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The biology of *Pipistrellus bodenheimeri* (Microchiroptera) in the Dead Sea area of Israel

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Abstract

Collecting data on the biology of *Pipistrellus bodenheimeri* during a survey of the bats of the Dead Sea area. This species is a year-round resident, hibernating between October and April. Capture rate during winter was 5 % of the summer rate. Lactating females were found between early May and early September. Females are significantly heavier and larger than males. The bats feed intensively in the evening and gain about 15 % of body weight within 2 h.

Introduction

Very little work has been carried out on the biology of any bats in the Near East (Atallah 1977–1978; Bates and Harrison 1989; Harrison 1984; Harrison and Makin 1988; Makin 1977; Mendelssohn and Yom-Tov 1988; Qumsiyeh 1965). *Pipistrellus bodenheimeri* was described by Harrison (1960), and it is found from the Dead Sea area to Aden. It is one of the smallest (less than 3 g) and least known species of its genus, and one of the smallest bats in the Palearctic region.

The aim of this study is to report data of the biology of *P. bodenheimeri* which we gathered during a survey conducted in the insectivorous bats of the Dead Sea area (Yom-Tov et al. 1991).

Material and methods

Study area

The study area is the western and southern coastal plain of the Dead Sea, a long (about 80 km) and narrow (about 15 km) salt lake which lies 400 m below sea level. It is a desert area, with mean annual precipitation of 50 mm which falls only during winter (November–April). Mean daily temperatures of 16–18 °C exist in December–February and 32–34 °C during June–August. Mean minimum monthly temperature is reached in January (11 °C) and mean maximal temperature in July (39 °C). Mean monthly relative humidity fluctuates between 35 % (July) and 50 % (January) (climatological data from Jaffe 1988). The coastal plain borders with high cliffs intersected by dry wadi beds. Several small oases and agricultural settlements exist along the valley, providing drinking water for wildlife. The vegetation is savannoid desert vegetation, with *Acacia* trees near and in the wadi beds and low bushes of the plain (Danin 1988).

Survey procedure

The study was conducted between April 1988 and January 1990. We made an effort to visit the area every 3–4 weeks during winter (November–April) and twice monthly during the rest of the year. Most visits lasted one day, but during the first summer there were several two-day visits. During the first summer we sampled various localities along the western shore of the Dead Sea from Ain Fashkha 36°27′ E, 31°44′ N (Occupied areas) in the north through the oasis of En Gedi 35°26′ E, 31°28′ N, and its environs, Nahal Zeelim 35°23′ E, 31°21′ N, En Boqeq 35°23′ E, 31°10′ N, Brechot Navit 35°23′ E, 31°07′ N and south to Neot Hakikar 35°23′ N, 30°55′ N. We caught bats at night using

monofilament and other mist nets, erected between vegetation and in open areas. We visited several caves, mostly in En Gedi area, but also near en Boqeq and Mt. Sdom 35°23′ N, 31°05′ N and tried to identify bats there by direct observation and by sampling the population by mist nets. We also observed bats near street lights at various settlements along the shore. Several bats were caught by abruptly waving mist nets towards approaching bats near street lights. After the first summer we concentrated most of our efforts in Neot Hakikar, where we repetitively erected mist nets, about 30 m long, parallel to the water line of a 40 m diameter irrigation pond. The nets were kept open from about 30 min before sunset to at least 3 hours after dark (normally 4–6 hours on average each summer night). Every individual captured was identified to its species and sex, its forearm measured by a digital caliper to 0.1 mm accuracy and weighted with Pesola spring balances to 0.1 g accuracy. Age was determined by examining the degree of ossification of the finger joints (Kunz and Anthony 1982). Body condition, pregnancy, lactation and testis size were noted in the animal released on the spot.

