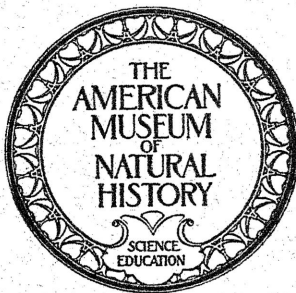


RESULTS OF THE ARCHBOLD
EXPEDITIONS. No. 40

NOTES ON VESPERTILIONID BATS

By G. H. H. TATE



BULLETIN
OF
THE AMERICAN MUSEUM OF NATURAL HISTORY

VOL. LXXVIII, ART. IX, pp. 567-597

New York

Issued December 31, 1941

Article IX.—RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 40

NOTES ON VESPERTILIONID BATS OF THE SUBFAMILIES MINIOPTERINAE, MURININAE, KERIVOULINAE, AND NYCTOPHILINAE

By G. H. H. TATE

	Page
INTRODUCTION.....	567
MINIOPTERINAE.....	567
MURININAE.....	575
KERIVOULINAE.....	583
NYCTOPHILINAE.....	590
LIST OF SPECIMENS IN THE ARCHBOLD COLLECTIONS.....	597

INTRODUCTION

Approximately twelve thousand mammals are contained in the valuable collections brought together from various parts of the Oriental tropics by Richard Archbold, of which three thousand are bats. Examination and study of this collection of Chiroptera has been in progress for more than a year. Progress in the work on the relationships of the many species has been marked by a series of seven published reports.¹

A definite part of the plans for working up the collections involved a prolonged visit to several European museums where the type specimens of many Indo-Australian species existed. In 1937 Mr. Archbold made it possible for me to visit the museums of natural history at London, Berlin, Leyden, Paris, Genoa and Sydney, where the curators in charge of mammals generously allowed me full access to the mammal col-

lections in their charge and gave permission for me to make notes and photographs.

Those photographs and notes, used in conjunction with the literature, the Archbold material, specimens in the regular collections of The American Museum of Natural History, and a number of rare species or supplementary specimens borrowed from other American museums have made it possible for me to make relatively detailed comparisons of the species of each successive genus. Those rather conclusive studies have in each case prepared the way for identification of the specimens in the Archbold collection and for their systematic allocation.

For the loan of numerous specimens by the curators of the Museum of Comparative Zoölogy, Field Museum of Natural History, and United States National Museum, I gratefully acknowledge my indebtedness.

One new species of *Kerivoula* is described.

MINIOPTERINAE

Skull with low, somewhat broad rostrum and high braincase. Anteorbital foramen placed far in advance of orbital fossa, almost above canine. Usually weak but in *tristis* group strongly developed lambdoidal and sagittal crests. Coronoid of mandible especially low.

¹ Amer. Mus. Novit. No. 1035 (*Emballonura*). Amer. Mus. Novit. No. 1036 (*Rhinolophus*). Bull. Amer. Mus. Nat. Hist., LXXVIII, Art. 5 (*Hipposideros*). Amer. Mus. Novit., No. 1140 (Leaf-nosed bats). Amer. Mus. Novit., No. 1141 (Taphozoinae). Amer. Mus. Novit. No. 1142 (Molossidae). Bull. Amer. Mus. Nat. Hist., LXXVIII, Art. 8 (*Myotis*).

Incisors much as in *Myotis*, about equal in height; premolars reduced to two, the anterior one, though moved inward in the row, with crown area large, but with cusp low, only half the height of p⁴; m³ unreduced; lower incisors progressively thickened from the inner to the outer, the latter twice as thick as the inner; three lower premolars retained, the anterior two usually subequal but considerably smaller than p⁴.

Skin with broad, short ears, extensive

membranes, and the peculiar reversed method of folding the third finger of the wing. Insertion of wing membrane not at outer edge of first metatarsus, as in most Vespertilioninae, or on edge of nail-bearing phalanx, as in some Murininae, but uniting with the base of the calcar, where, with the uropatagium, it forms a small pocket on the lower surface of the ankle. The family contains only the genus *Miniopterus*, nearly restricted to the tropics and subtropics of the Old World.

MINIOPTERUS BONAPARTE

Miniopterus BONAPARTE, 1837, Fauna Italica, fasc. 21.

TYPE SPECIES.—*Miniopterus ursinii* Bonaparte = *Vespertilio schreibersii* Kuhl.

More than sixty years ago Dobson¹ wrote "the species of this genus are so very closely allied that almost the only differences

number of forms of *Miniopterus* in Notes on Chiroptera.

Additional forms have been described by later authors until today about twenty-five names have been applied to Eurasian members of the genus (Fig. 1).

Allen⁴ lists twelve African species.

Main divisions of the genus *Miniopterus*

The 25 or more named forms (excluding African) of *Miniopterus*, when compared for size with the type species, range themselves into three rather ill-defined groups: medium-sized species, including *schreibersii* itself, ranging through the subtropics and tropics; large species, with forearm 47–53 mm., Oriental (Philippines, New Guinea, New Caledonia); quite small species with forearm 35–40 mm., also Oriental (India, Borneo, Philippines, Ti-

	Large (<i>tristis</i>)	Medium (<i>schreibersii</i>)	Small (<i>australis</i>)
Forearm length	47–53	42–46	35–40
Tibia	15–16	16–18	14–15
Basal phalanx of thumb	≈4	≈3	2.5–2.8
Anterior part of sagittal crest	Well developed	Weak to obsolete	Weak to obsolete
Upper incisors	Crowns as wide as deep	Crowns as wide as deep	Crowns wider than deep
Canines	Massive: length at cingulum 1.5, height 2.4	Tall, slender: length at cingulum 1–1.2, height 1.3–2.4	Short: length at cingulum 0.9–1.0; height 1.3–1.4
Lower premolars	p ₂ decidedly smaller than p ₃	p ₂ equal to p ₃	p ₂ equal to p ₃
Inner cingulum of m ¹⁻²	Moderately developed	Moderately developed	Moderately developed
Cingulum cuspule of m ²	Weak or none	Moderately to well developed	Weak or none
Length of inner margin $\frac{m^2}{m^1}$	Approximate $\frac{1}{1}$	Approximate $\frac{10}{12}$	Approximate $\frac{1}{1}$

noticeable are size, relative length of parts, and distribution of the fur." Dobson recognized only four species, one of which was African. About sixteen new names have been proposed for Asiatic *Miniopteri* since Dobson reached that conclusion. But his words today remain approximately true.

Twenty years earlier Tomes had written his Monograph of the Genus *Miniopterus*.² He had recognized as species *schreibersii*, *blepotis*, *tristis*, *australis*, *tibialis*, *scotinus*.

Allen³ discussed the relationships of a

mor, Amboina, New Guinea, Australia, New Caledonia).

The *tristis* group (*tristis* of Philippines is rare in collections) includes a series from Papua, described beyond, which is apparently identical to *tristis*. The skull of the type of *robustior* from Loyalty Islands, though smaller has all the characters of *tristis*.

The *schreibersii* group contains in the Orient one quite large form, *magnater* from New Guinea, and the following medium-sized forms:

¹ 1878, Cat. Chiropt. Brit. Mus., p. 348.

² 1858, Proc. Zool. Soc. London, pp. 115–128, plate 65.

³ 1908, Bull. Mus. Comp. Zool., LII, pp. 51–55.

⁴ 1939, Bull. Mus. Comp. Zool., LIII, pp. 102–104.

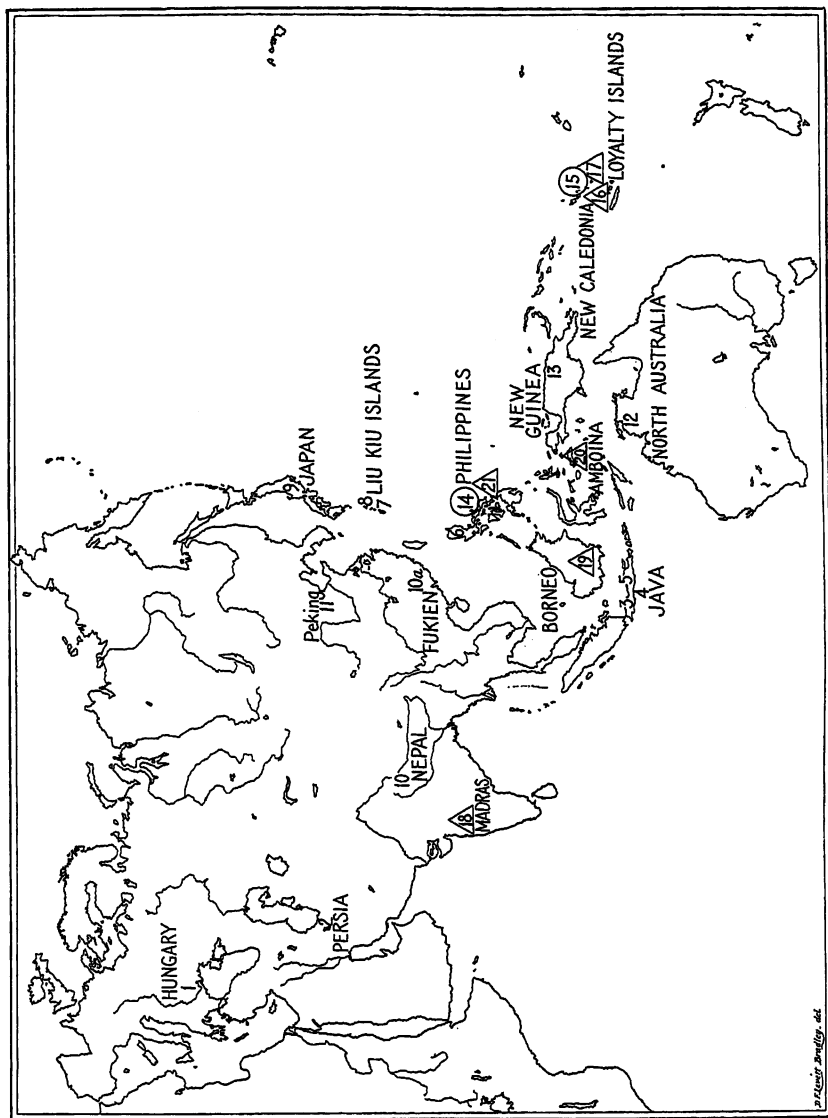


Fig. 1. Type localities of *Miniopterus*.

Schreibersii group: 1. *schreibersii*; 2. *pallidus*; 3. *blepoides*; 4. *ravus*; 5. *medius*; 6. *eschschohlzai*; 7. *fuscus*; 8. *yajeyamae*; 9. *japoniae*; 10. *fuliginosus*; 10a. *parvipes*; 11. *chinesensis*; 12. *orianae*; 13. *magnater*.
Tristis group (in circles): 14. *tristis*; 15. *robustior* (?).
Australis group (in triangles): 16. *australis*; 17. *macrocneme*; 18. *pusillus*; 19. *wilkampi*; 20. *tibialis*; 21. *paululus*.
 Type localities of European races (or synonyms) of *schreibersii* not shown.

<i>fuliginosus</i>	Nepal
<i>parvipes</i>	Fukien
<i>japoniae</i>	Japan
<i>fuscus</i>	Liu Kiu
<i>yayeyamae</i>	Liu Kiu
<i>eschscholtzii</i>	Philippines
<i>blepotis</i>	Java (restricted locality)
<i>medius</i>	Java
<i>ravus</i>	Java
<i>oriana</i>	N. Australia

The skulls of *eschscholtzii* and *yayeyamae*, are in my opinion identical. Also those of *parvipes* and *japoniae* appear alike. The two latter are very slightly larger than the two former, with teeth a trifle heavier.

My photographs of the type skulls of *blepotis*, *medius*, *ravus* from Java are virtually identical to each other and to *eschscholtzii*. The picture of the type skull of *chinensis*, though bad, suggests that *chinensis* also belongs here; that of *oriana* from N. Australia is of the same general type; *fuscus* and *yayeyamae* are perhaps identical to each other.

In view of the foregoing I believe that all of these bats of the *schreibersii* group must be regarded as members of a single species *schreibersii*, or, if we regard the ashy-colored western *schreibersii* as specifically distinct, *blepotis*. A provisional arrangement of the group will stand:

schreibersii schreibersii (= *orsini* = *ursini* = *italicus* = *inexpectatus*)
schreibersii pallidus
schreibersii blepotis (= *medius* = *ravus* = *eschscholtzii* = *fuscus* = *yayeyamae*)
schreibersii chinensis (?)
schreibersii fuliginosus (= *parvipes* = *japoniae*)
schreibersii oriana (?)
schreibersii magnater

The *australis* group includes a single species with three subspecies:

australis australis (= *macrocneme*)
australis pusillus (= *wilkampi*)
australis tibialis (= *paululus*)

Notes on selected species of *Miniopterus*

True *M. schreibersii*, with its desert race *M. s. pallidus*, differs from all other Eurasian forms of *Miniopterus* by its color, described by Miller (1912) as drab, and by Thomas as wood-brown—*pallidus* being even paler. The Oriental species, on the contrary, are much darker colored—usually dark brown or blackish brown.

The following remarks on true *schreibersii* are based upon Russian specimens from the Crimea. Their measurements fit perfectly into the table published by Miller.¹ Skulls with only a trace of sagittal crest, extending along the junction of the frontal bones and reaching its maximum anteriorly. Cusp of i^2 almost as high as anterior cusp of i^1 , and exceeding posterior cusp of i^1 . Canines small, height of cusp of cingulum, 1.8 mm. Molars, m^{1-2} posteriorly emarginate, as described by Miller, and provided with an internal cingulum, best developed at base of hypocone. Length of internal side of m^1 (protocone-paracone), 1.3 mm., considerably exceeding corresponding length of m^2 , 1.0 mm. In lower jaw, p_2 - s equal in size. The forearm of *schreibersii* varies from 44 to 46 mm.; $c-m^3$ from 5.8 to 6.0 mm.

The forms which, apart from their dark color, correspond most closely to *schreibersii* are *fuliginosus*, Nepal, forearm 46 mm.; *blepotis*, Java, forearm 44-45; *fuscus* and *yayeyamae* from Liu Kiu, forearm (both) 44; *eschscholtzii*, from Philippines, forearm 44; *oriana* from N. Australia, forearm also 44.

The skull of a topotype of *yayeyamae* (F.M. 47262)—but forearm only 41 mm.—agrees in virtually all particulars with those of *schreibersii*. That of *eschscholtzii* (M.C.Z. 35273), with forearm 44, possesses a fuller supraoccipital bulge and the posterior part of the crown of the skull rises higher. The internal molar cingula are more strongly developed and there are indications of a small cingulum cusp internal to the hypocone. I have no topotypical specimens of *blepotis* or *fuliginosus*. *Fuscus* and *yayeyamae* may be synonymous. *Oriana* appears to be closely related to *schreibersii*. Two very slightly smaller forms from Java, *medius*, with forearm 42 mm. and *ravus* forearm 43 (the latter with wider skull), appear also to belong here.

