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FLAT-HEADED BATS (MAMMALIA, TYLONYCTERIS) FROM THE PHILIPPINE ISLANDS

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Tylonycteris robustula is reported for the first time from the Philippines: specimens are available from Calauit and Luzon. Records of Tylonycteris robustula are from Calauit, Culion, Palawan, Luzon and Mindanao; other reports are probably erroneous. These records bring the number of species of the bat family Vespertilionidae in the Philippines to 21. No species are endemic, and most are widespread in the tropical portions of the Oriental and Australian zoogeographic regions. A few are shared only with the continent and continental shelf islands of Asia.

Bats of the genus Tylonycteris are widespread in Southeast Asia. Two species are currently recognized (Honacki et al., 1982; Tate, 1942). One of these species, T. pachypus, is perhaps the smallest bat in the world. Like its competitor for the record, Craseonycteris thonglongyai of Thailand, it weighs about two grams. The tiny size and the dorso-ventrally flattened skulls of these bats allow them to utilize extremely small cavities as roosting sites, including, for example, the hollow stems of bamboo, which they enter through cracks and insect holes (Medway and Marshall, 1970), and the small, hollow area inside young, erect banana leaves (Rabor, 1977:231).

Only one species of Tylonycteris, the lesser flat-headed bat (T. pachypus), has been reported previously from the Philippines. The purpose of this paper is to provide the first records of the greater flat-headed bat (T. robustula) from the Philippines and to summarize and reevaluate the Philippine records of T. pachypus. Data such as these are essential both for biogeographic studies that rely on accurate lists of species distributions (e.g. Heaney, 1986) and for development of conservation plans for preservation of the native fauna of the Philippines.

METHODS

All measurements were taken by Heaney with calipers calibrated to 0.05 millimeters. Measurements in Table 1 are given in millimeters as mean $\pm$ one standard deviation, with the range given in brackets. Measurements of forearms were taken from both dried skins and fluid-preserved specimens. Specimens examined

are housed in the following institutions: Field Museum of Natural History, Chicago (FMNH); Silliman University Museum of Natural History, Dumaguete (SU); University of Michigan Museum of Zoology, Ann Arbor (UMMZ); U.S. National Museum of Natural History, Washington, D.C. (USNM).

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ACCOUNTS OF SPECIES

Tylonycteris pachypus (Temminck, 1840).

The lesser flat-headed bat occurs from India east to southern China and south to Java (Honacki et al., 1982; Lekagul and McNeely, 1977). Peters (1872) reported the first specimen of Tylonycteris from the Philippines, describing it as a new species, T. meyeri, with only smaller size distinguishing it from T. pachypus (discussed below). The type locality was given only as southern Luzon. Hoffman (1887) reported an additional specimen from Mindanao, and Elera (1895) cited additional records from Cebu and Negros. Hollister (1912) cited these early records and also reported a specimen from Palawan and two specimens from Luzon (discussed below). Taylor (1934) repeated all of these records but examined none. Sanborn (1952) reported a series from Culion and Rabor (1977) again summarized these records. We have examined specimens from Calauit, Culion (first reported by Sanborn, 1952), Luzon (first reported by Hollister, 1912) and Palawan (first reported by Hollister, 1912).

We note that Elera's (1895) paper is generally recognized to contain many errors (Hollister, 1912:54), and that Rabor et al. (1970) included T. pachypus in their list of mammals of Negros Island only on the basis of these earlier references. Because we have been unable to locate specimens or other positive records of this bat from Cebu or Negros in spite of extensive field work on Negros by both of us, we do not accept these records as valid.

Hollister (1912) reported two specimens of T. pachypus from Montalban, Luzon. We have examined both of these specimens; one of these was identified correctly (USNM 173887), whereas the other is actually T. robustula (USNM 173888).

Specimens from the Philippines are consistenty smaller than reference material of T. pachypus pachypus from Java (the type locality of the species) and of T. pachypus fulvidus from Indochina, but these differences are slight (Table 1). For example, the condylo-incisive length of Philippine specimens ranges from 9.7 to 10.3, whereas specimens from Java range from 10.3 to 11.2. However, in this case, as in most others, there is some overlap.

Table 1. Selected measurements of Tylonycteris from the Philippines and reference areas.

