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Pipistrellus bodenheimeri.

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Pipistrellus bodenheimeri (Harrison, 1960)

Bodenheimer's Pipistrelle

Pipistrellus bodenheimeri Harrison, 1960:261. Type locality "Yotvata, Wadi Araba, 40 km. north of Eilat, Israel."

CONTEXT AND CONTENT. Order Chiroptera, suborder Microchiroptera, family Vespertilionidae, subfamily Vespertilioninae, genus *Pipistrellus,* subgenus *Hypsugo* (Koopman 1993), *savii* group, *savii* subgroup (Hill and Harrison 1987). *P. bodenheimeri* is monotypic (Harrison and Bates 1991).

DIAGNOSIS. *Pipistrellus bodenheimeri* (Fig. 1) can be distinguished from other sympatric pipistrelles by dentition and uropatagial color. Uropatagium is paler than wing membranes in *P. bodenheimeri* but not in *P. pipistrellus* or *P. savii* (Harrison and Bates 1991). First upper premolars of Bodenheimer's pipistrelle are minute and displaced inwards, unlike those of *P. arabicus* and *P. rueppellii* which are visible when the mouth is closed. First upper incisors are bicuspid, whereas those of *P. kuhlii* and *P. ariel* are unicuspid. However, 1 specimen of *P. bodenheimeri* has almost unicuspidate I1 (Harrison and Bates 1991), making the distinction between *P. bodenheimeri* and *P. ariel* based on dentition unreliable. Ears of *P. bodenheimeri* are lower and less pointed than those of *P. ariel,* and the muzzle is broad and round compared with the narrow and pointed muzzle of *P. ariel* (Harrison and Bates 1991).

Pipistrellus bodenheimeri has a short and broad baculum with an expanded distal end, and the terminal point is directed somewhat ventrally. This characteristic makes male *P. bodenheimeri* easily distinguishable from *P. arabicus* and *P. pipistrellus,* which have longer bacula with trifid and bifid tips, respectively (Harrison 1982).

GENERAL CHARACTERS. On average, *P. bodenheimeri* females are heavier and larger (mass = 2.9 g; length of forearm = 30.1 mm; n = 143) than males (2.5 g, 30.1 mm, n = 119—Yom-Tov et al. 1992). Average length of forearm of volant subadults does not differ from that of adults, but subadult body mass is less than adult body mass in July (Yom-Tov et al. 1992). Ranges (in mm) of external and cranial measurements for *P. bodenheimeri* are as follows: total length, 59–75 (n = 12—Harrison and Bates 1991); length of forearm, 26.2–31.6 (n = 5—Qumsiyeh 1985); length of hind foot, 4.8 (n = 11—Harrison and Bates 1991) to 7 (n = 5—Qumsiyeh 1985); length of tail, 26 (n = 11—Harrison and Bates 1991) to 37 (n = 5—Qumsiyeh 1985); length of ear, 8–11.6 (n = 5—Qumsiyeh 1985); greatest length of skull, 10.8 (n = 11—Harrison and Bates 1991) to 12.3 (n = 4—Qumsiyeh 1985); condylobasal length, 10.3–11.5 (n = 10); zygomatic breadth, 6.6–7.3 (n = 7); breadth of braincase, 5.2–5.9 (n = 11—Harrison and Bates 1991); length of maxillary tooth row from C to M3, 3.5 (n = 10—Harrison and Bates 1991) to 4.2 (n = 4—Qumsiyeh 1985); length of mandibular tooth row from c to m3, 3.8 (n = 11—Harrison and Bates 1991) to 4.5 (n = 4—Qumsiyeh 1985); mandibular length, 7.3–8.2 (n = 9—Harrison and Bates 1991; Fig. 2). Some measurements for the type specimen (in mm) are as follows: length of 3rd metacarpal, 27.3; length of 1st phalanx, 9.2; length of 2nd phalanx, 9.8; length of tibia, 12.1; height of tragus, 4; greatest width of tragus, 1.8 (Harrison 1960). Thumbs of *P. bodenheimeri* measure ca. 5 mm with claw included (Harrison and Bates 1991).