Chinensis Thomas is a larger species, with forearm 47-50 mm.; *japoniae* Thomas had the forearm 47 mm.; *parvipes* G. M. Allen had the forearm 48 mm. The skull of *parvipes* is obviously smaller than that of

¹ 1912, Mammals of Western Europe, pp. 274-275.

chinensis: $c-m^3$, 6.4:6.6; outer width across m^2-m^3 , 6.5:7.2. The cingulum cuspule internal from the hypocone is developed both in *parvipes* and in *chinensis*. *Japoniae*, judging from a photograph of the type skull, is very similar to *parvipes*.

A specimen from Japan, M.C.Z. 6922, is virtually identical with our material from Fukien. It differs from "*blepotis*" from Hainan by its smaller size and generally lighter build. Its forearm measures 46 mm. Skull: total length, 15.5; zygomatic breadth, 8.4; $c-m^3$, 6.0. The cingulum projection of m^2 is well developed as in *parvipes*.

Magnater Sanborn, the largest member of the *schreibersii* group, has the forearm = 51 mm. Though larger than *chinensis* it has the same type of dentition and the same development of the cingulum cuspule inwards from the hypocone. As in all the northern races, p_2-p_3 are equal in size. Compared with *tristis*, its sagittal crest and dentition are much weaker. It may be regarded as linking *tristis* to *chinensis*.

Tristis is one of the largest known species of *Miniopterus*. Waterhouse gave the length of the forearm as 2'' 1''' [about 53 mm.].

A specimen in alcohol from Calepan, Mindoro, Philippines, M.C.Z. 28300, apparently referable to *tristis* has been studied. The skull of this animal is strongly reminiscent of *robustior*. It possesses the high anterior premolar, characteristic of *robustior*. The cingulum cusp of m^2 is rather weak. The following measurements of the specimen were taken: forearm, 51 mm.; skull, condylocanine length, 17.7; zygomatic breadth, 10.5; width braincase, 9.0; mastoid width, 9.7; least intertemporal width, 4.2; outer width across canines, 5.6; across m^2-m^3 , 7.5; $c-m^3$, 7.9; width of m^2 , 2.2.

Robustior is apparently a species very distinct from the small *australis*—so much so that one cannot help but wonder whether the skin and skull were correctly associated. The skin of the type (B.M. 14.5.23.2) is but little larger than *australis*; the forearm only 40.5 mm. But the skull is much heavier. The high sagittal crest is essentially like the corresponding structure

present in *tristis* and my series from New Guinea: lower p_2 smaller than p_3 ; described in my notes as " $p_4 \frac{3}{4}$ height of c ; $p_3 \frac{2}{3}$ height of p_4 ; p_2 very slightly lower than p_3 ." The following are measurements of the type skull of *robustior* made by me in London in 1937: total length, 16.5 mm.; zygomatic breadth, 9.0; intertemporal width, 3.4; breadth of braincase, 7.3; mastoid width, 8.3; $c-m^3$, 6.4; m^1-m^3 , 3.75; m^1 , length \times width, 1.4×1.7 ; m^2 , 1.4×1.7 ; m^3 , 0.9×1.65 .

The series from New Guinea alluded to above was taken in Limestone caverns at Javareri, headwaters of the Musgrave River, Central Division, Papua; altitude 220 meters. It was believed to be a new species before examination of *tristis* had been made. But actually it appears to be inseparable from *tristis*. From *magnater* it differs by its high sagittal crest and small-sized anterior lower premolar.

The small-sized races of *Miniopterus* include *australis*, *wilkampi*, *tibialis*, *macrocneme* and *pusillus*—all with forearm 37–41 mm.; and in addition the tiny Philippine *paululus*, forearm, 35 mm.

Australis (M.C.Z. 29725) compared with *schreibersii* is, of course, much smaller; the basal phalanx of the thumb much shorter, 2.5:3.0, and weaker. In the skull the sagittal crest is virtually obsolete; palate relatively narrow; internal cingula developed but not inwardly projecting and without cuspule; lengths of inner sides of m^1 and m^2 nearly equal, respectively, 1.0:0.9 mm. (compare *schreibersii*, above); depth of upper canine cusp from cingulum, 0.6.

Wilkampi (one of Sody's original specimens, F.M. 47104) is closely similar to *australis*. Forearm, 38 mm.; m^2 perhaps a shade wider at the level of the hypocone than is the case in *australis*. Otherwise not separable.

Pusillus.—Specimens from Siam (M.C.Z. 35499) and a series from Hainan (e.g., A.M. 58413) marked "*pusillus*." These bats, with forearms 39–40 mm., have skulls distinguishable from those of *australis* only as the skull of *wilkampi* is: by slight widening of m^2 at the level of the hypocone. It seems that *pusillus* (if indeed these bats

are *pusillus*) should be treated as a race of *australis* and that *wilkampi* is a synonym of *pusillus*.

Tibialis, of which I have a photograph of the type skull, appears very like *australis* and identical to *paululus*. Tomes' description of the wing insertion appears to be erroneous.

A specimen, also from Amboina, marked "*tibialis*," M.C.Z. 28155, agrees more closely in my opinion with specimens from Mindoro referable to *paululus*, than with

our slightly larger *australis* from Australia and New Guinea. Its forearm only 36.5 mm.; c-m³, 5.3.

Macrocneme from Loyalty Islands is apparently synonymous with *australis*.

M. paululus (F.M. 47026) is a distinct race allied to *australis*, from which it differs chiefly by its smaller size (forearm, 36), and by the much smaller, shorter canines and anterior lower premolars. It is known only from the Philippine Islands (and Amboina?). Probably synonymous with *tibialis*.

ANNOTATED LIST OF NAMED FORMS OF EURASIAN *Miniopterus* Alphabetically arranged

australis TOMES, 1858, Proc. Zool. Soc. London, p. 125; 1871, Jour. Asiatic Soc. Bengal, p. 265.

TYPE LOCALITY.—Loyalty Islands.

MATERIAL.—Photo. of type, B.M. 54.5.19.5, ad. ♂, Loyalty Isles.

REMARKS.—The above is one of Tomes' original specimens (No. 2). In the lower jaw, p₂ and p₃ subequal. Measurements of co-type (1937): forearm, 38 mm.; total length of skull, 14.4; zygomatic width, 7.6; width of braincase, 7.1; c-m³, 5.6; m¹⁻³, 3.2; width m², 1.35.

This widely dispersed little species is represented by 26 skins and skulls in the Archbold collections. Twenty-two were taken by the Third Expedition near Hollandia, Dutch New Guinea; and two, which I secured at Sogeri, Papua, were taken in flight by whipping sticks back and forth across the fly-way.

blepotis TEMMINCK, 1841, Monogr. Mamm., II, p. 212.

TYPE REGION.—Java—also Banda, Amboina, Timor—Japan. (I propose restriction of the type locality to Java.)

MATERIAL.—Photo. of co-type, Leyden skull "e" from Java. The following additional co-types were seen at Leyden: "d," "f," "g," "h," from Java; "i," "j," "k," from Ceram; "l," "m," "n," from Amboina. I

suggest specimen "e" be named lectotype. Its description follows:

Braincase with slight sagittal crest; forearm, 44.5; (back of skull destroyed); zygomatic width, 9.5; interorbital width, 3.4; breadth of braincase, 7.0; c-m³, 5.85; m¹⁻³, 3.3; m¹, crown area, 1.3 × 1.4; m², 1.35 × 1.6; m³, 0.75 × 1.65.

Restriction of the type region of *blepotis* to Java makes the single specimen from Cheribon, Java, in the Archbold collection topotypical. I have been unable to separate four individuals from the adjoining island of Bali and one from South Celebes from the individual from Java.

chinensis THOMAS, 1908, Proc. Zool. Soc. London, p. 638.

TYPE LOCALITY.—30 miles west of Peking, China.

MATERIAL.—Photo. of type, B.M. 8.8.7.5, ad. ♀.

REMARKS.—My only measurement of the type is forearm, 48 mm. *Chinensis* appears to be a large race of *schreibersii*, dark in color as are all eastern forms. I have not seen a skull of this race.

eschscholtzii WATERHOUSE, 1845, Proc. Zool. Soc. London, p. 4.

TYPE REGION.—Philippines.

REMARKS.—I did not see the type of this bat in London. Waterhouse gave the forearm length as 1" 9" (45

mm.). It is a small race closely related to *blepotis*. The skull (of M.C.Z. 35273) shows the posterior part of m^2 widened at the inner cingulum, level with the hypocone; lower p_2 - p_3 equal; $c-m^3$, 6.1 mm., forearm (Waterhouse) 1" 9''' (44.5 mm.).

fuliginosus HODGSON, 1835, Jour. Asiatic Soc. Bengal, IV, p. 700.

TYPE REGION.—Nepal.

REMARKS.—"Wholly sooty brown. Ears, lips, muzzle as last [*Myotis formosus*] face sharp, but rostrum somewhat recurved, owing to concave bend of nasal bones . . . ; teeth $\frac{2.2}{6}$, $\frac{1.1}{1.1}$, $\frac{5.5}{6.6}$. In size somewhat less than *formosus*" [*M. formosus*, forearm, 48].

The type specimen not seen by me. A specimen from Ceylon, M.C.Z. 27521, is labeled *fuliginosus*, but due to the remoteness of Ceylon from Nepal this specimen cannot safely be employed in the present discussion. In it $c-m^3 = 5.9$; p_2 is slightly lower than p_3 ; no cingulum cusp is developed on m^2 - m^3 .

fuscus BONHOTE, 1902, Novit. Zool., IX, p. 626.

TYPE REGION.—Liu Kiu Isles.

MATERIAL.—Photo. of type, B.M. 2.10.7.3, ad. ♂.

REMARKS.—"Approaching in size most nearly to *M. pusillus* of the Nicobars." I measured the forearm of the type, 44 mm. I suspect *fuscus* to be virtually equal to *blepotis* (Java) and *eschschoitzii*.

inexpectatus HEINRICH, 1936, Mitt. g. Naturwiss. Inst. Sofia, IX, p. 34.

TYPE REGION.—Bulgaria.

REMARKS.—Described as race of *schreibersii*. Not likely to differ from true *schreibersii*.

italicus DAL PIAZ, 1926, Atti. Accad. Sc. Ven.-Trent.-Istria, XVI, p. 61.

TYPE REGION.—Liguria, Italy.

REMARKS.—Described as race of *schreibersii*. Probably equal to *ursinii*. Forearm, 47 mm.

japoniae THOMAS, 1905, Proc. Zool. Soc. London, p. 338.

TYPE REGION.—Japan.

MATERIAL.—Photo. of type, B.M. 6.1.4.22, ad. ♂.

REMARKS.—Described as race of *schreibersii*. Forearm measured by me, 47 mm. Probably very closely related to *parvipes*.

macrocneme REVILLIOD, 1913, in Sarasin and Roux, Nova Caledonia, Zool., (1) IV, p. 360.

TYPE REGION.—New Caledonia and Loyalty Isles.

REMARKS.—Forearm, 39.7; $c-m^3$, 5.5 (Revilliod). Apparently equal to *australis*.

magnater SANBORN, 1913, Field Mus. Nat. Hist., Zool. Ser., XVIII, No. 2, p. 26.

TYPE LOCALITY.—Sepik River, New Guinea.

REMARKS.—Described as race of *schreibersii*. A large form, of the same approximate size as *tristis*, but lacking the high sagittal crest, and with p_2 and p_3 nearly equal. Forearm, 48.4–51.4 mm.

Two specimens of this large form of *Miniopterus* obtained by the Third New Guinea Expedition from the neighborhood of the Upper Idenburg River extended the range 250 miles to the west of the type locality on the Sepik River.

medius THOMAS and WROUGHTON, 1909, Proc. Zool. Soc. London, p. 382.

TYPE REGION.—Java.

MATERIAL.—Photo. of type, B.M. 9.1.5.464, ad. ♀.

REMARKS.—"In size between *blepotis* and *tibialis*." Equal to or barely separable from *blepotis* (as now restricted to Java). Forearm 42 mm.

orianae THOMAS, 1922, Ann. Mag. Nat. Hist., (9) X, p. 616.

TYPE LOCALITY.—Darwin, North Australia.

MATERIAL.—Photo. of type, B.M. 22.10.8.1, ad. ♂.

REMARKS.—"Pale brown . . . not quite as dark as Sayal brown . . . head faintly grayer than back . . . forearm, 44 mm. . . . skull, greatest length, 15.2; breadth of braincase, 8.2."

In the lower jaw, p_2 and p_3 sub-

equal. Probably closely allied to *blepotis*. Forearm, 43; total length of skull, 15.5, zygomatic breadth, 8.8; interorbital breadth, 3.4; breadth of braincase, 8.0; c-m³, 6.0; m¹⁻³, 3.4; crown areas of molars, m¹, 1.4 × 1.4; m², 1.4 × 1.6; m³, 0.9 × 1.7.

The 43 specimens in the Archbold collection come from that part of Queensland adjoining the railroad out of Townsville. They conform closely to Thomas' description of *orianae* from Darwin.

orsinii TEMMINCK, 1841, Monogr. Mamm., II, p. 179.

TYPE REGION.—Italy.

REMARKS.—Apparently a synonym of *schreibersii*. Temminck gave the forearm length as 44 mm. Transliteration from *ursinii* (?). Forearm, 44 mm.

pallidus THOMAS, 1907, Ann. Mag. Nat. Hist., (7) XX, p. 197.

TYPE REGION.—South coast of Caspian Sea, N. Persia.

REMARKS.—Described as race of *schreibersii*. "Similar to *schreibersii* in all essential respects, but the general color is paler, approximately to Ridgway's 'wood brown,' while *schreibersii* is rather closer to 'broccoli-brown' . . ." Forearm, 46.5 mm.

parvipes G. M. ALLEN, 1923, Amer. Mus. Novit., No. 85, p. 7.

TYPE REGION.—Fukien, China.

REMARKS.—Described as race of *schreibersii*, the type specimen, A.M.N.H. 44656, has comparatively small skull and long forearm (48 mm.). Lower two anterior premolars equal. *Parvipes* ought to be compared with *fuliginosus* from Nepal.

paululus HOLLISTER, 1913, Proc. U. S. Nat. Mus., XLVI, p. 311.

TYPE LOCALITY.—Guimaras Is., Philippines.

REMARKS.—The smallest known species of *Miniopterus*. Type not seen. Forearm (Hollister), 35 mm. Skulls of specimens from Mindoro (e.g., M.C.Z. 35134) showed a form re-

lated to *australis*, with p₂₋₃ subequal. Condylar-canine length, 12.1; zygomatic breadth, 7.2; breadth of braincase, 7.0; c-m³, 5.3; m¹⁻³, 3.0; width m¹, m² = 1.2, 1.3. Widening of molar cingula incipient.

pusillus DOBSON, 1876, Monogr. Asiatic Chiropt., p. 162.