Results and discussion

Pipistrellus bodenheimeri was the most commonly found bat in our survey, with a total of more than 250 individuals netted. It was netted or observed every month of the year, but mainly between May and September, indicating that it is a resident species. The rate of capture (average number netted in 30 m net during 3 hrs at the beginning of an evening) in the summer was 20 times that of winter (Fig. 1). At least two possible explanations may account for this result: 1. The bats hibernate between October and April and arousal rate during hibernation is 5% (1:20), or 2. during winter there are more water sources available, and the bats disperse accordingly. We believe that the first explanation is correct since the number of bats hunting near street lights in winter is smaller by an order of magnitude than that in the summer.

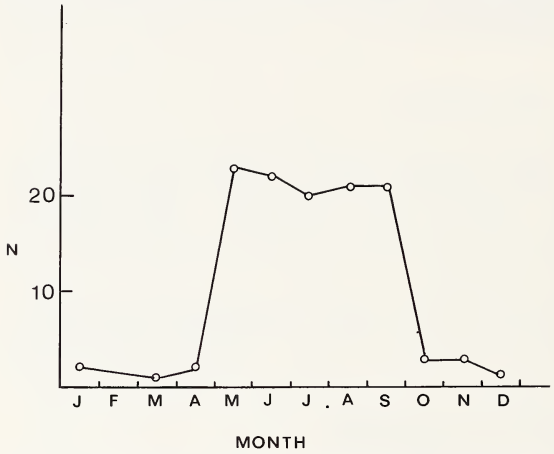

Fig. 1. The average number of *Pipistrellus bodenheimeri* caught during the year in a 30 m long mist net in a 3-hour period at the beginning of an evening in Neot Hakikar

P. bodenheimeri was caught even at ambient temperatures of 11 °C. We did not find a correlation between ambient temperature at the night of netting and either the number of species or the number of individuals caught. Neither there was a correlation between the moon phase and the number of bats caught during the summer (April–October).

Females (n = 143) were significantly ($t = 3.3$; $p < 0.01$) heavier than the males (n = 119; mean body weight 2.9 and 2.5 g, respectively), and had significantly ($t = 3.1$; $p < 0.001$) greater forearm length (mean 30.1 and 29.2 mm, respectively). Mean body weight (but not mean forearm length) fluctuated during the year (Fig. 2), reaching a maximum in May and a minimum in August. The average high body weight in May was probably due to the improved food conditions in spring and the combined effect of this and pregnancy in females. The decline in average body weight towards August was due to the appearance of young bats, which are easily distinguishable from the adults by having greyer fur, especially on the abdomen, and incomplete fusion of the epiphysis in the joints of the fingers. Young bats formed a large proportion (up to 50%) of the netted sample in July and August. The first young *P. bodenheimeri* were caught on 14 June 1989. These were