Fur of upper body and head is ca. 8.5 mm in length. Basal region of dorsal pelage is slaty brown or gray, and distal segment is a pale whitish buff, which contrasts sharply with darker membranes. Ventral hairs are slaty gray at their bases and white distally (Harrison 1960). Minor variation in color exists among adults, e.g., a specimen from Jazirat al Abid, south Yemen, was darker than the holotype from Yotvata, Israel (Harrison and Bates 1991). Subadults have grayer fur than adults, especially on the abdomen (Yom-Tov et al. 1992). Wing membranes are dark, lack a white border, and attach to the base of the toe. Ears and interfemoral membrane are semitranslucent and paler than the wings. The tip of the last caudal vertebra protrudes from the tip of the uropatagium, which is supported over less than half of its border by gracile calcars. A small postcalcareal lobe extends barely from the uropatagium but is distinct (Harrison 1960). Feet are small and delicate (Harrison and Bates 1991).

DISTRIBUTION. *Pipistrellus bodenheimeri* occurs in desert regions of Arabia (Fig. 3). Localities include Yotvata (type), Ein Geddi, Ein Yahav, and Eilot in Israel (Makin and Harrison 1988); St. Katherine monastery in Sinai, Egypt (Qumsiyeh 1985); and Seiyun and Jazirat al Abid in south Yemen (Harrison and Bates 1991). Range may include Socotra Island, Yemen (Corbet and Hill 1991). A specimen from Rostaq, Oman, was later assigned to *P. arabicus* (Harrison and Bates 1991). Fossils of *P bodenheimeri* are not known.

FORM AND FUNCTION. On both sides of the muzzle of *P. bodenheimeri* are well-defined pararhinal glandular swellings, visible as flat, orange bodies on each side of the skin's internal aspect (Harrison 1960; Harrison and Bates 1991). Ears are long with round tips. An emargination occurs a little above half the height of the ear on the slightly concave external border. The posterior border of the ear is proximally convex and then also emarginated just above its bluntly pointed basal lobule. Antitragus of

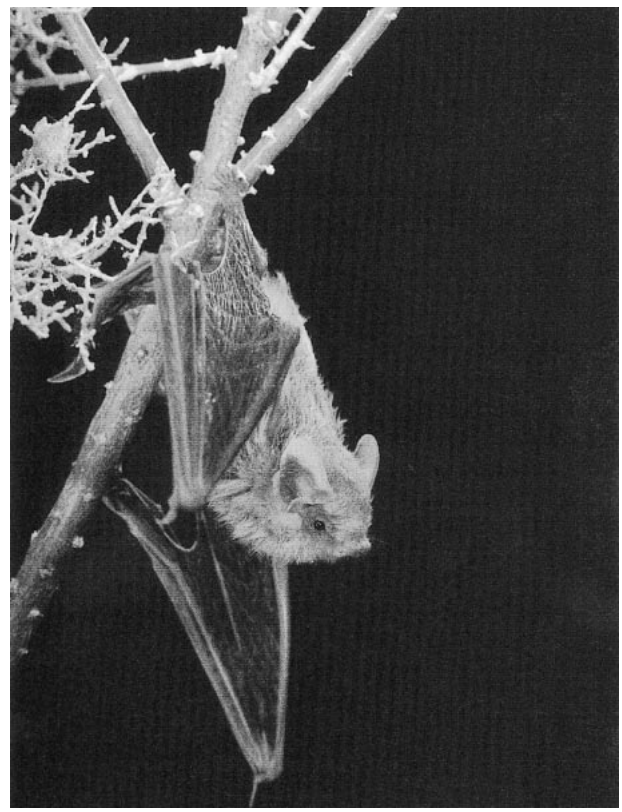

FIG. 1. *Pipistrellus bodenheimeri* adult male from southern Dead Sea region of Israel. Photograph by M. B. Fenton.