TYPE LOCALITY.—Madras, India.

REMARKS.—Described as variety of *schreibersii*. No information about the type specimen. Dobson gave the forearm length as 1'' 6 (40.6 mm.). Specimens from China and southwards have been referred to it. Probably it should be treated as a subspecies of *australis*.

ravus SODY, Natuur. Tijdschr. Ned.-Indie, XC, p. 271.

TYPE REGION.—Central Java.

MATERIAL.—Photo. of type, Sody, Amsterdam.

REMARKS.—Mr. Sody allowed me to make notes upon the type of *ravus*. The skull is broader and heavier than Temminck's *blepotis*, specimen "e"; forearm, 43 mm.; total length of skull, 16.1; zygomatic width, 9.0; breadth of braincase, 8.2; c-m³, 6.2; the crown dimensions of the teeth, m¹, 1.3 × 1.4; m², 1.35 × 1.6; m³, 0.75 × 1.65.

robustior REVILLIOD, 1913, in Sarasin and Roux, Nova Caledonia, Zool., (1) IV, p. 359.

TYPE LOCALITY.—Loyalty Isles.

MATERIAL.—Photo. of co-type, B.M. 14.5.23.2, ad. ♀.

REMARKS.—Described as race of *australis*, but the peculiar characters of the skull indicate no close relationship to that species. See discussion *antea*.

schreibersii KÜHL, 1819, Ann. Wetterau. Gesellsch. Naturk., IV, pt. 2, p. 185.

TYPE REGION.—Hungary.

REMARKS.—Genotype of *Miniopterus*. Type probably not in existence. Miller gives forearm 44-46 mm. But in original description it was stated to be 1'' 7½''' (41 mm.).

This may be due to the use of a longer "inch" at that time. Observations made in this paper are based upon Russian material.

tibialis TOMES, 1858, Proc. Zool. Soc. London, p. 126.

TYPE LOCALITY.—Amboina.

MATERIAL.—Photo. of topotype, B.M. 7.1.1.557.

REMARKS.—The original is supposedly at Leyden. Tomes gave the forearm as 1' 6½''' to 1' 7''' (39–40 mm.). The forearm of the B.M. topotype measures only 36 mm. *Tibialis* probably equals *paukulus*, unless Tomes was right about the insertion of the wing membrane.

tristis WATERHOUSE, 1845, Proc. Zool. Soc. London, p. 3.

TYPE REGION.—Philippines.

REMARKS.—The largest known species of *Miniopterus*. Type not seen. Waterhouse gave the forearm as 2' 1''' (52–53 mm.). Hollister recorded one specimen. *Tristis* represents a distinct group of *Miniopterus* with high anterior sagittal crest and reduced anterior lower premolar.

The interesting recurrence of this rare species in the Archbold collections from the upper Kemp Welch River, Papua, has been announced in the text. I had time to preserve only ten specimens, but the lime-

stone caverns from which they were taken contained hundreds of the animals.

ursinii BONAPARTE, 1837, Fauna Italica, fasc. 21.

TYPE REGION.—Italy.

REMARKS.—The type of the genus by monotypy. *Ursinii* is considered synonymous with *schreibersii*.

wilkampi SODY, 1930, Natuur. Tijdschr. Ned-Indie, XC, p. 272.

TYPE REGION.—East Borneo.

MATERIAL.—Photo. of type, Sody, Amsterdam.

REMARKS.—I find no important difference between *wilkampi* and the small bats of China and Malaya currently referred to *pusillus* of India. Both *pusillus* and *wilkampi* are without question closely related to *australis*. Forearm of type, 36.5 mm.; total length of skull, 14.2; zygomatic breadth, 7.5; breadth of braincase, 7.2; c-m³, 5.4; m¹⁻³, 3.3; width of m¹, m², 1.2, 1.3.

yayeyamae KURODA, 1924, "Tokyo," p. 6.

TYPE REGION.—Liu Kiu Isles.

REMARKS.—Described as race of *fuscus*, it may well be a synonym. Both had forearms 44 mm. Kuroda gives c-m³, 6.0 mm. In topotype specimens F.M. 47262–47263 the forearms, being broken just below the elbow cannot be measured.

MURININAE

In this small subfamily the rostrum is relatively massive and rises uniformly to merge with the moderately inflated braincase. The palate extends unusually far back beneath the pterygoid fossa.

In the dentition peculiar features occur: The outer upper incisor is enlarged and (except in *Harpiocephalus*) is as tall as the inner one. Although p² (or p³) is obsolete, the functioning anterior premolar is still proportionally as large as in *Kerivoula* (except *aurata*) and shows little tendency to become reduced in size as in *Myotis*; in m³ the posterior commissure is obsolete and the body of the tooth is much shortened

longitudinally (as in *Scotophilus*, etc.). In *M. hilgendorfi* m³ is somewhat narrowed so that its outer border in the toothrow does not quite line up with the outer margins of m¹ and m²; and in *Harpiocephalus* the entire tooth is obsolescent. In the lower jaw the incisors are imbricated (except in *aurata*) and are equal in size; the premolars, reduced to two, are unequal; the talonid of m₃ is reduced (in *Harpiocephalus* all talonids are reduced).

The skins show certain special characters. Ear broad, as in *Kerivoulinae*; inter-femoral membrane hairy. The wing membrane may be attached to distal phalanx of

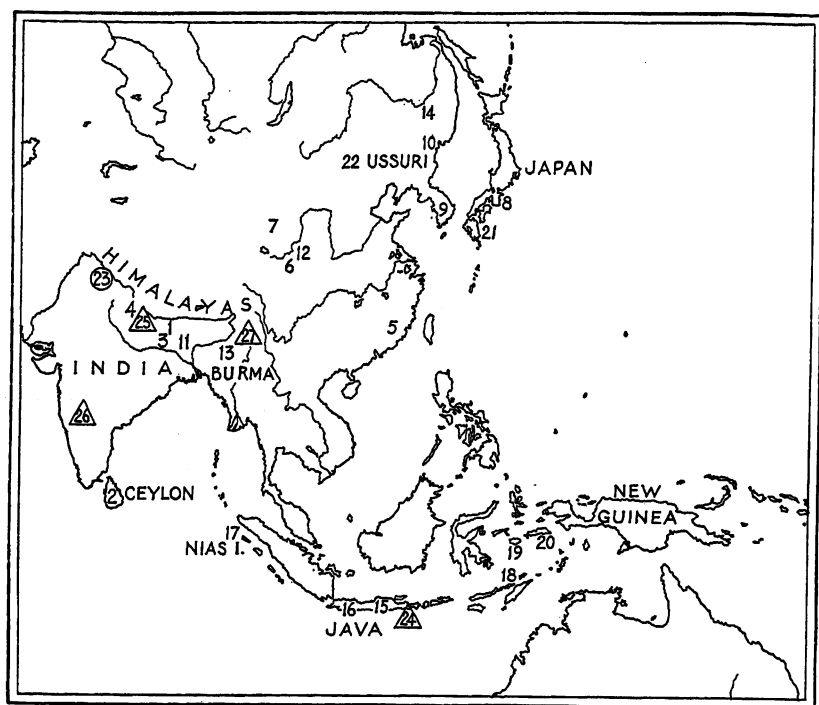


Fig. 2. Type localities of Murininae.

Murina: 1. *cyclotis*; 2. *eileenae*; 3. *huttoni*; 4. *tubinaris*; 5. *rubella*; 6. *leucogaster*; 7. *sibirica*; 8. *hilgendorfi*; 9. *intermedia*; 10. *ognevi*; 11. *rubex*; 12. *aurata*; 13. *feae*; 14. *ussuriensis*; 15. *suilla*; 16. *balstoni*; 17. *canescens*; 18. *florium*; 19. *toxopei*; 20. *lanosa*; 21. *puta*; 22. *fuscus*.
Harpiola (in circles): 23. *grisea*.
Harpiocephalus (in triangles): 24. *harpia*; 25. *lasiurus*; 26. *madrastus*; 27. *mordax*.
 Type locality of *pearsoni* not determined.

1st digit; thus apparently representing the extreme of this particular adaptation attained in Vespertilionidae. The tubular character of the nostrils is analogous to the condition as seen in *Nyctimene* of the Pteropodidae.

The range of the family Murininae is mainly restricted to the tropics and sub-tropics of Asia and the Indo-Australian archipelago, but in Eastern Asia reaches Japan and Ussuri (Fig. 2). Its absence from Africa, Australia and America suggests that it may have evolved as a local offshoot of the Vespertilionidae. Miller (1907) regarded it as a "specialized offshoot from some low, *Myotis*-like Vespertilionine form."

The Murininae are now divided into three genera: *Murina*, *Harpiola* and *Harpiocephalus*. Most of the species are con-

tained in *Murina*. The two latter genera appear to be specialized offshoots from the stem leading to *Murina*.

MURINA GRAY

Murina GRAY, 1842, Ann. Mag. Nat. Hist., X, p. 258.

GENOTYPE.—*Vespertilio suillus* Temminck.

Under Dobson's classification (1878) all Murininae recognized by him (six species) were placed in *Harpiocephalus*, which was divided into two subgenera: *Murina* and *Harpiocephalus*. *Murina* which has page precedence over *Harpiocephalus* ought to have been employed as the name for the full genus.

Miller in 1907 recognized *Murina* and *Harpiocephalus* as separate genera. All species except *H. harpia* were held in *Murina*.

Thomas in 1915 erected *Harpiola* to accommodate the peculiar species *grisea*. All remaining species were left in *Murina*.

At the present no less than twenty-two named forms have been referred to the genus *Murina*, after restriction by separation of *Harpiocephalus* and *Harpiola*.

The following is a more or less artificial key to the species of *Murina*.

- 1.—Species with anterior premolar but little smaller than *c* and *p*⁴; tooththrows but slightly convergent in front (outer width *c-c*: outer width *m*³⁻³ = 78 to 82 per cent).
 - a. Small species with forearm 30–32 mm. *cyclotis*, *eileenae*.
 - b. Medium-sized species with forearm 34–37 mm. *huttoni* (= *tubinaris*?), *rubella*.
- 2.—Species with anterior premolar markedly smaller than *c* and *p*⁴; tooththrows distinctly convergent in front (outer width *c-c*: outer width *m*³⁻³ = 65–75 per cent).
 - a. Rostrum deep and massive; species of large size (forearm, 40–43 mm.).
leucogaster, *sibirica*, *hilgendorfi*, *intermedia*, *ognevi* and possibly *rubex*.
 - b. Rostrum not extremely massive; species moderate to small in size.
 - (1) Extremely small forms with short canines (forearm, 28–32 mm.)
... *aurata*, *feae*, *ussuriensis*.
 - (2) Small forms (forearm, 30–32), with canines normal.
... *suilla*, *balstoni*, *canescens*.
 - (3) Medium-sized forms (forearm, 35–38 mm.) with canines normal.
... *florium*, *toxopei*, *lanosa*.

Remarks upon selected species of *Murina*

The smallest species of *Murina* is *aurata* Milne-Edwards, from Eastern Tibet, forearm, 28 mm. If the illustration (Pl. 37c, fig. 2a) can be relied upon, *aurata* has quite small canines, the lower canine in particular, and the anterior premolars are but half the size of *p*⁴. The crowns of the lower incisors are drawn very much lower proportionately than those shown on the same plate for *M. leucogaster*.

A specimen marked *aurata* from Szechwan, F.M. 37254, has gray pelage with light bronzy tips, underparts gray with whitish tips; membrane to claw-bearing phalanx of toe. Forearm, 27 mm.; tibia, 12; basal phalanx of thumb, 4; skull with low ro-

strum rising abruptly to paired frontal swellings; rostral and palatal sinus shallower than wide; tooththrows convergent in front; canines, upper and lower as small as (lower *c* smaller) *p*⁴; *p*² much smaller than *p*⁴. Condylar-canine length, 11.8; zygomatic breadth, 7.5; *c-m*³, 4.3; width of body of *m*², 1.1.

Feae from Burma, forearm 29 mm., was regarded by Thomas as an ally of *aurata*. *Ussuriensis* Ognev with forearm length 31 to 32 mm. is another possible relative of *aurata*. All other described northern *Murina* (*hilgendorfi* and *leucogaster*) are considerably larger, their forearms near 40 mm.

The "suilla group" (Thomas¹) is here held to include *suilla*, *balstoni* and *canescens*, small forms with forearms 30 to 32 mm., and *florium*, *toxopei* and *lanosa*, larger bats with forearms 35 to 38 mm. The group is distinguished from *cyclotis* by its broad molars and by the greater degree of convergence of the tooththrows anteriorly.

Cyclotis and the closely allied *eileenae* have smaller teeth and tooththrows subparallel. *Cyclotis* seemingly appears with two color phases. I have before me strongly rufescent specimens from Laos, Indo-China (F.M. 32205–32206) and a gray specimen from Gangfang, Burma (A.M. 114848). I can perceive no other differences.

Leucogaster and its race *sibirica* are larger species with the forearms 40 to 41 mm. Probably *hilgendorfi* and subspecies *intermedia* and *ognevi* which have short, massive rostra, should all be included with the *leucogaster* division. They are also large northern forms with forearms 41 to 43 mm. It is probable too that the large-sized *rubex* from Darjiling, forearm 41, is a southern relative of *leucogaster*.

I have not seen the description of *puta* Kishida. The bat may be expected to show relationship either with the *aurata* group or with *hilgendorfi*. A specimen (M.C.Z. 19365) from Japan, with forearm 32 mm., identified as *ussuriensis*, may represent *puta*.

¹ 1910, Ann. Mag. Nat. Hist., (8) V, p. 534.

