0.7	3.2			1.5	6.7
<b>Total Diptera</b>		1.6	10.6	0.9	2.7			<b>12.1</b>	27.4
Hemiptera						0.15	2.0		
Heteroptera	Cynidae	0.4	3.5			0.3	2.5		
	Lygaeidae	5.9	10.9			3.8	6.9	3.2	11.9
	Miridae								
	Pentatomidae	0.3	2.1	0.9	3.9	0.6	2.7	0.6	2.0
<b>Total Heteroptera</b>		<b>6.6</b>	11.3	0.9	3.9	<b>4.7</b>	8.0	3.8	12.3
Homoptera	Cercopidae	0.4	2.5						
	Cicadellidae	3.4	9.9			0.9	3.6	2.1	12.6
				5.1					
				15.4					
	Delphacidae	0.1	1.0						
	Other	0.2	2.0						
<b>Total Homoptera</b>		<b>4.0</b>	10.3	<b>5.1</b>		0.9	3.6	2.1	12.6
				15.4					
Hymenoptera	Formicidae	30.2	36.9	8.8		1.4	4.5	0.4	3.2
				21.0					
	Ichneumodidae	0.1	1.0					1.2	7.4
	Other							0.1	
<b>Total Hymenoptera</b>		<b>30.3</b>	37.0	<b>8.8</b>	21.0	<b>1.4</b>	4.5	1.7	0.8
Isoptera				<b>3.0</b>	12.1				
Lepidoptera		3.9	9.7			<b>11.1</b>		<b>32.7</b>	39.0
						21.9			
Orthoptera	Gryllidae	0.1	1.5	0.45	4.5			<b>11.3</b>	26.8
Plecoptera				0.1	1.0				
Trichoptera						1.0		0.1	1.0
Acarididae				0.7	6.5				
Spiders								0.1	
Unidentified		1.6	5.5	0.1		0.4	3.0	1.0	5.0
				1.0					

Migda 32°28' N 35°34' E, 100 m below sea level. The climate of this part of Israel is warm (mean temperature of the coldest and warmest months are 13 °C and 30 °C, respectively). Summers are dry, and the rainy season falls between October and April, with the mean annual rainfall ranging from 300 mm in Horvat Migda and Yardena to 500 mm in En Meimon (JAFFE 1988).

The results of the examination are presented in table 1. Note that the standard deviations of scarce food items are large, due to the great variability in the amounts of these items in the feces.

Coleoptera were the most abundant food items in all four samples, and comprise about 80% (most of which are Scarabidae) of the diet in both samples of *R. microphyllum* and 51% in *R. hardwickei*. Formicidae composed 30.4% of the diet of *R. hardwickei*. The diets of *R. microphyllum* and *R. hardwickei* were studied in the Rajasthan desert (India) by ADVANI (1981) and PRAKASH (1959), respectively. Coleoptera was the most common food item of *R. microphyllum* during most of the year, followed by Lepidoptera and Isoptera, while the diet of *R. hardwickei* was composed mainly of beetles, moths, and neuropterans.

At present there is information on the diet of 12 species of insectivorous bats from Israel (WHITAKER et al. 1994; FELDMAN et al. 2000), and Coleoptera were reported to be the main or one of the main food items in 9 of these species. This is not surprising because Coleoptera is the largest insect order in the world, comprising about a third of all insect species. However, the relative proportion of biomass of the various insect orders was not studied, thus it is not possible to determine the relationship between foods eaten and availability in each species, i. e. whether they take Coleoptera in proportion to their abundance, or whether they actively select beetles. Nevertheless, the proportion of Coleoptera in the diet of *R. microphyllum* and *R. hardwickei* was about 80% and 50%, respectively, much larger than its proportion among insects, indicating a clear preference for this order.

*Asellia tridens* had a more diverse diet than the *Rhinopoma* species, and the four most common food items found in its feces were Coleoptera (35.3%), Lepidoptera (32.7%), Diptera (12.1%) and Orthoptera (11.3%). FELDMAN et al (2000) reported that near the Dead Sea the main food item of *Asellia tridens* is Coleoptera (52.2% of diet) and the rest consists of various other orders. Hence, a wider food selection by this species was found in both studies.

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