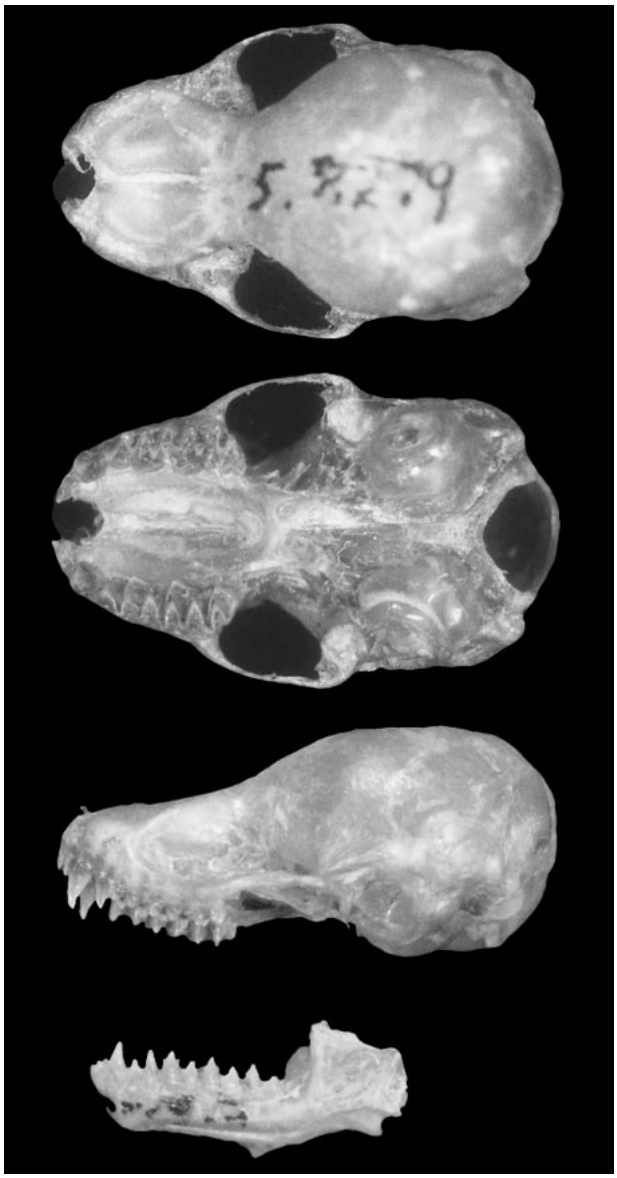

FIG. 2. Dorsal, ventral, and lateral views of the skull and lateral view of the mandible of *Pipistrellus bodenheimeri* from Ein Gedi, Israel (male, Harrison Zoological Museum 5.8279). Greatest length of skull is 10.0 mm. Photographs by M. Brock Fenton.

FIG. 3. Distribution of *Pipistrellus bodenheimeri* in Arabia (modified from Harrison and Bates 1991). Black dots indicate captures and sightings. *Inset:* Species' range in Israel (modified from Yom-Tov and Kadmon 1998). Gray area indicates the "climatic envelope" of the species in Israel proposed by Yom-Tov and Kadmon (1998).

pinna is extremely well developed, high, and narrow. Tragus is concave on its anterior border and rises to a blunt point at ca. half the height of the pinna. The superior border is slightly convex and meets the posterior border at the broadest point of the tragus, which is at ca. two-thirds of its total height (Harrison 1960).

Baculum is short and stout with a single pointed, down-curved extremity. The base is elevated dorsally and lacks paired lobes (Harrison and Bates 1991). The glans of the penis is furnished with long fine hairs. The urethral orifice is a simple vertical slit extending to the dorsal glans (Harrison 1982).

Sagittal crest of the skull is extremely reduced, and lambdoid crests are absent (Fig. 2). Each supraorbital ridge is well developed, with a hollow medial to its overhanging anterior part. A second, less pronounced hollow occurs in a median line between the nasal bones. Palate is highly arched and hollowed out posteriorly (Harrison 1960).

Dental formula is i 2/3, c 1/1, pm 2/2, m 3/3, total 34. First upper incisor is usually bicuspid, short, and broad; its posterior cusp is two-thirds the height of the principal cusp. However, 1 specimen referred to as *P. bodenheimeri* from Ein Geddi, Israel, has a virtually unicuspid I1 but is comparable in other characters to *P. bodenheimeri* (Harrison and Bates 1991). Second upper incisor is tall and unicuspid, exceeding the posterior cusp of I1 in height and attaining three-quarters of the height of the anterior cusp of I1. I2 has a weak angle on its posterolateral cutting edge at one-third of its height and a laterally projecting cingulum. First upper premolar is greatly reduced, is displaced lingually, and does not exceed the height of the cingulum of P2, which contacts the upper canine. Second premolar is three-quarters the height of the canine (Harrison and Bates 1991). The 6 lower incisors are tricuspid and overlapping. Lower canine has a prominent anteromedial cingular cusp lying behind the outer aspect of p1. Cusp is more than half the height of p2 and is in the line of the tooth row. Canine and adjacent premolar are not in contact on internal side (Harrison 1960). First lower premolar is small, more than half the height of p2 and ca. one-third its crown area; it lies in the line of the tooth row (Harrison and Bates 1991).