ANNOTATED LIST OF THE DESCRIBED FORMS OF EURASIAN *Murina*

- aurata* MILNE-EDWARDS, 1872, Mamm. du Tibet, p. 250.
 TYPE REGION.—"Eastern Tibet."
 REMARKS.—"Forearm, 28 mm.; tibia, 14; . . ." The smallest known species of *murina*.
- balstoni* THOMAS, 1908, Ann. Mag. Nat. Hist., (8) II, p. 370.
 TYPE REGION.—Java.
 MATERIAL.—Photo. of skull of type, B.M. 9.1.5.354.
 REMARKS.—"Allied to *M. suilla* Temminck . . . but distinguished by [5 characters] . . . forearm, 31 mm. . . . front of canine to back of m³, 4.8. . . ."
- canescens* THOMAS, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 254.
 TYPE LOCALITY.—Nias Island, Sumatra.
 MATERIAL.—Photo. of skull of type, B.M. 23.1.2.28.
 REMARKS.—"Nearly allied to *suillus* and *balstoni* . . . forearm, 29.5; . . . skull, greatest length, 14.2; basi-sinual length, 10.2; breadth of braincase, 7.4."
- cyclotis* DOBSON, 1872, Proc. Asiatic Soc. Bengal, p. 210; 1873, Jour. Asiatic Soc. Bengal, II, p. 206; 1876, Monogr. Asiatic Chiropt., p. 158; Cat. Chiropt. Brit. Mus., p. 282.
 TYPE LOCALITY.—Darjiling, India.
 MATERIAL.—Photo. of skull of type, B.M. 9.4.4.4.
 REMARKS.—Compared with *M. suillus*. "The tragus . . . is considerably longer than [that of *suillus*] and tapers to a fine point. Wings attached to outer toe as far as the base of the claw . . . this distinguishes . . . from *grisea* in which the wing membrane extends only as far as the base of the first phalanx . . . first and second premolars in the upper jaw . . . nearly equal in size, the first being slightly smaller than the second . . . forearm, 1.3 [inches, = 32 mm.]. . . ."
- eileenae* PHILLIPS, 1928, Ceylon Jour. Sci., B., 16, 3, p. 329.
 TYPE REGION.—Ceylon.
- MATERIAL.—Photo. of skull of type, B.M. 31.9.4.2.
 REMARKS.—"Very closely resembles *M. cyclotis* of India . . . Forearm, 30; toothrow, 4.5." Dobson recorded "*cyclotis*" from Ceylon.
- feae* THOMAS, 1892 (1891), Ann. Mus. Civ. Stor. Nat., Genova, (2) X, pp. 913-926.
 TYPE LOCALITY.—Karin Hills, Burma.
 REMARKS.—"Allied to *H. auratus* Milne-Edwards, but distinguished by the color being brown instead of golden yellow. . . . Anterior premolar very markedly shorter than the canine . . . forearm, 29 mm."
- florium* THOMAS, 1908, Ann. Mag. Nat. Hist., (8) II, p. 371.
 TYPE REGION.—Flores, Dutch East Indies.
 MATERIAL.—Photo. of skull of type, B.M. 63.12.26.14.
 REMARKS.—"Essential characters as in *M. suilla* . . . forearm, 35; . . . front of canine to back of m³, 5.3. . . . " Also zygomatic breadth, 8.7; inter-orbital breadth, 4.3; breadth of braincase, 7.6.
 Two species in the Archbold collection from Peling Island, east of Celebes, conform closely to the description of *florium*.
- fusca* SOWERBY, 1922, Jour. Mamm., III, 1, p. 46.
 TYPE REGION.—Manchuria.
 REMARKS.—Described as race of *huttoni*. " . . . forearm, 40 . . . upper toothrow, exclusive of incisors, 5.6. . . . " I have not been able to place this form.
- hilgendorfi* PETERS, 1880, Monatsber. Akad. Wiss. Berlin, p. 24.
 TYPE REGION.—Yeddo, Japan.
 MATERIAL.—M.C.Z. 37686 from Nagano, Japan.
 REMARKS.—" . . . first upper premolar much smaller than second . . . brownish gray, below pale; . . . forearm, 41."
 Peters' plate shows detailed drawings of skin and skull. Readily sep-

arated from the *suilla* group on account of its much greater size. A specimen from Japan (M.C.Z. 37686) differs chiefly by its greater size, more massive rostrum and lower braincase; forearm, 41; basal phalanx of thumb, 6.0; interorbital width, 5.0; $c-m^3$, 6.5; m^1-m^3 , 3.5; width of m^2 , 1.5. The membrane extends only to the end of the metatarsus.

huttoni PETERS, 1872, Monatsber. Akad. Berlin, p. 257; 1872, Proc. Zool. Soc. London, p. 711.

TYPE LOCALITY.—Dehra Doon, N. W. Himalaya.

MATERIAL.—Photo. of skull of type, B.M. 79.11.21.685.

REMARKS.—“Much smaller than *harpia* [*Harpiocephalus*]. Ears distinctly larger, broader . . . upper premolars clearly smaller . . . so that the first molar is not smaller but larger than the second premolar . . . forearm, 35. . . .”

“Dobson assigned *M. huttoni* to Milne-Edwards' *M. leucogaster*, but that animal is very considerably larger, its forearm 41 mm., and its skull (as figured) 20 mm.” (Thomas, 1914, Ann. Mag. Nat. Hist., (8) XIII, p. 441.)

intermedia MORI, 1933, Jour. Chosen Nat. Hist. Soc., XVI, p. 5.

TYPE REGION.—Korea.

REMARKS.—Described as race of *hilgendorfi* of Japan. “. . . forearm, 41.5 . . . skull, condylobasal length, 18.2; zygomatic breadth, 9.3; interorbital constriction, 5; breadth braincase, 8; upper toothrow, 6.2. . . .”

lanosa THOMAS, 1910, Ann. Mag. Nat. Hist., (8) V, p. 534.

TYPE REGION.—Ceram, Dutch East Indies.

MATERIAL.—Photo. of skull of type, B.M. 10.3.4.24.

REMARKS.—“*M. suilla* group, larger and more hairy . . . forearm, 37.5; . . . skull, greatest length, 17.1; basi-sinual length, 13; zygomatic breadth, 9.25; breadth of braincase,

8.1; front of canine to back of m^3 , 5.6.”

“Of the four species of the *suilla* group [*suilla*, *florium*, *balstoni*, *lanosa*], this is the largest. . . .”

leucogaster MILNE-EDWARDS, 1871, Nouv. Arch. Mus., VII, p. 91; 1872 Mamm. du Tibet, p. 250.

TYPE REGION.—Moupin.

REMARKS.—“ . . . large species . . . red brown above, white beneath (1871); ad. ♂ . . . forearm, 41; tibia, 17 . . . (1872).” Anterior premolars much smaller than posterior ones (see Milne-Edwards, plate 37c, fig. 3a).

ognevi BIANCHI, 1916, Annuaire Mus. Zool. Acad. Sci., XXI, pp. lxxiii-lxxxii.

TYPE LOCALITY.—Vladivostok, Siberia.

REMARKS.—Subspecific name applied to *M. hilgendorfi* subsp., referred to by Ognev, 1913.

“Membrane to base of toe . . . tragus straight . . . first upper incisor equal in height to second . . . forearm, 42.3. . . .” (Ognev, 1928).

puta KISHIDA, 1924, Dubuts. Zasshi, XXX-VI, pp. 30-49, 127-139.

TYPE REGION.—Japan (?).

REMARKS.—*Incertae sedis*. Description not seen.

rubella THOMAS, 1914, Ann. Mag. Nat. Hist., (8) XIII, p. 440.

TYPE REGION.—Fukien.

MATERIAL.—Photo. of skull of type, B.M. 8.8.11.6.

REMARKS.—Described as race of *huttoni*. “. . . forearm, 37.5 . . . skull, greatest length, 18.2; basi-sinual length, 13.7; front of canine to back of m^3 , 6.2.”

rubex THOMAS, 1916, Jour. Bombay Nat. Hist. Soc., XXIV, p. 639.

TYPE REGION.—Darjiling, India.

MATERIAL.—Photo. of skull of type, B.M. 16.3.25.111.

REMARKS.—“Largest of the Indian species, only equaled by the Japanese *M. hilgendorfi* . . . forearm, 41 . . . skull, greatest length, 18.5; basi-sinual length, 14; zygomatic breadth, 10.2.”

sibirica KASTSCHENKO, 1905, Observ.

Mamm. W. Siberia and Turkestan, pp. 102, c-h.

TYPE REGION.—Tomsk.

REMARKS.—Described as subspecies of *M. leucogaster*.

"Membrane to base of toe . . . forearm, 40; . . . first upper incisor equal in height to second . . . tragus bent slightly . . ." (Ognev, 1928).

suilla TEMMINCK, 1839, Monogr. Mamm., II, p. 224.

TYPE REGION.—Java.

MATERIAL.—Photo. of skull of co-type, Leyden, specimen "b."

REMARKS.—"Head elongate, terminated by prominent narial tubes . . . tragus long, filiform, pointed; membranes . . . attached to feet . . . to the claw-bearing phalanx . . . all interfemoral membrane . . . covered with hair but more abundant near coccyx . . . forearm, 1" [25.5 mm.]. The forearm of co-type "b" at Leyden measured 30.5 mm. The following are skull measurements of co-type "b": total length, 14.9; condylobasal length, 12.9; zygomatic breadth, 8.7; inter-orbital breadth, 4.4; breadth of braincase, 7.4; breadth at mastoid, 7.3; breadth of pterygoid fossa, 1.7; c-m³, 4.7; m¹⁻³, 3.0; breadth of m², 1.25; width inside m¹⁻¹, 2.15.

This species must be comparatively rare. The Archbold collection contains but a single specimen, from Borneo, which, however, appears not to differ from Javanese material.

toxopei THOMAS, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 254.

TYPE LOCALITY.—Buru Island, Dutch East Indies.

MATERIAL.—Photo. of skull of type, B.M. 23.1.2.27.

REMARKS.—"Nearly allied to *florium* . . . forearm, 35 . . . skull, greatest length, 17; basi-sinual length, 12; c-m³, 5.6. . ."

tubinaris SCULLY, 1881, Proc. Zool. Soc. London, p. 200.

TYPE LOCALITY.—Gilgit, Kashmir.

REMARKS.—Described as *Harpiocephalus* and compared with *suillus*. "Outer

incisor distinctly shorter than the inner, and does not touch the canine. The first upper premolar is smaller than the second; but there is no such disproportion in size between these teeth as obtained in *suillus* . . . forearm, 1"4 [34 mm.]."

ussuriensis OGNEV, 1911, Annuaire Mus. Zoöl., Acad. Imp. Sci. St. Petersburg, XVIII, p. 402.

TYPE REGION.—Usuri, Siberia.

REMARKS.—" . . . second, outer incisor of upper jaw is markedly smaller than first, inner. First upper premolar one-half smaller than second . . . forearm, 32. . . wing to distal part of toe, virtually to the claw" (Ognev, 1928).

HARPIOLA THOMAS

Harpiola THOMAS, 1915, Ann. Mag. Nat. Hist., (8) XVI, p. 309.

GENOTYPE.—*Murina grisea* Peters

Specialized on account of the reduced size of the metacone (scarcely higher than paracone) and the proportionally greater size of the teeth, especially of the canines. Primitive in that the wing membrane is attached to the base of the digit, as in many Vespertilioninae instead of to the claw-bearing phalanx, as in *Murina* proper.

The only known form is the type species, *grisea*.

grisea PETERS, 1872, Monatsber. Akad. Berlin, p. 258; 1872, Proc. Zool. Soc. London, p. 711.

TYPE LOCALITY.—Jeripanee, N. W. Himalaya, 5500 feet.

MATERIAL.—Photo. of skull of type, B.M. 79.11.21.117.

REMARKS.—"Upper tooththrow 6.3 mm. . . first incisor much longer than broad . . . first premolar almost as large as canine and only a little smaller than second . . . forearm, 33. . ."

HARPIOCEPHALUS GRAY

Harpiocephalus GRAY, 1842, Ann. Mag. Nat. Hist., (1) X, p. 259.

GENOTYPE.—*H. rufus* Gray = *Vespertilio harpia* Temminck.

This genus, according to Miller (1907), is

a highly modified derivative of the less specialized *Murina*. It was then monotypic. In 1924 Thomas¹ recognized three races of *harpia* and proposed a second, larger species, *mordax*.

Harpiocephalus, according to Miller, is distinguished, among other characters, by the prominence of the metacone at the expense of the reduced protocone and paracone, and by the extreme reduction of the last molar "to a mere scale. . . . This genus appears to be one of the most aberrant of the Vespertilionidae."

Remarks on specimens of *Harpiocephalus*

The following notes were drawn up from a near topotype of *Harpiocephalus harpia*, from Buitenzorg, Java, U.S.N.M. 154681, ♀: skin clear orange rufous, below buffy; skull with well-developed sagittal crest, higher behind than in front; intertemporal region tubular; rostrum short and broad, with distinct median depression; supra-orbital ridges short but prominent; ante-orbital foramen large (diameter, 1 mm.), placed close to orbital fossa; zygomata heavy, deep (1.4 mm.); mandible deep, massive, with high coronoid.

Anterior teeth very heavy and massive, even the incisors; canines greatly broadened, the thickness (inside to outside) 2.1 mm.; thickness of canines, premolars, m^1 and m^2 at cingulum level nearly constant from front to back; widths at bases (cingula) c , 2.0 mm.; p^2 , 1.9; p^4 , 1.8; m^1 , 2.0; m^2 , 2.0. The width of the obsolescent m^3 is 0.8. Reduction of the protocone of m^{1-2} is marked. The hypocone is absent. Interdental embrasures nearly closed by extensive lobes expanding from internoposterior part of each premolar and m^1 . In lower jaw widths of teeth are: c , 1.7; p_2 , 1.5; p_4 , 1.5; m_1 , 1.4; m_2 , 1.25; m_3 , 1.0. The internal and external cingula of the lower canine turn upwards and meet in an inverted V, into the hollow of which i_3 is pressed.

Forearm, 48 mm.; condylo-canine length of skull, 19.0; zygomatic breadth, 13.5; interorbital breadth, 7.2; least inter-

temporal breadth, 5.6; outer width across canine, 6.7; across m^{2-3} , 7.3; $c-m^3$, 7.0.

A specimen, labeled *H. lasiurus*, from Darjiling, southern foothills of the eastern Himalayas, M.C.Z. 32973, is at best a weak subspecies of *harpia*. The measurements, forearm length and $c-m^3$, are identical to those of the topotype described above; variations from other dimensions given above are negligible in amount; the teeth are very slightly heavier. If this specimen truly represents *lasiurus*, of whose type the forearm length was "1 $\frac{3}{4}$ inches" (44-45 mm.) then I believe *lasiurus* ought to be synonymized with *harpia*.

The massive character of the dentition of these bats suggests that their food may be different from that of most other Vespertilionidae, which live for the most part upon small flying insects which they masticate with their delicate, high-cusped teeth.

Note on the co-types of *Harpiocephalus harpia*

Two specimens ("a," "b") were brought me at Leyden as the "co-types" of *H. harpia* Temminck: specimen "a" from Mt. Gédé was accompanied by a cleaned skull; specimen "b," collected by S. Müller. Notes were made on specimen "a" only. Its skull was photographed. It becomes clear, upon later study of photograph and notes, that the skull was that of *Myotis* sp., and not a *Harpiocephalus* at all. Proof lies in my notes. "Skull rather low; no trace of nasal depression; back of anterior narial opening V-shaped . . . premolars three . . . p^4 large, intermediate in height between c and m^1 ; p^2 and p^3 both pushed slightly to inner side of toothrow and both quite small; p^2 less than half height of p^4 and p^3 half height of p^2 . . .," etc.