LOCALITY	N	Condylo-incisive length	Zygomatic width	Interorbital width	Mastoid width	Cranial depth	C to M3	Molariform toothrow	Palatal width at M3	Forearm
Tylonycteris pachypus										
Calauit	2	9.8 (9.7-9.9)	7.5 (7.5)	3.25 (3.2-3.3)	6.5 (6.4-6.6)	3.1	3.2 (3.1-3.3)	2.5 (2.4-2.6)	2.65 (2.6-2.7)	22.35 (22.1-22.6)
Culion	5	10.12±0.19 (9.8-10.3)	7.65 (7.5-7.8)	3.24±0.15 (3.0-3.4)	6.53±0.10 (6.4-6.6)	---	3.42±0.13 (3.2-3.5)	2.66±0.09 (2.5-2.7)	2.74±0.09 (2.6-2.8)	22.76±1.02 (22.0-24.1)
Luzon	1	10.1	7.6	3.0	6.7	3.3	3.4	2.7	2.6	24.4
Palawan	1	9.9	---	3.3	6.6	3.1	3.3	2.7	2.7	23.3
Java	11	10.83±0.31 (10.3-11.2)	7.90±0.27 (7.5-8.3)	3.27±0.15 (3.1-3.6)	6.90±0.16 (6.7-7.1)	2.91±0.26 (2.6-3.5)	3.55±0.14 (3.4-3.8)	2.73±0.28 (2.7-3.1)	2.85±0.19 (2.7-3.2)	26.07±0.54 (24.9-26.7)
Vietnam and Laos	8	10.70±0.21 (10.4-11.1)	8.12±0.23 (7.8-8.5)	3.32±0.11 (3.2-3.4)	6.91±0.21 (6.6-7.2)	2.97±0.10 (2.8-3.1)	3.51±0.10 (3.4-3.7)	2.76±0.12 (2.6-3.0)	2.91±0.12 (2.7-3.1)	25.5±0.62 (24.9-26.6)
Borneo	2	11.2 (11.1-11.3)	---	3.55 (3.5-3.6)	7.25 (7.2-7.3)	3.25 (3.2-3.5)	3.75 (3.7-3.8)	2.95 (2.9-3.0)	3.0 (3.0)	----
Tylonycteris robustula										
Calauit	2	11.55 (11.5-11.6)	8.7 (8.6-8.8)	3.9 (3.8-4.0)	7.35 (7.2-7.5)	---	4.0 (4.0)	3.25 (3.2-3.3)	3.35 (3.2-3.3)	25.1 (24.8-25.4)
Luzon	1	11.9	8.9	4.1	7.6	4.0	4.1	3.3	3.3	26.5
Java	4	11.98±0.27 (11.7-12.3)	9.08±0.13 (8.9-9.2)	3.73±0.15 (3.6-3.9)	7.48±0.5 (7.4-7.5)	3.70±0.14 (3.5-3.8)	4.03±0.15 (3.8-4.1)	3.18±0.13 (3.0-3.3)	3.33±0.13 (3.2-3.5)	27.75±0.54 (27.3-28.4)
Vietnam and Laos	5	11.90±0.14 (11.8-12.1)	9.10±0.20 (8.9-9.4)	3.82±0.13 (3.7-4.0)	7.46±0.09 (7.4-7.6)	3.43±0.96 (3.3-3.5)	3.98±0.08 (3.9-4.1)	3.14±0.05 (3.1-3.2)	3.34±0.11 (3.2-3.5)	27.0 (25.7-27.9)
Borneo	3	13.1	9.9 (9.6-10.2)	4.27 (4.2-4.3)	8.33 (8.2-8.5)	3.7	4.2 (4.1-4.3)	3.4 (3.3-3.5)	3.63 (3.5-3.7)	28.2 (27.9-28.6)

The single specimen of T. pachypus from Luzon fits well with the larger series from the Palawan group of islands. Tate (1942) recognized the Philippine populations as a distinct subspecies on the basis of the size difference, using meyeri Peters (1872) as the subspecies designation. We have not examined the type of T. meyeri, but Peters described it as being very similar to T. pachypus, differing only in its smaller size; forearm length was given as 22.3 and 24 for two specimens. This description fits our Philippine species well. On this basis, we accept Tate's assignment of the small Philippine bats as T. p. meyeri. The large amount of variation between samples (e.g. Borneo vs. adjacent populations in the Philippines) indicates that additional specimens from areas of contact between subspecies are needed in order to fully evaluate the extent of divergence between taxa.

External measurements from our two specimens from Calauit are: total length, 60, 62; tail, 24, 25; ear from notch, 8, 7; weight, 1.4, 2.7 grams. The second of these was a pregnant female which carried one embryo in each uterine horn (crown-rump length, 6.5). The other was an adult male; both were taken on 2 May 1983.

Specimens examined: PHILIPPINES. Palawan Prov.: Calauit Island, near center of island (SU 27309; UMMZ 158856). Culion Island, San Pedro (FMNH 63656, 63658, 63661, 63673, 63675). Palawan Island, Puerto Princesa (USNM 105484). Luzon: Rizal Prov.: Wawa, near Montalban (USNM 173887). INDONESIA. Borneo: Laham (USNM 198979, 198981). Java: Buitenzorg (USNM 156363, 156367-375, 156378). LAOS. Phong Saly, 4400 ft. (FMNH 32159, 32160, 32162). VIETNAM. Lai Chau (USNM 240594). Tonkin: Muong Mnun, south of Lai Chao, 1200 ft. (FMNH 32153-32155). Tonkin (USNM 260035).