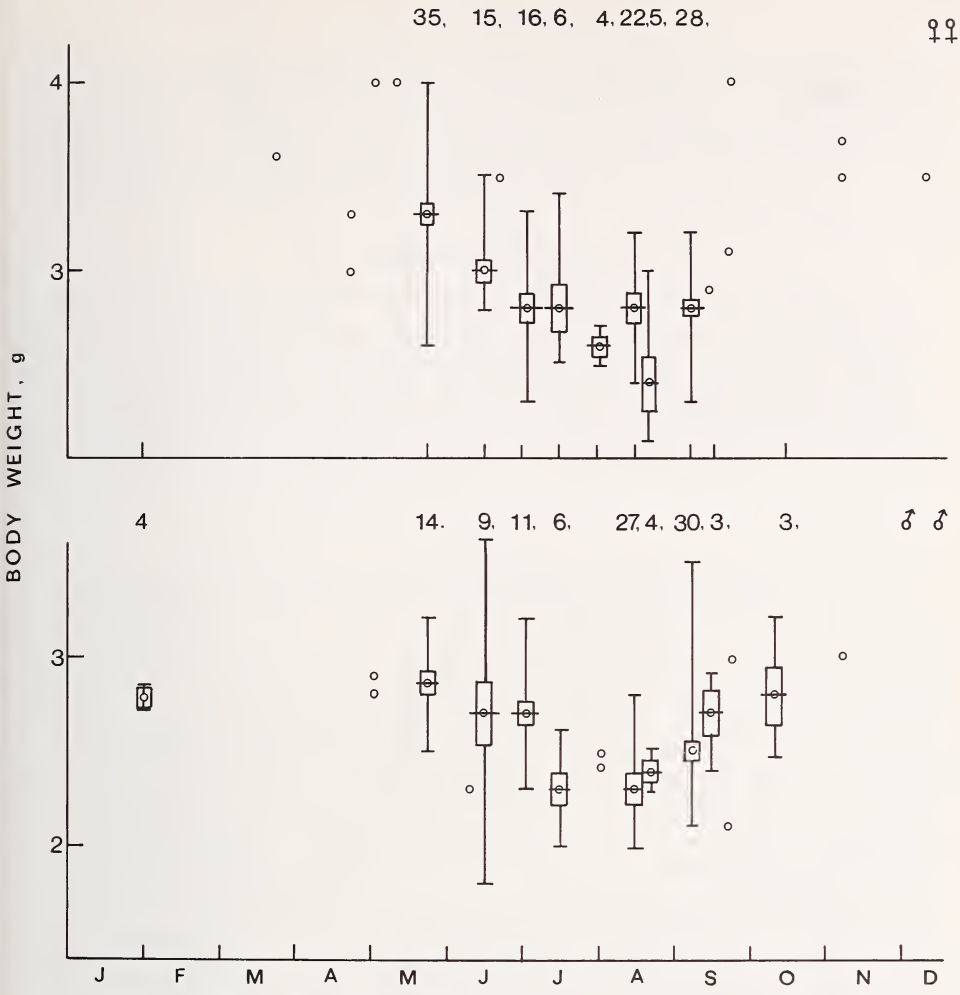

Fig. 2. Body weight (a) of male and female *Pipistrellus bodenheimeri* caught in the Dead Sea area during the year. Means, SE and ranges. Sample sizes for samples larger than three are given above the means

2 females weighing 2.9 and 3.0 g, respectively, with forearms measuring 30.3 and 20.9 mm, respectively; and a male, weighing 1.8 g (the lightest *P. bodenheimeri* ever caught) with a forearm measuring 27.0 mm. These three specimens composed 12.5 % of the 24 captured during that evening, but the percentage of young bats increased to 45 % and 53 % of the samples caught in July and August, respectively. The forearms of the young bats were not significantly different from those of the adults, but body weight was lighter in July. In that month adult males were 21 % heavier than the young ($t = 5.0$, $p < 0.001$, $df = 9$), and adult females were 15 % heavier ($t = 3.8$, $p < 0.01$, $df = 14$). In August the difference decreased and the body weight of young animals was not significantly different from that of the adults.

Lactating females were captured from 24 May until 3 July, but evidence of recent lactation (protruding nipples with no hair 3–5 mm around) was noticed between 2 May until 7 September. Of the 102 females checked during the summer for signs of lactation, 90