Regarding the skin, I noted the following: "A large-sized Vespertilionid with broad ears and simple, spatulate tragus; feet densely hairy; present color light cinnamon-brown above, brownish buff beneath . . . length of head and body, 68 mm.; tail, 50 =; forearm, 50; ear, 13." The only distinctly Murinae character in the above is "feet densely hairy." No mention

¹ Jour. Bombay Nat. Hist. Soc., XXIX, pp. 88-89.

was made of the uropatagium or the tubular nostrils. In view of the undoubted error in the skull it would be well for the authorities at Leyden to decide whether the specimen in question is actually the type of

Temminck's *harpia* or not. Temminck's original description and figures unquestionably indicate the kind of bat which we now name *Harpiocephalus harpia* and not a species of *Myotis*.

SYNOPTIC LIST OF DESCRIBED FORMS OF *Harpiocephalus*

harpia TEMMINCK, 1839, Monogr. Mamm., II, p. 219.

TYPE LOCALITY.—Mt. Gédé, Java.

MATERIAL.—Photo. of co-type, Leyden, skull "a."

REMARKS.—Forearm, 1" 7 to 8" [42 mm.].

lasiurus HODGSON, 1847, Jour. Asiatic Soc. Bengal, p. 896.

TYPE REGION.—"Central Hills, sub-Himalayas."

REMARKS.—Dobson placed this name in synonym of *harpia*. "Described under *Noctilinia*. . . Forearm, 1³/₄ inches" [44 mm.]. Thomas (1924) treated it as a race of *harpia*. Forearm, 43.5 mm.

madrasius THOMAS, 1924, Jour. Bombay Nat. Hist. Soc., XXIX, p. 88.

TYPE LOCALITY.—Palni Hills, S. India.

REMARKS.—Described as race of *harpia*. "Forearm longer than in the other subspecies . . . 53.5 and 52 mm., as against 49.5, 50.0 and 50.5 in Javan females."

mordax THOMAS, 1924, Jour. Bombay Nat. Hist. Soc., XXIX, p. 88.

TYPE REGION.—Upper Burma.

MATERIAL.—Photo. of skull of type, B.M. 4.4.27.1.

REMARKS.—Related to *harpia*. "Skull markedly larger than that of *harpia*. . . anterior teeth, incisors and canines, much enlarged . . . posterior

molar not quite so minute . . . forearm, 54 mm. . . skull, greatest length, 23.6; occipito-nasal length, 21.4; zygomatic breadth, 14.6; breadth across muzzle astride canines, 7.3; palato-sinual length, 10.8; front of canine to back of m³, 7.3."

pearsonii TOMES, 1858, Proc. Zool. Soc. London, p. 87.

TYPE REGION.—Uncertain.

REMARKS.—" . . . wing membranes extend to the base of the toes . . . thumb very long, and its claw also large and hooked . . . upper canines short, stout and conical, with a blunt inner lobe . . . upper surface of interfemoral membrane more or less covered with hair . . . forearm [of No. 1, Horsfield's type], 1" 10" [46-47 mm.]."

Dobson (1878) placed *pearsonii* Tomes in synonym of *harpia*.

Tomes compared his *pearsonii* with *Myotis* (*Dichromyotis*) *formosus*. A specimen, B.M. 79.11.21-118, from Darjiling, marked "type," has the forearm, 49 mm.

rufus GRAY, 1842, Ann. Mag. Nat. Hist., X, p. 259.

REMARKS.—Indicated by Gray as *rufus*. "*Vesp. harpia* Temm." [*Nomen nudum*.]

KERIVOULINAE

The type of dentition present in the Kerivoulinae appears to be the least specialized of vespertilionid bats. Upper premolars with p^4 slightly larger than p^2 and p^3 , which are subequal; lower premolars also subequal; m_3^2 unreduced; incisors and molars devoid of special characters.

The skulls are distinguished by the low, delicate, unshortened rostrum with nasal sulcus deeper than in *Myotis* (except in *Phoniscus*). The rostrum rises abruptly to a high, domed cranium, upon which no

Troughton's view, is held to be closer to *Myotis* than to *Kerivoula*.

Phoniscus contains only a few species and *Anamygdon* one. But some twenty names have been applied to species of *Kerivoula* from the Orient. Allen² lists fourteen forms from Africa.

As early as 1858 Tomes³ monographed the genus *Kerivoula*. He dealt with five species: *picta* Pallas, *papillosa* Temminck, *hardwickii* Horsfield (with synonym *pellucida* Waterhouse), *lanosa* Smith and

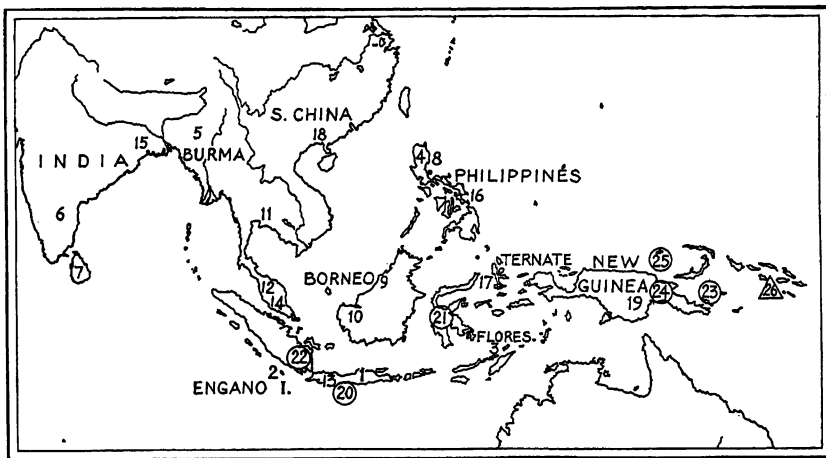


Fig. 3. Type localities of Kerivoulinae.

Kerivoula: 1. *hardwickii*; 2. *engana*; 3. *flora*; 4. *whiteheadi*; 5. *depressa*; 6. *crypta*; 7. *malpasi*; 8. *pellucida*; 9. *pusilla*; 10. *bombifrons*; 11. *minuta*; 12. *bicolor*; 13. *papillosa*; 14. *malayana*; 15. *lenis*; 16. *jagorii*; 17. *picta*; 18. *bellissima*; 19. *muscina*.
Phoniscus (in circles): 20. *javanus*; 21. *rapax*; 22. *atrox*; 23. *agnella*; 24. *papuensis*; 25. *myrella*.
Anamygdon (in triangles): 26. *solomonis*.

more than a trace of sagittal and lambdoidal crests appear. Palatal, basicranial and otic areas without special characters. Sternum differing from Vespertilionine sternum as described by Miller.¹

Skin with short, rounded, funnel-shaped ears; otherwise Vespertilionine. Feet with wing attached at base of toe. Calcar without lobe.

Three genera, *Kerivoula* and *Phoniscus*, and the more remotely allied *Anamygdon* (see beyond), constitute this subfamily (Fig. 3). *Chrysopteron* Jentink, contrary to

aerosa Tomes. The first three species are Oriental, the remaining two African.

In 1903, Jentink⁴ reviewed the orthography of *Kerivoula*. In 1910⁵ the same author placed *weberi* from Celebes, a *Myotis*, earlier described as a species of *Kerivoula*, under his new genus *Chrysopteron*.

The most recent work on the Kerivoulinae bats is that of Troughton.⁶ That author

¹ 1939, Bull. Mus. Comp. Zool., LXXXIII, pp. 100-102.

² 1858, Proc. Zool. Soc. London, pp. 322-338.

³ Notes Leyden Mus., XXIV, pp. 174-175.

⁴ Notes Leyden Mus., XXXII, pp. 73-77.

⁵ 1929, Records Australian Mus., pp. 85-99.

⁶ 1907, Bull. U. S. Nat. Mus., LVII, pp. 197, 232.

concludes (mistakenly, I believe) that *Chrysopteron* is more closely related to *Kerivoula* than it is to *Myotis*, although the shape of the ear and skull and the arrangement of the premolars are typically those of *Myotis*.¹

Anamygdon, of which I have only poor photographs made of the type when I visited Mr. Troughton in Sydney, appears to me very different from *Myotis*. Compared with *M. weberi*, the rostrum is broad and the zygomatica very little expanded. The braincase is low, with a low, posterior sagittal crest. The U-shaped mandibular symphysis and lack of imbrication of the lower incisors appear to be distinctive characters. Instead of linking *Anamygdon* closely with *Chrysopteron*, as Troughton does, I regard the latter as a subgenus of *Myotis*. *Kerivoula* and *Phoniscus* are closely associated as a distinct line of development. *Anamygdon* may then be treated as a separate offshoot descended from near the common origin of the lines leading, respectively, to *Myotis* and *Kerivoula*. The fact that in *Anamygdon* a *Kerivoula*-like sternum is combined with *Myotis*-like premolars supports this view.

KERIVOULA GRAY

Kerivoula GRAY, 1842, Ann. Mag. Nat. Hist., X, p. 258.

TYPE SPECIES.—*Vespertilio pictus* Pallas, by subsequent designation, Peters.² Peter's designation antedates *Vespertilio hardwickii* Horsfield, designated by Selater,³ and referred to by Palmer⁴ and Miller.⁵

Apart from the African forms of which Allen lists fourteen, the bats of this genus come under four main groups: *hardwickii*, *pusilla*, *papillosa* and *pictus*. Although, as shown above, *pictus* is the genotype, *hardwickii* has been chosen in the following pages as a more generalized species with which to make comparisons.

A number of species—*javana*, *myrella*, *agnella*, *papuensis*—with enlarged canines and increased depth of the outer upper incisor have been moved from *Kerivoula*

into *Phoniscus*. *K. weberi* and allies are regarded as *Myotis*.

Kerivoula hardwickii (Horsfield)

Vespertilio hardwickii HORSFIELD, 1825, Zool. Researches in Java.

MATERIAL.—Poor photographs of the type skull, B.M. 79.11.21.181 (which show only the rostral parts, the braincase having been destroyed); six specimens, which may be regarded as topotypical, from Cheribon, Java.

The forearm of the type measures 32 mm.; those of our Cheribon series, 31–34. Pelage brownish gray.

The skull of *K. hardwickii* is provided with the narrow, low, tapered rostrum and high braincase distinctive of the genus. The nasal sinus is narrow (1.2 mm.) and deep (1.8 mm.). Zygomatica well expanded;

mastoid w. = $\frac{7.5}{8.8}$. Cochleae wider than zygomatic w. = $\frac{7.5}{8.8}$.

Cochleae wider than their distance apart, 2.5:1.5 mm. Palate extended far behind m^3 – s , and provided with heavy post-palatal spine; distance from back of m^3 to back of spine, 2 mm. Width of palatal extension beneath pterygoid canal at narrowest (just anterior to pterygoids), 1.7 mm. Interdental palate well arched, both longitudinally and transversely.

DENTITION.—No diastema between upper incisors and canine, as in *Myotis*. Inner incisor about half height of canine, provided with small, basal cingulum cusp posteriorly. Outer incisor generally low, provided with small low anterointernal cusp appressed between the main and the subsidiary cusps of the inner incisor. Canine simple. Cheek teeth (and maxillae) pinched in at the position of p^4 , so that the outer face of p^4 forms an angle with the alignment of p^2 and p^3 ; p^2 – s parallel. The molar rows are approximately parallel but wider apart than the premolars, on account of the offset occasioned by p^4 . Outer width of p^2 – s = 3.5 mm.; of m^1 – s = 5.2 mm. The two anterior premolars subequal (p^2 slightly larger than p^3), and considerably smaller than p^4 , though in no way approaching the great reduction reached in *Myotis*. No reduction of the pattern of m^3 .

¹ Tate, 1941, Review of *Myotis*, Bull. Amer. Mus. Nat. Hist., LXXVIII, Art. 8.

² 1866, Monatsber. Akad. Wiss. Berlin, p. 399.

³ 1901, Mamm. S. Africa, II, pp. 132–134.

⁴ 1904, North Amer. Fauna, XXIII, p. 357.

⁵ 1907, Bull. U. S. Nat. Mus., LVII, p. 232.

Inner and middle lower incisors subequal, very slightly imbricated, tricuspid; outer lower with minute internal cusp, crowded between middle incisor and canine. The three incisors becoming progressively thicker from the middle tooth to the outer one. Three lower premolars subequal in height, the cingulum length of p_4 in tooth-row slightly greater than cingulum lengths of p_3 and p_2 .

ADDITIONAL MEASUREMENTS.— $c-m^3$, 5.8 mm.; m^{1-3} , 3.1.

The following forms appear to be closely allied to *hardwickii* (as opposed to *pusilla* and its relatives): *engana* Miller, 1906 from Engano Island; *flora* Thomas, 1914 from Flores; *whiteheadi* Thomas, 1894 from Luzon; *depressa* Miller, 1906 from Southern Burma; *crypta* Wroughton and Riley, 1913 from Southern India; *fuscus* Dobson, 1871 without exact locality; *malpasi* Phillips, 1928 from Ceylon. *Pellucida* Waterhouse, 1845 from Philippines was held by Tomes in his monograph (1858) to be a synonym of *hardwickii* but was considered a good species by Dobson. Dobson stated that the two inner pairs of lower incisors in *pellucida* have four cusps.

Kerivoula pusilla Thomas

Kerivoula pusilla THOMAS, 1894, Ann. Mag. Nat. Hist., (6) XIV, p. 461.

Kerivoula bombifrons LYON, 1911, Proc. U. S. Nat. Mus., XL, p. 134.

MATERIAL STUDIED.—Photograph of type skull, B.M. 94.9.29.17.

This *Kerivoula* appears to be a species thoroughly distinct from *hardwickii*.

Slightly smaller, the forearm measures 28–30 mm. in our five specimens. The pelage is a pale gray much lighter in shade than any of our *hardwickii*.

The skull differs in the following particulars: Rostrum shorter and braincase rising more abruptly; rostral sinus wider (1.5) and not so deep (1.6) as in *hardwickii*.

Zygomata less expanded: $\frac{\text{mastoid w.}}{\text{zygomatic w.}}$

$= \frac{7.2}{8.0}$. Interdental palate much narrower;

outer width m^3 – s , 5.0 mm.; in *hardwickii*, 5.4. Pterygoid extension of palate much

narrowed, its width only 1.4 mm. (*hardwickii*, 1.7). Posterior palatal tubercle of *hardwickii* replaced by a pointed triangular projection.

Inner upper incisors closer together, slenderer and less thrown forward in front of canines; outer incisors smaller; canines, premolars and molars smaller and narrower. Mandibular teeth very like those of *hardwickii* but narrower. Coronoid of *hardwickii* rising higher.

ADDITIONAL MEASUREMENTS.— $c-m^3$, 5.7; m^{1-3} , 3.0.

I am able to find nothing in Lyon's diagnosis of *bombifrons* to distinguish it from *pusilla*, except its "distinctly larger ears." *Bombifrons* came from Matan River, western Borneo, *pusilla* from Sarawak, a little to the north.

K. minuta Miller, 1898, from Trong, Siam, and *K. bicolor* Thomas, 1904, from Jalor seem to have features in common with *pusilla*.

Kerivoula papillosa (Temminck)

MATERIAL EXAMINED.—Photographs of a co-type, Leyden, skull "a," female, the back of braincase broken away.