Other records: PHILIPPINES. Mindanao: no specific locality (Hoffman, 1887). Luzon, southern: no specific locality (Peters, 1872).

Tylonycteris robustula Thomas, 1915.

The greater flat-headed bat is known to occur from southern China to Java and Sulawesi (Honacki et al., 1982; Lekagul and McNeely, 1977). We have examined two specimens from Calauit Island (collected from a monsoon forest) and one from Luzon. The Philippine specimens are easily distinguished from T. pachypus on the basis of their larger size (Table 1). For example, condylo-incisive length exceeds 11.5 mm in Philippine T. robustula but is less than 10.4 in Philippine T. pachypus (Table 1). Our few specimens from the Philippines are smaller than those from Java and Vietnam, although only slightly so (Table 1). Specimens from Borneo average larger than any of the other samples by a substantial margin (Table 1), indicating that the pattern of geographic variation is not simple or clinal. No subspecies of T.

robustula are currently recognized, but the distinctiveness of specimens from Borneo indicates that, as with T. pachypus, a complete review of the taxonomy of the group is needed.

External measurements from our two specimens from Calauit are: total length, 75, 71; tail, 27, 27; ear to notch, 8, 9; weight, 5.0, 4.8 grams. Both were pregnant; the first carried a single embryo (crown-rump length, 7.5) and the second carried two (crown-rump length, 8.0). Both were taken on 2 May 1983.

Specimens examined: PHILIPPINES. Palawan Prov.: Calauit Island, near center of island (SU 27310; UMMZ 158855). Luzon: Rizal Prov.: Wawa, near Montalban (USNM 173888). LAOS. Phong Saly, 4400 ft. (FMNH 32157, 32158, 32186). MALAYSIA. Sabah (Borneo): Mt. Kinabalu, Bundu Tuhan (USNM 292462-463). Sabah: Ranau (USNM 317174). INDONESIA. Java: Buitenzorg (USNM 156380). Central Java: Karangmangu, 12 km S Mt. Slamet (USNM 481396-397, 481399). VIETNAM. Mon Prov.: Quang Tri (USNM 260032-033).

DISCUSSION

With the addition of Tylonycteris robustula, the number of species of the family Vespertilionidae known from the Philippines comes to 21; these are listed in Table 2. Only the family Pteropodidae, the fruit bats, is more speciose in the Philippines, with about 25 species present. In spite of this diversity, the Philippine vespertilionids are, with few exceptions, very poorly represented in museum collections, and distributional patterns within the Philippines are very poorly known. The following is a brief summary of major patterns, based on our examination of specimens now in museum collections.

Of the nine genera of vespertilionids in the Philippines, one is primarily restricted to the Oriental faunal region (Glischropus); three are generally widespread in Asia (Murina, Scotophilus, Tylonycteris) and five are very widespread in Asia and Australasia (Kerivoula, Miniopterus, Myotis, Philetor, Pipistrellus). Thus, the majority are widespread and the others are Asian; none show certain affinity to the Australian zoogeographic region or to Wallacea, the area between the Oriental and Australian regions. This is unlike fruit bats (Pteropodidae), which show equal affinity to the Orient and to Wallacea, but in which about 25% of the genera are endemic to the Philippines (Heaney and Peterson, 1984). About 50% of the species of fruit bats are endemic to the Philippines; no vespertilionids are endemic.

The picture that emerges from these data on Philippine vespertilionids is of a fauna in which most species are very widespread in the eastern Old World tropics, but there is also a clear tendency for more species to be shared with Asia than with the Australian faunal region. Very few species are restricted to

Table 2. List of bats of the family Vespertilionidae known to occur in the Philippine Islands.

Glischropus tylopus spp.
Kerivoula hardwickii spp.
Kerivoula jagorii
Kerivoula pellucida
Kerivoula whiteheadi pusilla
Miniopterus australis paululus
Miniopterus schreibersii eschscholtzii
Miniopterus tristis tristis
Murina cyclotis peninsularis
Myotis horsfieldii jeannei
Myotis macrotarsus
Myotis muricola browni
Myotis rufopictus
Philetor brachypterus brachypterus
Pipistrellus javanicus meyeni
Pipistrellus petersi
Pipistrellus stenopterus
Pipistrellus tenuis tenuis
Scotophilus kuhli castaneus
Tylonycteris pachypus meyeri
Tylonycteris robustula

areas near the Philippines, although exceptions are present (e.g. Myotis macrotarsus in the Philippines and Borneo). Because many islands in the Philippines are geologically young and have not had land bridge connections to the Asian mainland at any time (Heaney, 1985, 1986), this implies that these bats have high colonization ability. On this basis, we predict that few, if any, endemic vespertilionids will be discovered in the Philippines, that vespertilionids will be among the first bats to reach new volcanic islands in Southeast Asia (e.g. the new island of Anak Krakatau) and that they should occur on isolated oceanic islands in the Philippines where non-volant mammals and even fruit bats are absent or depauperate. Field work should be undertaken to test these predictions.

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