Mean body mass of individuals caught with mist nets fluctuated from a minimum just after dark to a maximum (15% increase) ca. 2 h later and then decreased (Yom-Tov et al. 1992). This fluctuation probably reflects an increase in individual body mass as the result of intensive feeding. The difference between maximum and minimum body mass was significant for females ($n = 111$) but not for males ($n = 81$—Yom-Tov et al. 1992).

ONTOGENY AND REPRODUCTION. A female *P. bodenheimeri* collected in Yotvata, Israel, on 22 April 1962 carried 2 embryos. Crown–rump length of each was 13 mm (Harrison and Bates 1991). Lactating females were caught from 24 May to 3 July, and evidence of recent lactation (protruding nipples with a hairless perimeter) was observed between 2 May and 7 September (Yom-Tov et al. 1992). Breeding is not synchronized and a long breeding season may allow some females to give birth twice annually. Subadult bats were first caught with mist nets in June, and over July and August they constituted 50% of bats caught (Yom-Tov et al. 1992).

ECOLOGY. Geographical localities of historical collection and sighting records of *P. bodenheimeri* in Israel were tabulated by Yom-Tov and Kadmon (1998). The species' distribution was compared with annual precipitation and mean temperature of coldest and hottest months, a "climatic envelope" for the species was generated from those data, and *P. bodenheimeri* was classified as a desert species (Yom-Tov and Kadmon 1998).

Pipistrellus bodenheimeri is active every month of the year, but number of active individuals in a summer night (May–Septem-

ber) is 20 times higher than that in a winter night (Yom-Tov et al. 1992). This discrepancy may be the result either of seasonal hibernation with 5% arousal rate or of winter dispersal. Bats were caught at temperatures as low as 11°C, and number of individuals caught in mist nets is independent of both temperature and lunar phase in summer (Yom-Tov et al. 1992).

At desert oases, *P. bodenheimeri* has been observed flying at dusk near lines of tamarisk and eucalyptus trees. The trees occurred around an area of cultivation, surrounded by sandy desert and acacia trees (Harrison and Bates 1991). *P. bodenheimeri* roosts in cracks and fissures of rocks (Shalmon et al. 1993).

Bodenheimer's pipistrelle is an opportunistic predator in open desert habitats; its diet consists mostly of lepidopterans, dipterans, and coleopterans (Whitaker et al. 1994). Other food items include arachnids (Whitaker et al. 1994), hymenopterans, hemipterans, and homopterans (Y. Yom-Tov, pers. comm.).

BEHAVIOR. Bodenheimer's pipistrelle locates its prey by echolocation. Prey is ingested by catching, piercing, and slicing motions of canines, premolars, and molars (Yom-Tov 1993). *P. bodenheimeri* commonly gleans insects from water surfaces and from around white street lights, eating in flight rather than taking prey elsewhere for consumption (Shalmon et al. 1993).

Flight of *P. bodenheimeri* is delicate and tends to be low over the ground and around trees (Harrison and Bates 1991). Most activity occurs in the early hours of evening. Vocalizations of this bat are between 17 and 71 kHz but are most intense at around 44 kHz (Shalmon et al. 1993)

GENETICS. Mitochondrial cytochrome *b* DNA sequences ally *P. bodenheimeri* with *P. ariel, P. pipistrellus,* and *P. rueppelli,* and separate it from *P. javanicus, P. pipistrellus, P. p. mediterraneus, P. mimus, P. nanus, P. somalicus, P. stenopterus,* and *P. tenuipinnis* (*P. pipistrellus* may be paraphyletic or hybridized, including mitochondrial genotypes from two distinct clades—Barratt et al. 1995).

REMARKS. The genus name is derived from the Italian word for bat, *pipistrello.* The specific epithet honors Professor F. S. Bodenheimer.

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