Forearm of co-type of *papillosa*, 44.5 mm.

This species is much larger and its skull and teeth are more heavily built than those of *hardwickii*. Structurally the skull and teeth resemble those of *hardwickii* closely, the principal difference appearing in the widened mastoid region, proportionately smaller cochleae and development of distinct lambdoidal and sagittal crests.

The outer lower incisor agrees with that of *hardwickii*. It is compressed against the canine and simplified to a single large, rounded cusp, the lateral cusps having disappeared.

The characters of the skin given by Temminck seem not to be unique.

SOME SKULL MEASUREMENTS (taken from co-typical skull).—Interorbital width, 3.5 mm.; width inside m^{1-1} , 3.0; $c-m^3$, 7.5; m^{1-3} , 3.6. Our Bornean specimens agree in all essentials with the type from Java.

Near relatives of *papillosa* are *malayana* Chasen, 1940, *lenis* Thomas, 1916, and perhaps *jagorii* Peters, 1866.

K. malayana was proposed as a geographical race with type locality, Selangor-Pahang boundary. Specimens from Sarawak were included. The race was supposed to be larger but as can be seen from the few comparable measurements of the broken type skull of *papillosa*, *malayana* is not especially larger.

K. lenis from Calcutta was described as allied to *papillosa* but smaller. The forearm length 41 mm. is within the range given by Chasen for *malayana*. Interorbital breadth, 3.2 (in *papillosa*, 3.5 mm.).

K. jagorii from Samar, Philippine Islands, was distinguished from *papillosa* chiefly by the non-papillose margin of the uropatagium.

Kerivoula picta (Pallas)

Vespertilio pictum PALLAS, 1867, Spicill. Zoöl., fasc., 3, p. 7.

Pallas applied his name to the two bats illustrated by Seba,¹ and stated the countries of origin to be "Ceylon and Moluccas Archipelago." But Seba's name "Chauvesouris de Ternate" implies strongly that his specimens came from the Island of Ternate, near Halmahera.

MATERIAL STUDIED.—Photograph of skull, B.M. 67.4.12.342, marked "co-type" and labeled "Ternate L. de J., ♂."²

These distinctively colored bats—the bodies orange, the wings orange with the interdigital membranes fuscous—represent a line of development divergent from *hardwickii* chiefly in their dentition. The pinched-in condition at the premolars, mentioned under *hardwickii* is accentuated and the contrast in size between p^4 and p^{2-3} is more pronounced. The cusps of p^{2-3} are sharper and more compressed. The inner incisor has developed its posterior cusp; m^2 and m^3 are proportionately wider than m^1 ; p^{2-4} more compressed, shearing, in *picta* than in *hardwickii*.

MEASUREMENTS.— $c-m^3$, 5.4; m^{1-3} , 3.0;

width of p_2 at cingulum, 0.5 mm. (in *hardwickii*, 0.7 mm.).

The arrangement of the cusps of the upper and lower incisors and the indication of a diastema between incisor and canine in this species is suggestive of the condition in *Myotis mystacinus*, even though reduction of the premolars is far less advanced.

The peculiar color pattern seen in the wings of *picta* and its allies is reproduced with seeming exactness in *Myotis formosus* and allies. But quite apart from fundamental structural differences, the patterns are not identical: in *formosus* a patch of *fuscus* appears on the part of the membrane anterior to the forearm and humerus, and the feet, tibiae and the outer edges of the ears are fuscous.

The Archbold mammal collection contains two specimens of a species of *Kerivoulineae* from the Fly River, Papua, which agrees with no Papuan species in size and with no extra-territorial *Kerivoula* in structure. It forms, in fact, a connecting link between *Kerivoula* and *Phoniscus*, having the tricuspid lower incisors and small size (forearm 32 mm.) of *Kerivoula*, in combination with the enlarged, divergent canines and compressed premolars of *Phoniscus*. It provides good evidence of the essentially subgeneric relationships of *Kerivoula* and *Phoniscus*. In it the cusp of the outer upper incisor is unreduced, as is partly the case in *K. picta*. It is quite unlike *Anamygdon* which has a rather broad muzzle, low braincase and forearm 38.5 mm. and shows some relationship to *Myotis*.

Kerivoula muscina, new species

TYPE.—No. 105315, Amer. Mus. Nat. Hist.; adult ♂; Lake Daviumbu, 6 miles above mouth of Strickland River, middle Fly River, Western Division, Papua; altitude approximately 20 meters; Sept. 6, 1936; collector, G. H. H. Tate, 1936 New Guinea Expedition. The type is a skin with skull, in good condition.

GENERAL CHARACTERS.—Externally very similar to *K. pusilla* but slightly larger.

DESCRIPTION OF TYPE.—Skin colored dorsally pale fawn, the tips pale rufescent; underparts grayer, the chest and belly hair with rather dark gray bases. Ears broad, rounded, translucent; wings from distal end of metacarpus.

Skull with braincase elevated about as in

¹ Thesaurus, I, Pl. 56, figs. 2, 3.

² This appears to be one of the skulls of the Lidde de Jude collection, from which many of the Seba plates are believed to have been prepared. The appearance of the word "Ternate" is corroborative. See Thomas, 1892, Proc. Zool. Soc. London, pp. 309-318, especially, pp. 315, 316.

hardwickii, less than in *pusilla*; a well-defined rostral depression; palate narrowed at p^4 ; back of palate broad and terminated in post-palatal process as in *hardwickii*.

Teeth distinguished from those of *hardwickii* by the non-reduction of the upper, outer incisor and by the narrower, lighter build of the entire dentition. Canines slightly divergent; much more so in the paratype.

MEASUREMENTS OF TYPE.—Total length, 78 mm.;¹ length tail vertebrae, 42 mm.;¹ hind foot (s.u.), 7;¹ skull, occipito-canine length, 11.8;

basi-sinual length, 9.4; zygomatic width, 7.6; least temporal width, 2.8; width braincase, 6.4; mastoid width, 7.1; width palato-ptyergoid extension, 1.7; outer width m^3-3 , 4.7; width of cochlea, 2.2; width apart of cochleae, 1.2; length $c-m^3$, 5.3; m^1-3 , 2.6; width of m^1 , 1.0 (in *hardwickii*, 1.15).

A second specimen of this bat was obtained near the source of the Fly River, at the mouth of the river Palmer. It is older and slightly more rufescent.

LIST OF NAMED FORMS OF *Kerivoula*

Alphabetically arranged

bellissima THOMAS, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 423.

TYPE REGION.—S. China.

MATERIAL.—Photo. of skull of type, B.M. 6.1.13.1.

REMARKS.—The much larger Chinese representative of *K. picta*. Forearm, 39 mm.

bicolor THOMAS, 1904, Ann. Mag. Nat. Hist., (7) XIV, p. 199.

TYPE REGION.—Jalor, Malaya.

REMARKS.—“With white tipped wings . . . its nearest relation is probably *K. minuta*.” Forearm, 29 mm.

bombifrons LYON, 1911, Proc. U. S. Nat. Mus., XL, p. 134.

TYPE REGION.—W. Borneo.

REMARKS.—A small species with forearm 30 mm. closely similar to or perhaps not separable from *pusilla*.

crypta WROUGHTON AND RILEY, 1913, Jour. Bombay Nat. Hist. Soc., XXII, 3, p. 14.

TYPE LOCALITY.—Shimoga, S. India.

MATERIAL.—Photo. of skull of type, B.M. 12.8.25.2.

REMARKS.—A dark-colored form of *hardwickii*, with forearm 31.5 mm.

depressa MILLER, 1906, Proc. Biol. Soc. Wash., XIX, p. 64.

TYPE REGION.—Karin Hills, Burma.

REMARKS.—A small-sized race, forearm 33 mm., with low braincase nearly one and one-half times as broad as deep, apparently most nearly related to *hardwickii*.

engana MILLER, 1906, Proc. U. S. Nat.

Mus., XXX, p. 825.

TYPE LOCALITY.—Engano Island.

REMARKS.—Nearly related to *hardwickii*.

Forearm, 33–34.5 mm.

flora THOMAS, 1914, Ann. Mag. Nat. Hist., (8) XIII, pp. 441–442.

TYPE LOCALITY.—S. Flores.

MATERIAL.—Photo. of skull of type, B.M. 97.4.18.22.

REMARKS.—Member of *hardwickii* group but considerably larger, with forearm 39.5 mm.

fuscus DOBSON, 1871, Proc. Asiatic S. Bengal, p. 215.

TYPE REGION.—India, locality unknown.

REMARKS.—Very near to *hardwickii*; Dobson synonymized it. Forearm, 33.

hardwickii HORSFIELD, 1824, Zool. Researches in Java.

TYPE REGION.—Java.

MATERIAL.—Photo. of skull of type, B.M. 79.11.21.181.

REMARKS.—A small species of seemingly wide distribution. Forearm about 30–32 mm. Numerous closely related forms have been described.

Besides six specimens from the type region, the Archbold collections contain material, apparently identical, from Borneo, Bali and Celebes (see synoptic list at end of this paper).

jagorii PETERS, 1866, Monatsber. Akad. Berlin, p. 399.

TYPE LOCALITY.—Samar, Philippines.

REMARKS.—Apparently a rather distinct species of which I have seen no

¹ Made before skinning by collector in the field.

- specimens. Forearm (Dobson), 1'' .55 [38-39 mm.]. The only other large species seen by me is *papillosa* from Java. Peters gave no cranial characters. The type should be examined for possible relationship to *Phoniscus*.
- lenis* THOMAS, 1916, Jour. Bombay Nat. Hist. Soc., XXIV, p. 417.
 TYPE LOCALITY.—Calcutta, India.
 MATERIAL.—Photo. of skull of type, B.M. 79.11.21.126.
 REMARKS.—Closely allied to *papillosa*. Forearm, 41.
- malayana (papillosa)* CHASEN, 1940, Bull. Raffles Mus., XV, pp. 55-56.
 TYPE REGION.—Selangor, Malaya.
 REMARKS.—The Malayan representative of *papillosa*.
- malpasi* PHILLIPS, 1932, Ceylon Jour. Sci., B, 16, 3, p. 331.
 TYPE LOCALITY.—Mulhalkelle district, C. P., Ceylon.
 MATERIAL.—Photo. of skull of type, B.M. 31.11.7.1.
 REMARKS.—The representative of *hardwickii* in Ceylon.
- minuta* MILLER, 1898, Proc. Acad. Philadelphia, L, p. 321.
 TYPE LOCALITY.—Trong, Siam.
 REMARKS.—It is possible that *minuta* is the continental representative of *pusilla* (= *bombifrons*?) of Borneo.
- muscina* TATE, described in this paper.
papillosa TEMMINCK, 1835, Monogr. Mamm., II, p. 220.
 TYPE LOCALITY.—Bantam, Java.
 MATERIAL.—Photo. of skull of co-type, Leyden, skull "a."
 REMARKS.—A large species sharply different from the three common types of *Kerivoula hardwickii*, *pusilla* and *picta*. Forearm, 40 mm. Represented on the mainland by *malayana*.
 Two individuals from Borneo seem in no way to differ from Javanese specimens.
- pellucida* WATERHOUSE, 1845, Proc. Zool. Soc. London, p. 6.
 TYPE REGION.—Philippine Islands.
- REMARKS.—This little bat, with forearm only 1'' 3''' [32 mm.], may be the representative of either *hardwickii* or *pusilla*.
- picta* PALLAS, 1767, Spicil. Zool., fasc. 3, p. 7.
 TYPE LOCALITY.—(?), Ternate.
 MATERIAL.—Photo. of skull of co-type, B.M. 67.4.12.342.
 REMARKS.—A well-known and distinctively colored species. The type of the genus *Kerivoula*. Its peculiar color pattern and features of its skull and teeth make it markedly different from other species currently placed in the genus. A larger race *bellissima* represents it in S. China. Forearm, 31-32 mm.
 A remarkably stable species in the East Indies. Our series in the Archbold collection from Java and Bali seems without important variations. We have no topotypes.
- pusilla* THOMAS, 1894, Ann. Mag. Nat. Hist., (6) XIV, p. 461.
 TYPE REGION.—Sarawak.
 MATERIAL.—Photo. of skull of type, B.M. 94.9.29.17.
 REMARKS.—A small species readily distinguishable from *hardwickii* and its allies (see discussion elsewhere). Forearm, 28 mm.
 In the Archbold collections are four specimens from southwest Borneo, not very far from the type locality of *bombifrons*, and two from northeast Borneo.
- rubella (picta)* KERR, 1792, Linn. Animal Kingdom, p. 96.
 TYPE REGION.—Unknown.
 REMARKS.—Probably unidentifiable. Likely to be equal to *picta*.
- whiteheadi* THOMAS, 1894, Ann. Mag. Nat. Hist., (6) XIV, p. 460.
 TYPE REGION.—Luzon.
 REMARKS.—Compared with *hardwickii* by the describer, and likely to prove to be its representative in Philippines, just as *pellucida* probably represents *pusilla*. Forearm, 32 mm.

PHONISCUS MILLER

Phoniscus MILLER, 1905, Proc. Biol. Soc. Wash., XVIII, p. 229.

GENOTYPE.—*P. atrox* Miller.

The bats of this genus present a mixture of primitive and specialized characters. Primitive are the unreduced cusp of the outer upper incisor; specialized, the four cusps¹ on the lower inner and middle incisors; the great increase in size and the longitudinal grooving of the canine, and the widening of the distal end of the muzzle to accommodate such teeth.

The geographical range of *Phoniscus*—Java, Sumatra, Celebes, New Guinea—is more or less peripheral to the range of *Kerivoula*.

Six species are now currently included: *rapax* Miller, 1931, from Celebes; *atrox* Miller, 1905, from Sumatra; *javana* Thomas, 1880, from Java; and *agnella* Thomas, *myrella* Thomas, *papuensis* Dobson, all from the New Guinea region.

We have in the collection the single species *javanus*, in which, however, the characteristics of the genus are strongly defined.

Phoniscus javanus (Thomas)

Kerivoula javana THOMAS, 1880, Ann. Mag. Nat. Hist., (5) V, p. 472.

This species requires comparison only with *P. rapax* of Celebes but is larger. *P. atrox* from Sumatra is yet smaller. Miller's² comparison of the three species serves perfectly for their discrimination.

The peculiar buffy whitish tips of the dark grayish pelage give these bats a grizzled appearance. The golden yellow hairs on forearms, thumb, limbs and feet agree wholly with Thomas' original description.

In the skull the rostral and palatal sinuses are shortened, as indicated by Miller, to the extent that they are shallower than wide; and in the dentition obvious characters are: reduction in size of the crown area of i^2 and its compression between the first incisor and canine; the flattened, enlarged, fluted, dagger-like canines; the strongly compressed upper and lower premolars; the reduction of the hypoconic region of m^1-2 , with consequent enlargement of the inter-molar embrasures.