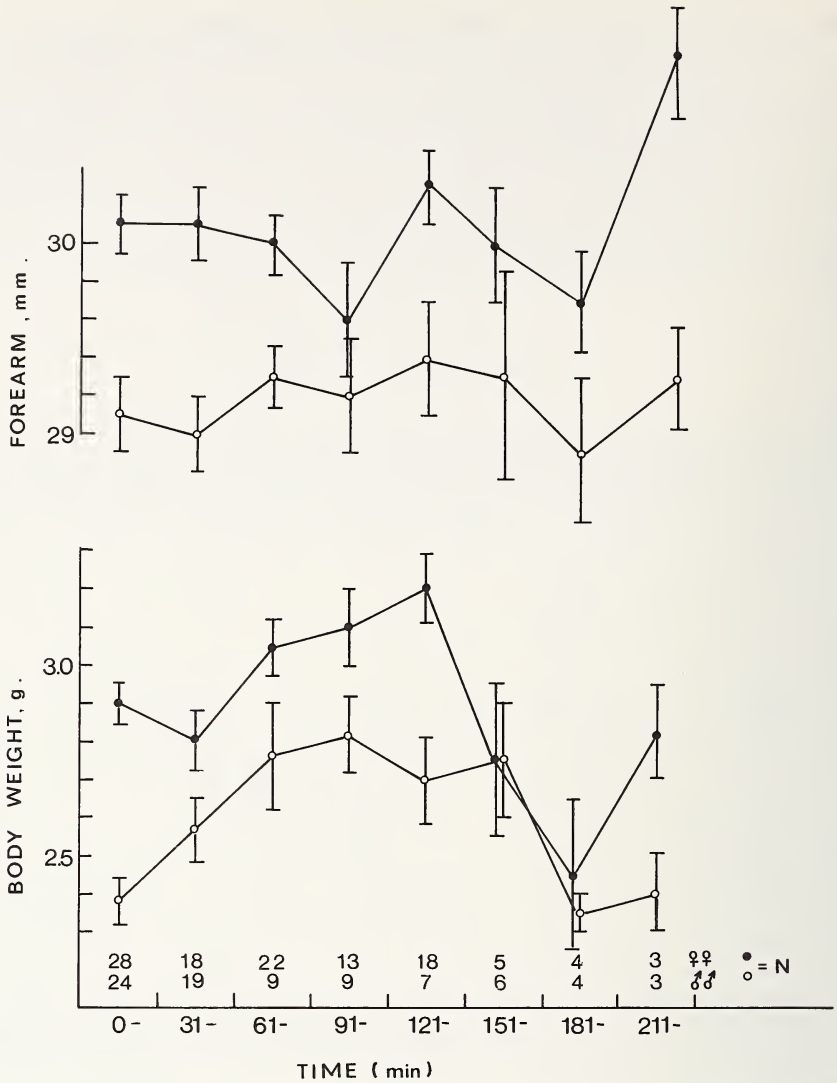

Fig. 3. Mean ± SE body weight and forearm length of male and female *Pipistrellus bodenheimeri* caught in mist nets during the first hours after sunset

had either milk in their milkglands or protruding nipples. There was no evidence of synchronized breeding.

Lactating females were observed from early May until early September and this may indicate that some females give birth twice annually.

Mean body weight fluctuated during the evenings rising from a minimum just after dark to a maximum about 2 hours later and decreased again (Fig. 3). The difference between maximum and minimum body weight was significant for females ($t = 3.14$, $p < 0.001$), but not so in the males ($t = 1.82$, $p = 0.1 > p > 0.05$). Since mean forearm length was similar during this period, it is possible that the increase in body weight was due to intensive feeding by the bats, which added about 15 % to their weight during the first two hours of hunting.

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Zusammenfassung

Die Biologie von Pipistrellus bodenheimeri (Microchiroptera) im Gebiet des Toten Meeres in Israel

Daten über die Biologie von *Pipistrellus bodenheimeri* wurden während einer Untersuchung über die Fledermäuse im Gebiet des Toten Meeres gesammelt. Diese Art kommt während des ganzen Jahres hier vor und überwintert von Oktober bis April. Im Winter wurden nur 5 % der Anzahl von Fledermäusen gefangen, die im Sommer gefangen wurden. Säugende Weibchen wurden von Anfang Mai bis Anfang September gefunden. Weibchen sind deutlich größer und schwerer als Männchen. Diese Fledermäuse fressen am meisten mit Beginn der Aktivitätsphase am Abend und nehmen innerhalb von zwei Stunden 15 % an Gewicht zu.

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