LIST OF NAMED FORMS OF *Phoniscus*

Alphabetically arranged

agnella THOMAS, 1908, Ann. Mag. Nat. Hist., (8) II, p. 372.

TYPE LOCALITY.—St. Aignans Island, New Guinea.

MATERIAL.—Photo. of skull of type, B.M. 98.4.1.2.

REMARKS.—Thomas first compared *agnella* with *K. hardwickii*. Forearm, 38 mm.; $c-m^3$, 6; mastoid width decidedly exceeding the greatest breadth of braincase. . . .

atrox MILLER, 1905, Proc. Biol. Soc. Wash., XVIII, p. 230.

TYPE REGION.—E. Sumatra.

REMARKS.—Type species of *Phoniscus*. Nearest to *javanus* and *rapax* but

smaller than either. Forearm, 34–35 mm.

javanus THOMAS, 1880, Ann. Mag. Nat. Hist., (5) V, p. 472.

TYPE LOCALITY.—Kosala, near Bantam, Java.

REMARKS.—Described as a *Kerivoula* but unmistakably a species of *Phoniscus*. Forearm, 37–38 mm.

Probably rather rare. The Archbold collection contains only two specimens, from Borneo, which present no important differences from Javanese material.

myrella THOMAS, 1914, Ann. Mag. Nat. Hist., (8) XIII, p. 438.

TYPE LOCALITY.—Manus Island, off New Guinea.

MATERIAL.—Photo. of type, skull B.M. 14.4.1.10.

¹ In the type species four cusps were described. The status of *myrella* and *agnella* seems to be intermediate between *Phoniscus* and *Kerivoula*. Four cusps are seen in some species of *Myotis*, e.g., in *M. chinensis*, *M. formosus*, etc.

² 1931, Jour. Mamm., XII, 4, p. 412.

REMARKS.—The structure of this bat emphasizes the doubtful validity of separating *Phoniscus* from *Kerivoula*. *Agnella* has the massive canines of the former, but its premolars are uncompressed as in *Kerivoula*. Forearm, 37.5–38.5.

papuensis DOBSON, 1878, Cat. Chiropt. Brit. Mus., p. 339.

TYPE LOCALITY.—Port Moresby, Papua.

MATERIAL.—Photo. of type, skull B.M. 78.2.20.1.

REMARKS.—Described as a *Kerivoula*. Forearm, 1''5 [= 37–38 mm.].

rapax MILLER, 1931, Jour. Mamm., XII, 4, p. 412.

TYPE REGION.—N. E. Celebes.

REMARKS.—A form of medium size, between *atrox* and *javanus*. Forearm 35. Apparently these three forms constitute a distinct group representing truly typical *Phoniscus*. The Papuan species on the contrary seem less specialized and are perhaps annectant between *Phoniscus* and *Kerivoula*.

ANAMYGDON TROUGHTON

Anamygdon TROUGHTON, 1929, Records Austral. Mus., XVII, 2, pp. 87–89.

GENOTYPE.—*A. solomonis* Troughton.

The unique species of this genus came from Rubiana Island, Solomon Islands. It has been fully described by Troughton. The genus as pointed out earlier in this article, displays characters connecting it both with *Myotis* and with *Kerivoula*.

Mr. Troughton kindly allowed me when in Sydney, to photograph the skull of *A. solomonis* but the picture proved on development to be too poor to show important details.

The reduction in size of the middle upper premolar (p^3) strongly suggests the genus *Myotis*, of which the subgenus *Leuconoe* is represented in the Papuo-Australian area by three species: *Myotis moluccarum*, *stalkeri* and *macropus*. The fact that Mr. Troughton has demonstrated (*op. cit.*, p. 85) a kerivoulina sternum in *Anamygdon* probably precludes its close relationship to *Myotis* (*Leuconoe*). I have shown elsewhere² that *Chrysopteron*, with which Troughton compared *Anamygdon*, is not a kerivoulina bat but another subgenus of *Myotis*.

NYCTOPHILINAE

Specialized Vespertilionid bats in which small noseleaves are developed and the premolar series is reduced to $\frac{1}{2}$. Represented by *Nyctophilus* and *Pharotis* in Australia-New Guinea region (Fig. 4), and by *Antrozous*¹ in North America. *Nyctophilus* is present also in New Caledonia and Fiji Islands.

Skull with face somewhat shortened (approaching the stage seen in *Eptesicus fuscus*); nasal sulcus deep; rostrum moderately high, without abrupt frontal step up to braincase as in Kerivoulinae; bullae quite large (diameter may be twice distance apart); coronoid process high.

Dentition specialized: upper incisors

and premolars one each; upper m^3 usually unreduced in *Nyctophilus*, greatly reduced in the American genus *Antrozous*; lower incisors three in *Nyctophilus*, two in *Antrozous*. Lower premolars two, the anterior much reduced. Talonid of m_3 usually unreduced in *Nyctophilus*, reduced in *Antrozous*.

The external characters of special interest are the small nasal eminences and comparatively large, united ears. *Antrozous* appears to be in every way more specialized than *Nyctophilus*.

Pharotis is a specialized branch derived from *Nyctophilus*, with large ears similarly united and with similar dental formula but modified skull.

¹ The relationship between *Nyctophilus* and *Antrozous* was noted by Gray as early as 1866 (Ann. Mag. Nat. Hist., (3) XVII, p. 91).

² Results of Archbold Exped. No. 39.

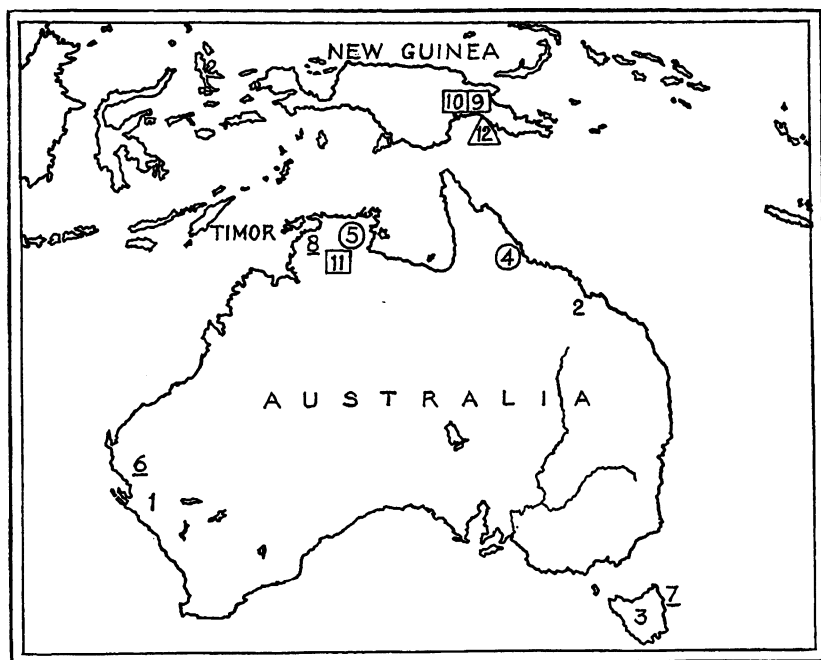


Fig. 4. Type localities of Nyctophilinae.

Nyctophilus timoriensis group: 1. *major*; 2. *gouldi*; 3. *sherrini*; (that of *timoriensis* unknown).
Nyctophilus bifax group (in circles): 4. *bifax*; 5. *daedalus*.
Nyctophilus geoffroyi group (underlined): 6. *geoffroyi*; 7. *unicolor*; 8. *pallidus*; (that of *timoriensis* unknown).
Nyctophilus microtis group (in squares): 9. *microtis*; 10. *bicolor*; 11. *walkeri*.
Pharotis (in triangles): 12. *imogene*.

NYCTOPHILUS LEACH

Nyctophilus LEACH, 1827, Trans. Linn. Soc. London, XIII, p. 78.

Barbastellus GRAY, 1831, Zool. Miscellany, p. 38.

TYPE SPECIES.—*Nyctophilus geoffroyi* Leach, from Australia.

Nyctophilus was monographed by TONES,¹ who recognized four species: *geoffroyi*, *timoriensis*, *gouldi* and *unicolor*, the two latter described as new. At almost the same time Peters was studying *Nyctophilus* and published his paper on the "Chiropterengattung *Nyctophilus*,"² in-

cluding therein as an appendix a summary of TONES' work. Dobson (1878) later referred all species to the synonymy of *timoriensis*.

In 1915 THOMAS³ published Notes on the genus *Nyctophilus*, wherein he reviewed the species and proposed a classification based chiefly upon the degree and type of development of the noseleaf and upon the structure of the baculum.

In the following list the described forms of *Nyctophilus* are arranged in sequence, based upon the dimensions of forearm and toothrow of the type specimens:

¹ 1858, Proc. Zool. Soc. London, pp. 25-37.

² 1861 (1860) Abhandl. Akad. Wiss., Berlin, pp. 123-137.

³ Ann. Mag. Nat. Hist., (8) XV, pp. 493-499.

	Locality	Forearm	c-m ³	m ¹⁻³
<i>major</i> Gray	Perth, W. Australia	44	7.3	4.7
<i>timoriensis</i> Geoffroy	?	46.5	...	4.6
<i>sherrini</i> Thomas	Tasmania	45	6.9	4.5
<i>gouldi</i> Tomes	Moreton Bay, S. Queensland	45	6.4	4.1
<i>bifax</i> Thomas	Herberton, N. Queensland	41	6.5	4.1
<i>daedalus</i> Thomas	N. Terr., Australia	41	6.5	4.1
<i>bicolor</i> Thomas	Aroa R., Papua	40	6.0	4.0
<i>microtis</i> Thomas	Sogeri, Papua	39	5.5	3.6
<i>geayi</i> Trouessart	Victoria	39	...	....
<i>unicolor</i> Tomes	Tasmania	38	5.8	3.8
<i>pacificus</i> Gray	"Island of Pacific"	37	5.5	3.65
<i>australis</i> Peters	?	37.5	...	....
<i>pallescens</i> Thomas	N. Terr., Australia	36	5.7	3.6
<i>geoffroyi</i> Leach	W. Australia	35	5.5	3.65
<i>walkeri</i> Thomas	N. Terr., Australia	33.5	4.7	3.3

In their checklist Iredale and Troughton¹ made *sherrini* and *gouldi* subspecies of *timoriensis*, of which *major* was made a synonym. By Thomas' criteria *major* and *sherrini* have unspecialized and *gouldi* moderately specialized noseleaves, while the baculum of *sherrini* is "slender . . . tapering to a fine point" and of *gouldi* "stout . . . abruptly narrowing in its terminal third to a long point." The baculum of *major* is unknown.

There appear to be four full species-groups of *Nyctophilus*:

- (1) the large *timoriensis*, with allies *major*, *sherrini*, *gouldi*
- (2) *bifax* and *daedalus*

(3) *geoffroyi*, with *pacificus* and *pallescens*

(4) *microtis*, and subspecies *bicolor*; and perhaps also related *walkeri*.

The last named bats have smaller ears and unenlarged bullae. They may be more primitive than other groups.

N. timoriensis group

I have photographed and studied the type specimens of *major*, *gouldi* and *sherrini*, and also the specimen in Paris marked "*Nyctophilus timoriensis*, type?" The last has the widely set canines and massive rostrum shown by *major*; the rostra of *gouldi* and *sherrini* are slenderer.

The following table shows important measurements of the type specimens:

Specimen	<i>timoriensis</i> Paris Mus. no number. In alcohol	<i>major</i> B.M. 44.7.9.20 dry skin and skull	<i>gouldi</i> B.M. 7.1.1.339 dry skin and skull	<i>sherrini</i> B.M. 52.1.15.50 In alcohol
Head and body	60	65	55	52
Tail	50.5	40	45	46
Hind foot (s.u.)	10	8	8	8.5
Forearm	46.5	44	41	45
Ear, height	24	16	18.5	18
Skull, total length	19.8	....	....	18.9
Zygomatic breadth	11.4	12	10.4	10.8
Interorbital width	5.4	5.6	4.9	4.6
Intertemporal width	4.2	4.0	3.7	4.0
Breadth braincase	9.0	9.0	8.0	8.9
Breadth mesopterygoid fossa	2.1	....	1.6	2.5
Width inside m ¹⁻¹	3.35	3.4	2.7	3.1
Outer width canines	5.1	5.4	4.6	4.7
Width of bulla	3.3	....	....	4.1
Width of cochlea	2.6	....	....	2.3
Length, c-m ³	7.0	7.3	6.4	6.6
Length, m ¹⁻³	4.6	5.0	4.1	4.5
Crown area, m ¹	1.8 × 1.65	1.9 × 1.65	1.6 × 1.6	1.7 × 1.45
Crown area, m ²	1.7 × 1.9	1.9 × 1.95	1.6 × 1.65	1.75 × 1.7
Breadth, m ²	1.7	2.0	1.6	1.8

¹ 1934, Mem. Australian Mus., VI, pp. 94-95.

The considerably greater size of *timoriensis* and *major* is apparent. The ear length of *major* (18) is partly accounted for by shrinkage of the dry skin.

A specimen in alcohol from Broom Hill, West Australia, M.C.Z. 14928, is distinguished by its "helmet" (raised posterior sagittal crest plus lambdoidal crest) and its greatly reduced m^3 . The height of the ear above crown is 19 mm. In all these respects it resembles *major* (type) rather than *timoriensis* (Paris specimen). In the latter m^3 is not extremely reduced, nor is there a "helmet," and its very large ear measures 24 mm.; width of bulla, 3.3 in *timoriensis*, not measurable in the type of *major*. The forearm, 43.

The differences between *timoriensis* (Paris specimen) and *major* (type) shown in the table, indicate the likelihood that the two are not strictly synonymous. The maximum length of m^3 in the tooththrow of *timoriensis* is 1 mm. Thus m^3 is little or not at all reduced. The same measurement in the type of *major* is 0.8 mm., the W-pattern being considerably reduced and the commissure which would in a normal molar (m^1 or m^2) extend from the paracone triangle towards the metacone is obsolescent. Exactly the same condition appears in M.C.Z. 14928, from Broom Hill as in the type of *major* from Perth. The conclusion appears plain. Either we have not yet rediscovered true *timoriensis*, or the Paris specimen is Geoffroy's type, of which he gave no dimensions.

Gouldi from near Brisbane, apart from its smaller size, differs from *timoriensis* and *major* chiefly by the narrowness of the rostrum in relation to the zygomatic width. Because of the broken state of the skull its total length and the diameter of tympanic ring and cochlea could not be measured.

The Tasmanian race *sherrini* has the rostrum similarly narrowed but the tympanic ring proportionally much larger—the proportion of distance apart of bullae: diameter of tympanic ring = 1.7:4.1.

Both *gouldi* and *sherrini* have the posterior commissure on m^3 nearly complete and the body of the tooth longer (in the

tooththrow) as in *timoriensis*, contrary to the condition in *major*.

N. bifax group

The two species, *bifax* and *daedalus*, though only slightly smaller than the smaller races of *timoriensis*, were treated as distinct species by Iredale and Troughton (*op. cit.*). Both were shown by Thomas to have unspecialized noseleaves; the baculum in *bifax* was bifurcate, in *daedalus* unforked. From the standpoint of size and proportion they scarcely differ. But while m^3 is normal in *bifax*, in *daedalus* it has become specialized, reduced and shortened, as in *major*.

Type specimen	<i>bifax</i>	<i>daedalus</i>
	B.M. 15.3.13.3 In alcohol	B.M. 97.4.12.8 In alcohol
Head and body	49	47
Tail	39	45
Hind foot (s.u.)	8	6
Forearm	43	40
Ear	16	15.5
Skull, total length	17.9	17.7
Zygomatic breadth	10.9	11.4
Intertemporal breadth	3.5	3.6
Breadth braincase	8.5	8.2
Mastoid breadth	9.0	9.2
Breadth bulla	3.75	3.5
c- m^3	6.4	6.4
Crown dimensions, m^1	1.6 × 1.5	1.7 × 1.45
Crown dimensions, m^2	1.6 × 1.7	1.65 × 1.85
Crown dimensions, m^3	1.0 × 1.75	1.1 × 1.8

The chief differences appear in length of tail and length of forearm. These in combination with Thomas' character may well provide only subspecific separation. Photographs of their respective type skulls are virtually alike.

N. microtis group

The Papuan *bicolor* and *microtis*, designated subspecies by Thomas are without doubt very close together—perhaps synonymous. Thomas placed them in his class 2 (noseleaves slightly specialized; bacula slender . . . the tip bifurcate). He pointed out that the ear of *microtis* was not truly so small as he had supposed. . . . The

height of the ear above the crown, measured on my two specimens of *N. microtis* in the field, was in each case 13 mm.; forearm, 40.5. One came from Sogeri and is thus a topotype; the other from the Middle Fly River. They appear identical. Unfortunately the Sogeri specimen has a skull of *Pipistrellus* mismatched with it.

In the Fly River specimen (N. bank opposite Sturt Island) cranial measurements are as follows: total length, 16.2 mm.; zygomatic width, 10.2; interorbital width, 5.1; least intertemporal width, 3.6; width of braincase, 7.1; mastoid width, 8.3; diameter of tympanic ring, 3.0; of bulla, 1.2; c-m³, 5.8; crown dimensions of molars, m¹, 1.5 × 1.4; m², 1.5 × 1.7. This specimen was one of several hiding in bamboo-culms.

Geayi from Victoria has been placed by Iredale and Troughton (*op. cit.*) in the synonymy of *geoffroyi*. The published forearm length (39 mm.) agrees with *microtis*.

The tiny species *walkeri* appears to be a wholly distinct species. The type specimen, a female in alcohol, has the ear length only 10 mm.; zygomatic breadth, 8.8; intertemporal breadth, 3.2; breadth of braincase, 6.4; mastoid breadth, 6.6; width of bulla, 3.0; of cochlea, 1.8; c-m³, 4.75; crown dimensions of molars, m¹, 1.3 × 1.3; m², 1.25 × 1.4; m³, 0.8 × 1.4.

N. geoffroyi group

There remain the names *pacificus*, *australis*, *unicolor*, *pallascens*, *geoffroyi*, all of which forms seem closer related to each other than to anything else.

Pacificus, Islands of the Pacific (= Tasmania, *vide* Iredale and Troughton) is probably derived from the northeast rather than from the southeast of Australia. Its affinities then would be with *pallascens* (Northern Terr.), rather than with *unicolor* (Tasmania). But actually Iredale and Troughton and before them Thomas have synonymized it with the latter. True

geoffroyi of western Australia is probably distinct subspecifically.

Photographs of the type skulls (*geoffroyi*, B.M. 7.1.1.338; *pallascens*, B.M. 7.1.4.1; *unicolor*, B.M. 7.1.1.342; *pacificus*, B.M. without number, show small skulls with rather massive rostra (interorbital width: zygomatic width = 4.5:10). The following are crown dimensions:

	<i>geoffroyi</i>	<i>unicolor</i>
m ¹	1.5 × 1.4	1.5 × 1.5
m ²	1.4 × 1.5	1.4 × 1.6
m ³	1.1 × 1.65	1.1 × 1.5
	<i>pacificus</i>	<i>pallascens</i>
m ¹	1.45 × 1.3	1.35 × 1.3
m ²	1.45 × 1.45	1.40 × 1.5
m ³	1.00 × 1.45	0.90 × 1.4

Thus on the basis of the tooth sizes of these four type specimens it appears that *pacificus* and *pallascens* have slightly smaller and *geoffroyi* and *unicolor* larger teeth. The noseleaves of all of these bats, according to Thomas are highly specialized. *Australis* Peters, locality uncertain, belongs here, possibly in *geoffroyi*.

A.M. 109277 is a *Nyctophilus* from Pentland, North Queensland, on the railroad a little more than 100 miles SW. of Townsville. It is characterized by very large ears (measuring in field "25 mm." now, dry, 18 mm.), and the posterior noseleaf being specialized as in Thomas' class 3. Forearm, 37; tibia, 17. Skull low, its occipital region not crested as in *microtis*. Audital area specialized, the tympanic rings greatly enlarged (diameter, 4.1 mm.; space between them 1.5). Last molar more reduced than in *microtis*, its maximum length in tooththrow, 0.7 (*microtis*, 0.8); c-m³, 5.6.

This specimen is evidently related to *geoffroyi*, and because of its pale gray dorsal color and ashy (with gray bases) ventral hue may be referred to subspecies *pallascens*. The forearm of the type of *pallascens*, however, measures only 33 mm.

LIST OF NAMED FORMS OF *Nyctophilus*
Alphabetically arranged

- australis* PETERS, 1860 (1861), Abhandl. Akad. Wiss. Berlin, p. 125.
TYPE LOCALITY.—"Unknown; probably West Australia."
REMARKS.—Treated as synonym of *geoffroyi*, by Thomas (1915). Forearm, 37.5 mm.
- bicolor* THOMAS, 1915, Ann. Mag. Nat. Hist., (8) XVI, p. 498.
TYPE LOCALITY.—Aroa River, Papua, near coast.
MATERIAL.—Photo. of skull of type, B.M. 5.11.28.2.
REMARKS.—Proposed as subspecies of *N. microtis*. c-m³, 5.9; forearm, 39.
- bifax* THOMAS, 1915, Ann. Mag. Nat. Hist., (8) XV, p. 496.
TYPE LOCALITY.—Herberton, N. Queensland.
MATERIAL.—Photo. of skull of type, B.M. 15.3.13.3.
REMARKS.—"Noseleaf of the least degree of development . . . bifurcated baculum . . . maxillary toothrow, 6.5; forearm, 41. . ."
- daedalus* THOMAS, 1915, Ann. Mag. Nat. Hist., (8) XV, p. 498.
TYPE LOCALITY.—Dalsy River, N. Terr., Australia.
MATERIAL.—Photo. of skull of type, B.M. 97.4.12.8.
REMARKS.—Forearm, 41; c-m³, 6.5.
- geayi* TROUESSART, 1915, Bull. Mus. Nationale Hist. Nat., XXI, pp. 146-147.
TYPE REGION.—Victoria.
REMARKS.—Skull lost. Forearm, 39.
- geoffroyi* LEACH, 1822, Trans. Linn. Soc. London, XIII, p. 78.
TYPE REGION.—West Australia.
MATERIAL.—Photo. of skull, B.M. 7.1.1.338, possible topotype.
REMARKS.—". . . back yellowish black; below, chest and throat dirty white. Ears broad, moderate. Membranes fuscous black; tail acuminate. . ."
This species from unknown locality was the only one listed under *Nyctophilus*.
"Noseleaf of most highly developed type" (Thomas, 1915). c-m³, 5.5; forearm, 35.
- gouldi* TOMES, 1858, Proc. Zool. Soc. London, pp. 31-33.
TYPE REGION.—Moreton Bay, Australia.
MATERIAL.—Photo. of type skull, B.M. 7.1.1.339.
REMARKS.—"Intermediate in size between the two last [*geoffroyi* and *timoriensis*] . . . fur . . . very distinctly bicolored . . . on the whole of the undersurface the fur is strongly bicolored. . . " Forearm, 1" 6½/2'''-1" 7½/2''' [39-41] . . . c-m³, 6.4 (Thomas, 1915).
- leachii* DOBSON, 1878, Cat. Chiropt. Brit. Mus., p. 174.
REMARKS.—Merely a record of a specimen in the B.M. collections, so labeled.
- major* GRAY, 1841, Jour. Two Exped. Australia, II, appendix 3, p. 400; 1844, Zool. Erebus Terror, I, pl. 21. See also Peters, 1860, Abh., p. 125.
TYPE LOCALITY.—Perth, West Australia.
MATERIAL.—Photo. of type, B.M. 44.7.-9.20.
REMARKS.—Proposed as a "var." of *geoffroyi*. But, as has been shown, it is probably near *timoriensis*.
- microtis* THOMAS, 1888, Ann. Mag. Nat. Hist., (6) II, p. 226.
TYPE LOCALITY.—Sogeri, Papua.
MATERIAL.—Photo. of skull of type, B.M. 88.4.14.1.
REMARKS.—"Noseleaf of medium development . . . baculum essentially as in *bifax* [bifurcated] but very much slenderer . . . ears really but little shorter than those of *bifax*. . . " (Thomas, 1915.) Max. toothrow, 5.6. The two specimens in the Archbold collection have been discussed in the text.
- novae-hollandiae* GRAY, 1831, Zool. Misc., p. 38.
TYPE LOCALITY.—Not known.
REMARKS.—Described as *Barbastellus*.
- pacificus* GRAY, 1831, Zool. Misc., p. 38.

- TYPE LOCALITY.—"Islands of the Pacific."
- MATERIAL.—Photo. of skull of type, B.M.; no number.
- REMARKS.—Described as *Barbastellus*. By Thomas (1915) made a subspecies of *geoffroyi*. c-m³, 5.5. Thomas also synonymized *unicolor* Tomes with it.
- pallascens* THOMAS, 1913, Ann. Mag. Nat. Hist., (8) XI, pp. 79-80.
- TYPE LOCALITY.—Alexandria, N. Terr., Australia.
- MATERIAL.—Photo. of skull of type, B.M. 7.1.4.1.
- REMARKS.—Made a subspecies of *geoffroyi*. c-m³, 5.7 by Thomas (1915). The Archbold collection contains a single specimen of this pallid, large-eared species (see text).
- sherrini* THOMAS, 1915, Ann. Mag. Nat. Hist., (8) XV, p. 495.
- TYPE REGION.—Tasmania.
- MATERIAL.—Photo. of skull of type, B.M. 52.1.15.50.
- REMARKS.—"Noseleaf of a little developed type . . . forearm, 45 . . . c-m³, 6.9 . . . evidently related to the West Australian *major*. . ."
- timoriensis* GEOFFROY, 1806, Ann. Mus. Paris, VIII, p. 200.
- TYPE LOCALITY.—Unknown.
- MATERIAL.—Photo. of specimen, Paris, without number, marked "type?"
- REMARKS.—" . . . ears broad, length of head, and united together by a small membrane . . . tail 40 mm. . . " No locality given. Described under *Vespertilio*.
- In Tomes' monograph (1858) "*timoriensis*" is based upon three individuals from W. Australia.

unicolor TOMES, 1858, Proc. Zool. Soc. London, p. 33.

TYPE REGION.—Tasmania.

MATERIAL.—Photo. of skull of type, B.M. 7.1.1.342.

REMARKS.—" . . . fur everywhere short and cottony, perfectly devoid of luster, and unicolor . . . upperparts dark olive brown . . . beneath . . . similar, but paler . . . the tips . . . a little tinged with ash-color . . . patch on throat which is whitish brown, dirty white, or occasionally pure white . . . ears destitute of sulci, more membranes . . . length of forearm, 1" 7'''-1" 7½''' [40-41 mm.]. . . "

By Thomas (1915), synonymized with *pacificus* Gray.

walkeri THOMAS, 1892, Ann. Mag. Nat. Hist., (6) IX, pp. 405-406.

TYPE LOCALITY.—Adelaide River, N. Terr., Australia.

MATERIAL.—Photo. of skull of type, B.M. 92.4.4.1.

REMARKS.—Forearm, 33.5; c-m³, 4.7.

PHAROTIS THOMAS

Pharotis THOMAS, 1914, Ann. Mag. Nat. Hist., (8) XIV, p. 381

GENOTYPE.—*P. imogene* Thomas.

This genus, proposed as an offshoot of *Nyctophilus*, is distinguished by its much higher, fuller braincase and less enlarged tympanic rings which are more widely spaced than is the case in *Nyctophilus*. The last upper molar is unmodified. The single species *imogene* comes from the lower Kemp Welch River, Papua.

The ears are very large, united over the frons as in *Nyctophilus*, and provided with an anterior basal lobe, turned in for 6 mm. The posterior noseleaf high and narrow somewhat as in *N. geoffroyi*.

LIST OF SPECIMENS IN ARCHBOLD COLLECTIONS

<i>Miniopterus:</i>		Kalianda, S. Sumatra
<i>M. s. orianae.</i>	Ample representation from various localities in N. Queensland (Pentland, Port Stuart, Spurgeon, Canjebris) 43	.....17
<i>M. s. blepotis.</i>	Cheribon, Java.....1	Parit, S. Borneo.....2
	Lambasang, S. Celebes.....1	Perboewa, N. W. Borneo.....1
	Noesa Penida, Bali...4	Peleben, N. E. Borneo.....1
<i>M. s. magnater.</i>	Dutch New Guinea..2	Bali.....16
<i>M. tristis.</i>	Javaleri, Papua...10	Peling Island, Celebes.4
	Dutch New Guinea..3	Riam (Kotawarmin-gen) S. W. Borneo...4
<i>M. australis.</i>	Sogeri, Papua.....2	Badang, N. E. Borneo.....2
	Dutch New Guinea.22	Parit (Tjempaga), San-pit, S. Borneo.....4
	Port Stuart, Queens-land.....1	<i>K. picta.</i> Bali.....14
	Peling Island.....1	Cheribon, Java.....11
<i>Murina:</i>		<i>K. muscina.</i> Fly River, Papua....2
<i>M. florum.</i>	Peling Island, Celebes.....2	<i>Phoniscus:</i>
<i>M. suilla.</i>	Peleben, N. E. Borneo.....1	<i>P. javanus.</i> Riam, S. W. Borneo..1
<i>Kerivoula:</i>		Bali.....1
<i>K. hardwickii.</i>	Cheribon, Java.....6	<i>Nyctophilus:</i>
		<i>N. g. pallescens.</i> Pentland, Queensland.....1
		<i>N. m. microtis.</i> Fly River, Papua....1
		Sogeri, Papua.....1